MAX KOHL A.G.

Chemnitz, Germany.

Price List No. 50, Vol. I.

Equipments for Physics and Chemistry Class Rooms

Experimental Switchboards

Projection Apparatus and Accessories

Further Corrigenda to Vol. I.

Page 126, No. 50 514. **Double Switch Contact Rheostat.** The figure should read **50 510**, not 50 410.

„ 1223, „ 9531—9550. For **microprojection** special **curtains fitted to a drop board** are necessary as shown in fig. 8. They cost £ . . . .

„ 1224, „ 9572—9574. New but varying prices of the **Nicol Prisms.** which can only supplied in the 1st quality, see Nos. 54 637, 54 639, 54 640 on page 559.

„ 1227, „ 9620. The **Switchboard,** for **connecting** up the Megadiascope to the **wall** now costs £ **3.15.0**, not £ 2.10.0.

„ 1230, „ 9620. / 9659. The Switchboards cost £ **3.15.0**, not £ 2.10.0. The total sum of No. 9659 is thus £ **80.4.0**, not £ 78.10.0.

See also the Corrigenda on p. II, vol. I, and p. XV, vol. II.

B. 3. L. 50, Ie.

Price List No. 50, Vol. I.

Equipments for Physics and Chemistry Class Rooms.

The prices given in this list are not subject to any advance.

All prices of the pages 191 and 192 re cancelled.
For new prices of these articles see pages 1092—1094 (vol. II. and III).

23 e

Megadiascope, small Model, with Hand Regulator.

MAX KOHL A. G.

CHEMNITZ (GERMANY)

Telegraphic Address:
Physik.
ABC-Code 5th Ed. used.

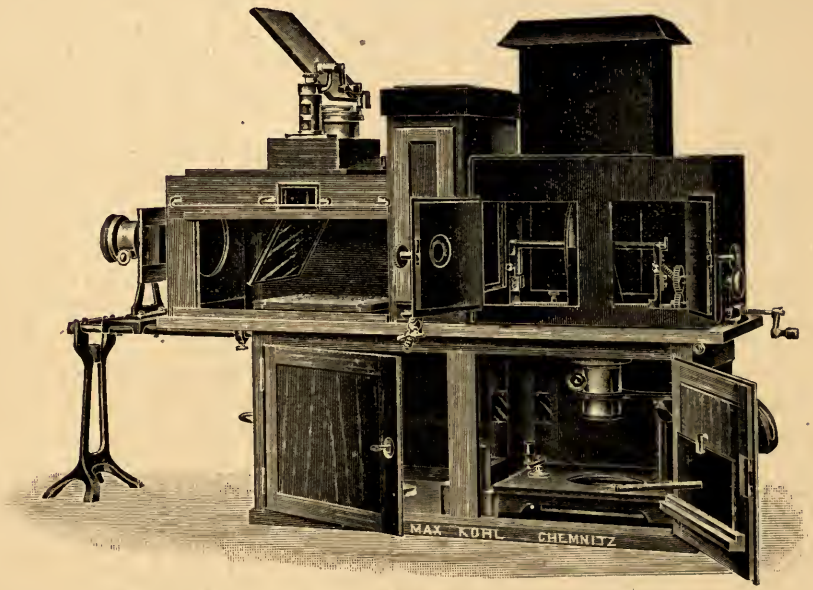
Adorfer Strasse 20.

Telephones
Nos. 104 and 531.

Fully paid-up Capital, M. 1,600,000.

Price List No. 50, Vol. I.

Equipments for Physics and Chemistry Class Rooms.



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Conditions of sale.

The prices quoted in this list are cash prices, no discount being allowed; if institutions giving large orders must have credit this can be granted by arrangement.

All goods are delivered Chemnitz.

Cases and Packing are in every case charged separately at cost price. Even where gross weights are given in the list the prices for packing are not included in the listed prices of the goods.

The prices for packing given for individual articles in this list only hold for packing suitable for land transit. Packing for sea transit has as a rule to be charged at double that for land transit. We pack oversea consignments in zinclined cases, with a further lining of waterproof cloth, unless specially instructed otherwise.

Packing is done with the greatest care by experienced packers; we cannot, therefore, be held responsible for breakage in transit. In order, however, to secure our customers in case of damage, we insure our goods against breakage and loss in transit, charging the lowest possible premium.

In the case of orders from abroad it is necessary to notify us of any special conditions as regards despatch or prepayment of customs duty.

Claims are not recognised unless made immediately on arrival of the goods.

The illustrations appended to this price list do not correspond in every detail with the apparatus supplied, as in many instances, of course, alterations and improvements in apparatus, etc. show themselves to be necessary.

In a number of illustrations auxiliary apparatus and accessories are included for the purpose of showing the use of the apparatus and aiding the understanding (e. g., Fig. 50,996 the Projection Apparatus); these articles are not included in the price of the object and are supplied only when specially ordered, being charged for as an extra.

The scale given below the illustrations allows an approximate judgment to be made as to the size of the apparatus; but this scale is not binding as regards the actual size of the object. In the case of perspective drawings the scale only holds good for one dimension.

In the case of the larger pieces of apparatus, etc. we have in many instances included the Net and Gross Weights. All data as regards weight are, however, only approximate and not binding. Packing for sea transit weighs as a rule about half as much again as that for land consignments.

Corrigenda.

Page 80, No. 50,394. Geyser (Fletcher, Russell's). Price should be £ **1. 15. 0** and not £ 11. 5. 0.
„ 121, „ 50,502. The **pressure** to be taken with the switchboard is between **0.3** and 110 **volts,** and not 0.03.
„ 139, 140 and 142. The compound winding **cannot** be switched out.
„ 144, 146. The speed of the transformers cannot be reduced but only increased to 15% of the given.

Introductory Remarks.

We have pleasure in placing before our friends this first volume of our most recent price list. It contains, in a considerably enlarged form, the chapters on Fittings for Class Rooms, Experimental Switchboards, Gas Generating Plant for gasoline gas, Internal Combustion Engines for Gas and Liquid Fuels, Electric Transformers, Direct Current Dynamos, and Projection Apparatus with Accessories. The enlargement of the list, which covers twice the amount of space as hitherto, plainly shows the considerable increase of our selection in the various types. Hand in hand with this increase in the size of the catalogue, our factory equipment has been correspondingly enlarged, and our facilities for supplying the apparatus listed have been increased.

We possess an excellently equipped and recently extended plant, fitted with the most up-to-date mechanical arrangements and we have our own electricity works. Our staff of officials and workmen are men of very wide experience.

For the manufacture of fittings for physics and chemistry lecture rooms and laboratories — our speciality now for the last 25 years — our workshops have large rooms for drying wood by steam heating and a machine cabinet shop fitted with all auxiliary wood-working machines. With the aid of this equipment, backed up by a large stock of all the kinds of wood entering into the manufacture of the various articles we supply, we are able to meet the largest orders in the least possible time.

The largest institutions in Germany, Austria, Russia, Belgium, etc. have allowed us to supply their fittings from our designs and have acknowledged to us the quality and practical nature of the construction. The great strides which our works have made is ample proof of the satisfaction afforded to our clients. We hope in the future to enjoy the same confidence and good-will as in the past, and it will be our firm endeavour to continue to justify this.

In view of the great trouble and expense attendant on the production of a catalogue like the present, we would respectfully request that it be carefully preserved.

Max Kohl A. G.

Literature

together with abbreviations employed.

Frick, Phys. T. = Dr. J. Frick's work entitled „Physikalische Technik" by Dr. O. Lehmann, 7th Edition, Braunschweig, 1904, Friedr. Vieweg & Sohn.

M. T. = Friedr. C. G. Müller, „Technik des physikalischen Unterrichts nebst Einführung in die Chemie. Otto Salle, Berlin, 1906.

W. D. = Ad. F. Weinhold, „Physikalische Demonstrationen", 4th Edition, Leipzig, 1905, Joh. Ambr. Barth, formerly Quandt & Händel. The references to the 3rd edition are enclosed in square brackets when these references differ from those contained in the 4th edition.

Z. f. d. phys. u. chem. U. = Zeitschrift für den physikalischen und chemischen Unterricht, edited by Prof. Poske, published by Julius Springer, Berlin.

Contents.

Printed by Hugo Wilisch, Chemnitz.

Equipment of the Class Rooms.

Preface.

We respectfully draw the attention of Building Officials, Directors and Professors who wish to go into the question of installing physical and chemical class-rooms, laboratories and meeting rooms to the following

General Hints for Planning and for the Estimation of Cost,

from an experience derived from many years of knowledge in the construction of such installations.

In going through the plans for the construction of such rooms, etc., it should be seen that **sufficient funds are ensured** for the equipment of the rooms. For it is **better** and **cheaper** to consider the question of a complete arrangement from the start, as an equipment which has to be supplemented from time to time works out at a higher cost owing to the numerous alterations necessary, than an installation in connection with which everything is considered during the process of construction.

But since not all teachers are sufficiently acquainted with the various technical details to thoroughly comprehend the sum total of modern requirements and who perceive after lapse of time the lack of practical apparatus which is abreast of the times, it is advisable not to limit unduly the costs of equipping the buildings. We will take as an example the **electric lighting** of the town. In all cases, even when it is proposed to found a school in the smallest town, the question of providing a connection to an electric light main should be considered in building the school. For even should there be no electricity works in the vicinity capable of supplying electric current, it may be taken judging from the present condition and rapid development of technical matters that sooner or later the question of an Electricity Supply will be brought up. In fact, small communities possess to-day their stations which had not been thought of a few years back, and which were even looked upon as an impossibility.

In order conveniently and easily to answer such questions, we are willing to submit all information desired and estimates of cost. As proof that we possess the necessary experience we would mention the large number of installations carried out by us, of which we append a list. This is also shown by the numerous appreciations which we have been accorded.

The quality and durability of the experimental tables, laboratory tables, etc. can not be judged alone from the appearance and from drawings, but these depend upon the **selection** and **treatment** of the woods used and upon the **expert working up** and **manipulation** of the half-finished parts, from the sawing of the wood blocks to the last coating of paint or varnish.

In regard especially to the **provision of the experimental table,** we strongly dissuade our clients from having it made on the spot, as the various fittings on same, such as leads, etc. are generally never constructed in a practical manner. Such a table will always be more incomplete when finished than one supplied from a special factory. It often happens moreover that the price of the table has increased beyond what it would have cost if originally purchased from us.

It is, in addition, advisable whenever possible to choose one of the standard listed constructions of table and not one constructed according to an independent design, on the score of cheapness and expedition in delivery. Of course we give due consideration to all alterations which seem desirable on account of the peculiarity of conditions relative to space. Since, furthermore, we have **more than 100 drawings of experimental tables of special** construction at our disposal, we are in a position to make proposals conforming to all cases.

We take the liberty of introducing a few remarks concerning the **electric wiring installation,** as this will generally be considered at the same time as the constructional plans. The electric wiring proposed for the physics class room must be designed for from 45 to 50 amperes, as about 15 to 25 amperes must be allowed for the projection lamp and 20 to 30 amperes for other experimental purposes. If it be planned to install a large projection apparatus (e. g., a Megadiascope with an arc

lamp taking more than 25 amperes), this must be taken into account accordingly. **The wiring for the general lighting of the room should be installed independently of the above.**

The same stipulation, viz., that the wires for the general lighting and those for the experimental tables should be quite independent of each other, holds good in regard to the **gas piping.**

In case local special regulations as to the **construction of the water supply** and to the kind of piping have to be considered (employment of jacketted pipes or galvanised iron piping), we would ask that this be stated in all orders.

It is very desirable to place all orders as early as ever possible since towards the close of the building season they often accummulate so that in the case of orders reaching us late it is not possible to meet all wishes at the proper time, notwithstanding the extent of our factory and the large staff at our disposal.

In addition to the objects of equipment catalogued in the present list (which are generally ample for the requirements of a well equipped secondary school, ordinary private schools and colleges) we are in a position to supply complete equipments for the **physical and chemical Lecture Rooms and Laboratories of Universities, Technical High Schools, Veterinery Colleges, Academies of Agriculture and Forestry, for Technical Institutes, Industrial Works, etc.,** and will gladly give all information required and submit estimates, if desired, as well as send references to work of the kind already carried out.

We have supplied such installations to the following, among others: The Chemical Institute (Prof. Emil Fischer), Berlin; Hofmann-Haus, Berlin; Laboratory for Applied Chemistry at Leipzig University (Prof. Beekmann); Physical Institute at Leipzig University (Prof. Wiener); Institute for Chemical Technology of the Technical High School at Charlottenburg (Prof. Otto N. Witt); Chemical Institute of the Charlottenburg Technical High School; Physical Institute of the Technical High School, Danzig-Langfuhr (Prof. Max Wien); Chemical Institute of the Technical High School, Danzig-Langfuhr (Prof. Otto Ruff); Chemical Institute of Tübingen University; Chemical Institute of Kiel University (Prof. Harries); Physical Institute of the Physical Society at Frankfort-on-the-Main, and many others.

Advice as to the Arrangement of the Class Rooms.

In drawing up plans for the erection of a new school, the following points should be taken into consideration in respect of the **class rooms for Physics and Chemistry:**

The rooms are best arranged on a raised ground floor, on account of the better draught in the chimneys, the more convenient inlet and outlet of the water, also because of the higher water-pressure and the greater solidity of the floor.

It is only when great importance is attached to the use of the heliostat and when buildings or trees in front prevent the admission of the sun, that the physics rooms should be situated on a higher floor. The rooms for physics should, also on account of the heliostat, face south, or else the south-east or south-west. In view of the fact, however, that all optical experiments can be carried out with an electric projection lantern, and a very beautiful carbon spectrum obtained, such great value has not been ascribed in recent times to the heliostat. Plate I (bound in with Page 3) contains a ground plan of the class rooms as they can be arranged in the most practical manner in a modern high school or in a secondary school, Class rooms, preparation rooms and collection rooms are arranged at the window side. The folding doors in the preparation room are exactly opposite so that the continuation of their centre line ends by the side of the lecture bench and the transport of apparatus, especially when a travelling table is employed, is greatly facilitated; such a table is then a prolongation of the lecture bench and has the advantage that it can be brought behind and in front of the experimental bench and also transported to other rooms. The folding doors must however have no pieces raised above the floor. It is also possible in this arrangement of doors to have rails laid on which the table can more conveniently travel. The wall separating the class room from the preparation room has in the centre besides the doors referred to, a hollowing for the draught uptake. The preparation room and the general class room have their own entrances from the corridor, so that during hours of study the other teacher of physics may make his preparations.

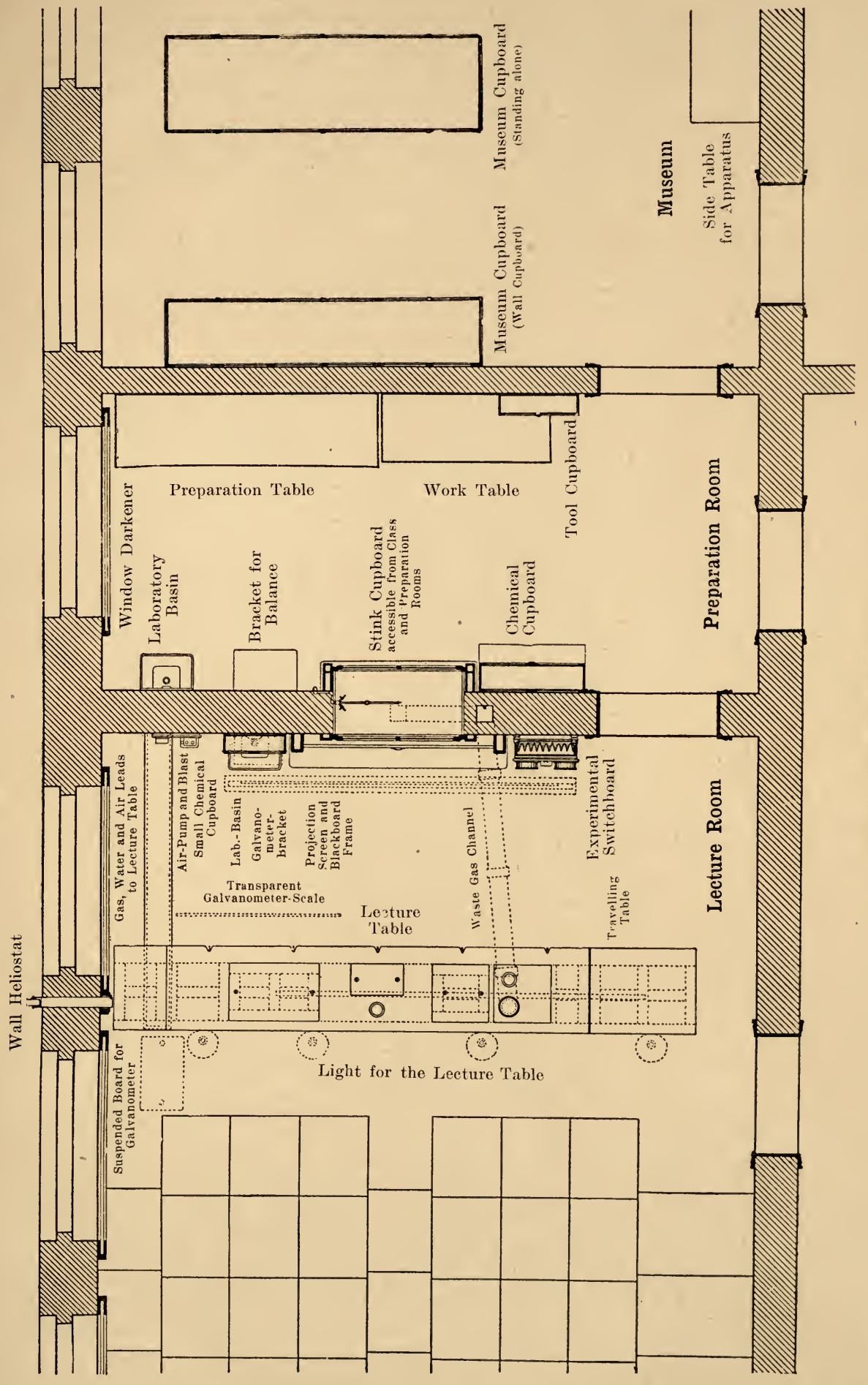


Plate I. Plan of the Class Rooms. 1:50.

Max Kohl A. G., Chemnitz, Germany.

The space and the objects to be installed are so arranged that they can be used for physics, or in case of need, for chemistry. In passing on to the discussion of the individual rooms, the most important articles necessary are enumerated. With due regard to the varying local conditions and the difference in the amount of funds available for equipment, we have drawn up an estimate at the end of the list; if desired, we will be happy to prepare such to suit individual cases.

In the **Physics Class Room** the windows are arranged, having regard to the erection of an experimental table, in such wise that the longitudinal axis of the lecture table runs on the centre of a mullion to allow of a wall heliostat being used. The distance of the experimental bench from the wall receiving the blackboard is from 1,50 to 2 m. The windows can be easily arranged from these data. If in the case of completed buildings the windows have been constructed differently from the manner just mentioned, i. e., in such wise that the longitudinal axis of the bench is towards a window, the heliostat can be inserted in the darkening arrangement of the window in question, being maintained by a holder screwed into the window board. There should be a free space of at least 60 cm between the experiment table and the first row of benches. For a Physics and Chemistry class room (see Tables I and II) a **lecture bench** of at least 4 m long is essential. This bench should if at all possible be connected up to the gas, water and electricity supplies themselves so that no piping or leads of any kind for the use of gas, water or electricity need be laid between the blackboard and the bench. Besides the supply pipes, etc., just mentioned, it is desirable to have at the same time piping laid for the purpose of producing a vacuum and air pressure obtained by means of water air-pump and a water jet blower respectively. Further, a gas waste pipe, low-pressure water system, piping for steam, oxygen, carbonic acid gas, etc. can be fitted according to the requirements of each individual case.

For taking off the gases at the lecture table, it is important that a gas exhaust should be arranged in one of the neighbouring walls in such manner that the piping leading to this flue may be laid under the floor or underneath a platform. This flue can also be utilised in connection with the draught cupboard and the stink cupboard in the wall. This flue or channel must have two connections with the draught cupboard, one underneath, over the slate slab, for heavy gases; the other above for light gases. The channel can best be formed of internally glazed acid-resisting stoneware pipes of square section. If desired, we shall be glad to supply these pipes and also the unions and the acid-resisting cement; and we would respectfully ask that building authorities and teachers should communicate with us in connection with this question **before the completion of the masonry.** All conduits should be laid in the floor up to the lecture table, and the electric leads, piping, etc. of the bench, as constructed by us, all commence at the floor. We would mention the following special fittings for the lecture bench: expanding leaves, the pneumatic trough, built into the table (possibly fitted with lowering device), the explosive slab (capable of being lowered), wind-chest, etc. Finally, we would refer to the complete descriptions of the various experiment tables.

As auxiliaries to the table the following objects may be mentioned: a **travelling table** which can conveniently pass through the doors leading from the preparation room and the museum; a **draught box** for placing over the gas exhaust on the experiment table; a **draught pipe,** which is better for many experiments; a support or a stand for pendulums etc.; a **sliding slab** for protecting the top of the bench and for setting to one side apparatus that have been used; a **switchboard.**

For purposes of illumination in the case of darkened rooms, on dull days and in the evening, a number of **lighting units** will be necessary for providing light for the lecture table and the blackboard in addition to the **gas distributing pipes,** when gas is used for the purpose. Electric light should naturally be given the preference from a hygienic standpoint, and the switching on of the various lamps can be conveniently arranged. A good **table lamp** should be provided so that each individual apparatus or parts of an apparatus may be well illuminated. For the transport of heavy objects, electromagnets, electric motors, etc. over the lecture bench, an **I-beam** should be arranged on the ceiling to take a **traveller, pulley blocks** being suspended from the latter. Lighter pieces of apparatus can be set up on a **board suspended from the I-beam.** For the reflecting galvanometer, a **wall bracket** can be fixed to the black board wall, a **transparent scale** being arranged over the lecture bench; or a **suspended board** or other roof suspension can be provided over the bench, and an

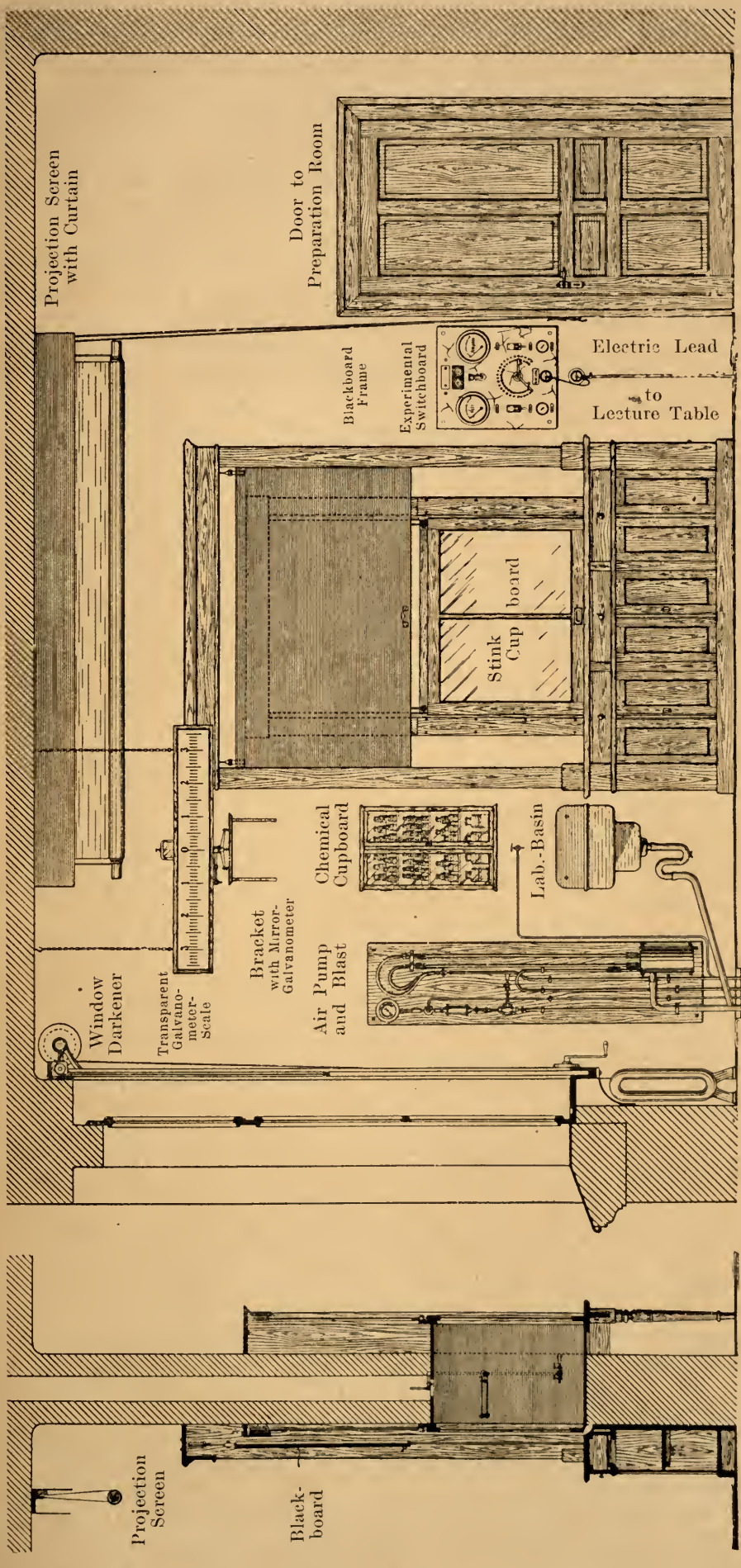


Plate II. Stink Cupboard and Blackboard Wall of Class Room. 1 : 35.

ordinary **linen scale** on the black board or on one of the side walls. The **water air pump** with the **water jet blower** are arranged on a common board placed on the blackboard wall (see Plate II). The **experimental switchboard** (our complete price list of these may possibly help in its selection) is likewise fitted to this wall, in order that the deflections of the measuring instruments may be observed by the students. By means of a flexible lead with 2 plugs and one plug box each on the wall and on the switchboard, the switchboard can be completely separated from the lecture table. The **blackboard stand** occupies the centre of the board wall. The **draught cupboard** does not require a special room when it is aranged in a wall niche according to Plate I and II. It is in this case also accessible from the preparation room. As to the **draught conduit,** mention has already been made of this. The **darkening arrangement** (see Plate III) is fitted both in the class room and the preparatory room. All the windows of a room are darkened simultaneously by pressing a hand lever, or by electric motor. The **projection screen** is fitted in front of the blackboard frame. The screen, rolled up, rests underneath a curtain protecting it from dust, being let down by means of a cord arrangement. On one of the walls a **laboratory basin** with

water inflow and outflow is fitted, behind the lecture table; there is also a small cupboard for the more frequently used chemicals. A **wall heliostat** is fixed on the window wall, or a **window heliostat** in the window, opposite the narrow end of the lecture table. The **projection lantern** is also an important part of the equipment, and great care should be devoted to the selection of this. Only a good lantern should be used, and this should have an electric arc lamp; it should be adapted not only for the projection of diapositives but also for projecting physical apparatus and phenomena. A **stand table** with arrangement for tilting should be provided for the lantern. A **hoisting arrangement** for drawings, tables (of figures), etc. or a plan easel, and some **portraits** or **busts** of famous physicists complete the equipment of the physics lecture room.

The **Chemistry Lecture Room** is arranged similarly to the Physics Lecture Room both as regards dimensions and in general and in connection with the preparatory room and laboratory and other fittings. It should contain a special **Chemistry Lecture Table** having the same leads and piping as the Physics Lecture Table. The chemistry bench, however, is built to conform to the special conditions imposed; the top especially must be protected from the action of acids and corrosive substances. On account of the frequency with which water is employed, a **special outflow** should be provided on the bench itself. The accessories previously mentioned and complements are employed in exactly the same manner.

The **preparatory room** is situated immediately alongside the lecture room (see Plate I) and a door should communicate with the rooms behind the lecture bench. In the physics preparatory room a **laboratory bench**, a **work bench with parallel vice** and **anvil**, and a judicious selection of **mechanics'** and **woodworking tools** of good quality should be provided in special tool cupboards. A **cupboard for chemicals, a wall bracket for an analytical balance** and also a **laboratory basin** with inflow and waste, and a **stool** are necessary, and a **window darkener** should be fitted. For the **Chemistry Preparatory Room** a simple **tool board** with the tools necessary for use and for keeping the apparatus in order will be sufficient. The work table can probably be dispensed with, but, this being so, the laboratory bench must be provided with a basin, water pipe and gas piping. A **flushing basin with drying rack**, a **glass-blowing table**, a second **cupboard for chemicals** and the articles mentioned in connection with the Physics Preparatory Room are requisite. It is also advantageous to have an **iron table** topped with flagstones on which combustion furnaces, etc. may be placed.

The **collection room** (or museum) for physical apparatus should abut directly on to the preparatory room. A conveniently large number of **cupboards** should be provided, which can take the form partly of wall cupboards with the back to the wall, and partly as cupboards standing alone. Further, a table for setting aside apparatus is required, and sufficient clear space should be left for standing up larger apparatus, the air pump, the fall machine, electric influence machine, etc., without impeding the passage to the cupboards.

The **physical laboratory**, of sufficient size, for the students should be provided for in the neighbourhood of the physics class rooms. It should have the requisite number of **laboratory benches** and **stools, 1 draught cupboard, 1 blowpipe table, blackboard frame, 1 chemical cupboard, 1 balance wall-bracket** and a **laboratory basin.**

The **Chemical Laboratory** should be equipped in the same manner with **laboratory benches** and **stools**, a number of **fume cupboards** or a fume cupboard with a number of compartments, a **flushing table with drying rack**, a **table for glass-blowing**, a few **cupboards for chemicals** and **cupboards for the glassware**, as well as one or more **wall brackets.**

It is, further, advisable to fit up a room as a **dark room** for photographic work, photometry and for spectroscopic work. It is also practicable to have, in addition to the preparatory room for the teachers, a special room as a **workshop**, in which repairs to apparatus can be carried out and small simple pieces of apparatus constructed.

For **astronomical observations** the following arrangement is desirable (Zeitschrift für den physikalischen und chemischen Unterricht, **20**, 1907, p. 403): a platform on the roof, and beneath this a store room for the astronomical instruments.

The following are used in connection with instruction in chemistry: The chemistry class room, a preparatory room for the teachers, a collection room, and a large room serving as a students' laboratory.

For **instruction in biology** it is desirable to erect a special class room and a special collection room. Apart from the fact that certain demonstrations can not be carried out in

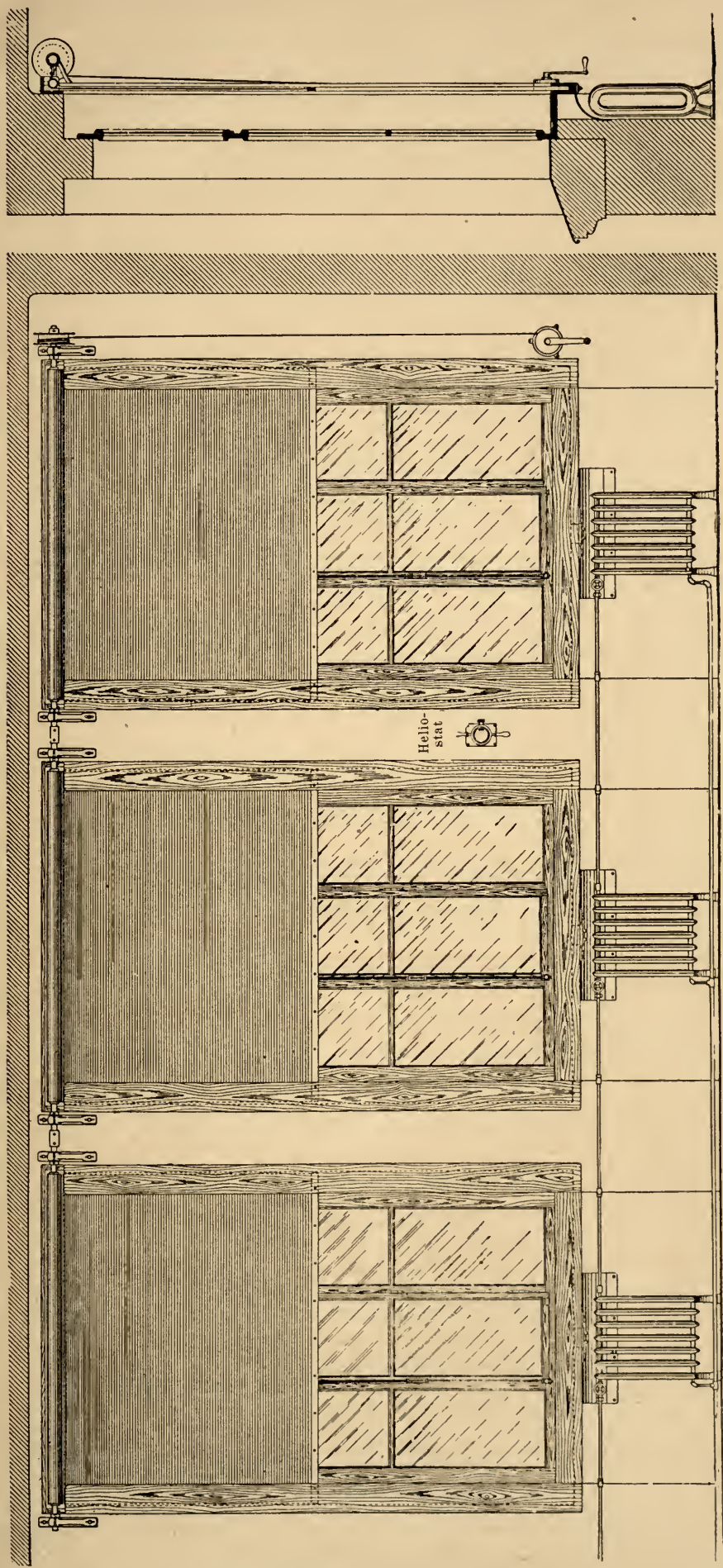


Plate III. Darkening of the Lecture Room.

the class room and prolonged experiments (plant culture, etc.) are impossible, a projection lantern can be kept always in readiness in the biology class room. The biological collection room should communicate directly with the class room. A **special room** is also necessary for the student's exercises in biology if it is proposed to introduce such.

Where gas is not available, it is desirable to erect a **gas plant;** this generates gas in the quantity required to be consumed at the time, and the plant is very easy to manipulate. The gas can be used both for lighting and heating, and for working gas engines.

Mechanical power is most conveniently obtained from an electrical network. The machines to be driven are worked by electric motors. If power from an electricity station is not available, but if gas is laid on, a gas engine can be erected. If gas also is not at hand, the gas plant just mentioned is desirable. In addition, benzine, spirit and petrol engines can be usefully employed. For lesser demands, water motors are useful.

Electric current, which can not entirely be dispensed with, is either derived from the electricity works, or it may be generated in the building by means of one of the engines mentioned in the last paragraph connected up with a dynamo. It is very advantageous also to install a battery of accumulators, which can be charged from the dynamo, and which is always a ready source of current of regular voltage. In this case, by employing a suitable dynamo, the whole arrangement can be made for that voltage which is most

desirable. In consideration of the arc lamp for the projection lantern and for experiments, as well as for arc light illumination, a pressure of about **65 volts** is the most suitable. Direct current should be given the first consideration in selecting the kind of current. Supposing the pressure of the central station supplying direct current to be high, e. g., 220 or 500 volts, and if it be desired not to work continuously with large energy-losses, a **direct current-direct current transformer** should be installed, transforming the network voltage down to 65 volts. If it is wished to have alternating and three phase as well as direct current available, a **direct-alternating-triphase transformer** is used in conjunction with a direct current network, and a **triphase-direct-alternating current transformer** if the supply is three phase.

We shall be pleased to give all advice and submit the necessary drawings relative to the laying of the leads and piping lines of every description — the gas and water pipes, the water outlet in the floor, the arrangement of water air pumps and water jet blowers, the fixing of draught chambers and channels for draught cupboards, the fitting of window darkening devices, the galvanometer suspension, etc. — in fact in connection with the **whole equipment.** With this object, we would ask that the **constructional plans** of the rooms in question should be sent to us **at the proper time.**

If desired, we shall also be pleased to send an engineer out to discuss the question of the fittings and their erection on the spot with clients.

It is advisable to allow us to carry out the preliminary work before building commences.

The fact that we are in a position to make thoroughly reliable proposals is vouched for by the very large number (more than 750 up to the present) of higher grade schools, science and art schools, universities, technical high schools, etc. for the physical and chemical class, preparation and collection rooms of which we have supplied fittings and apparatus.

Equipment of the Class Rooms of Public Schools and Colleges.

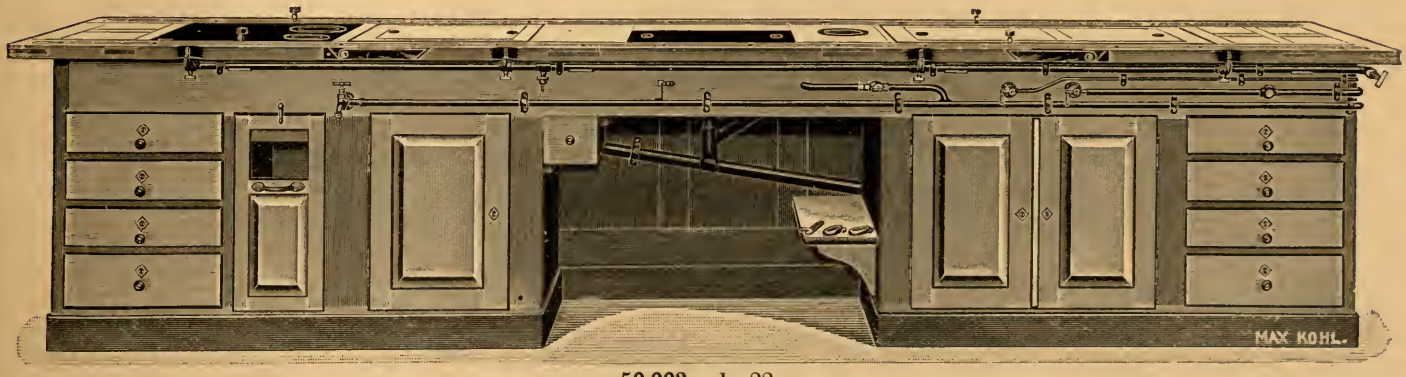
Lecture Tables for Physical and Chemical Instruction.

We supply the table tops either in **teak** or **oak.** The teak possesses the property of neither cracking, shrinking nor warping in the wet or dry state. Oak which is intended to be worked up into bench tops is used only after having lain for a number of years upon the drying heap, and, finally remained in the cut up condition, in our steam drying room for a number of months. Only thoroughly well seasoned wood is employed in our joiners' shops. We utilise **pitch pine** exclusively for the body of the tables: this wood being quite free from knots and being the most suitable for laboratory purposes. Only the bottoms and inner walls of the drawers are constructed of deal. All tables and cupboards have oak bottom fillets which do not become disfigured when knocked. Unless advised to the contrary, we supply all tops varnished with three coats of linseed oil. If desired, however, the tops can be supplied stained an acid proof black.

All **taps, leads, valves,** etc. for **gas, water, aspirated** and **compressed air,** etc. are constructed in a reliable manner in our own workshops, and **only the best of materials are used for the purpose.** The gas taps have hose unions bent in an upward direction, thus obviating any tearing or pinching of the hose itself. The leads and piping are also fitted on to the benches in our workshops by workmen possessing years of experience in such work. Our customers are therefore guaranteed the most substantial and reliable workmanship in this connection.

The lecture tables can be made of any length desired; we have built benches up to **18 m** in length.

The following lecture tables are those which are intended in the first place to be used in **High Schools and Colleges.**



50 003. 1 : 22.

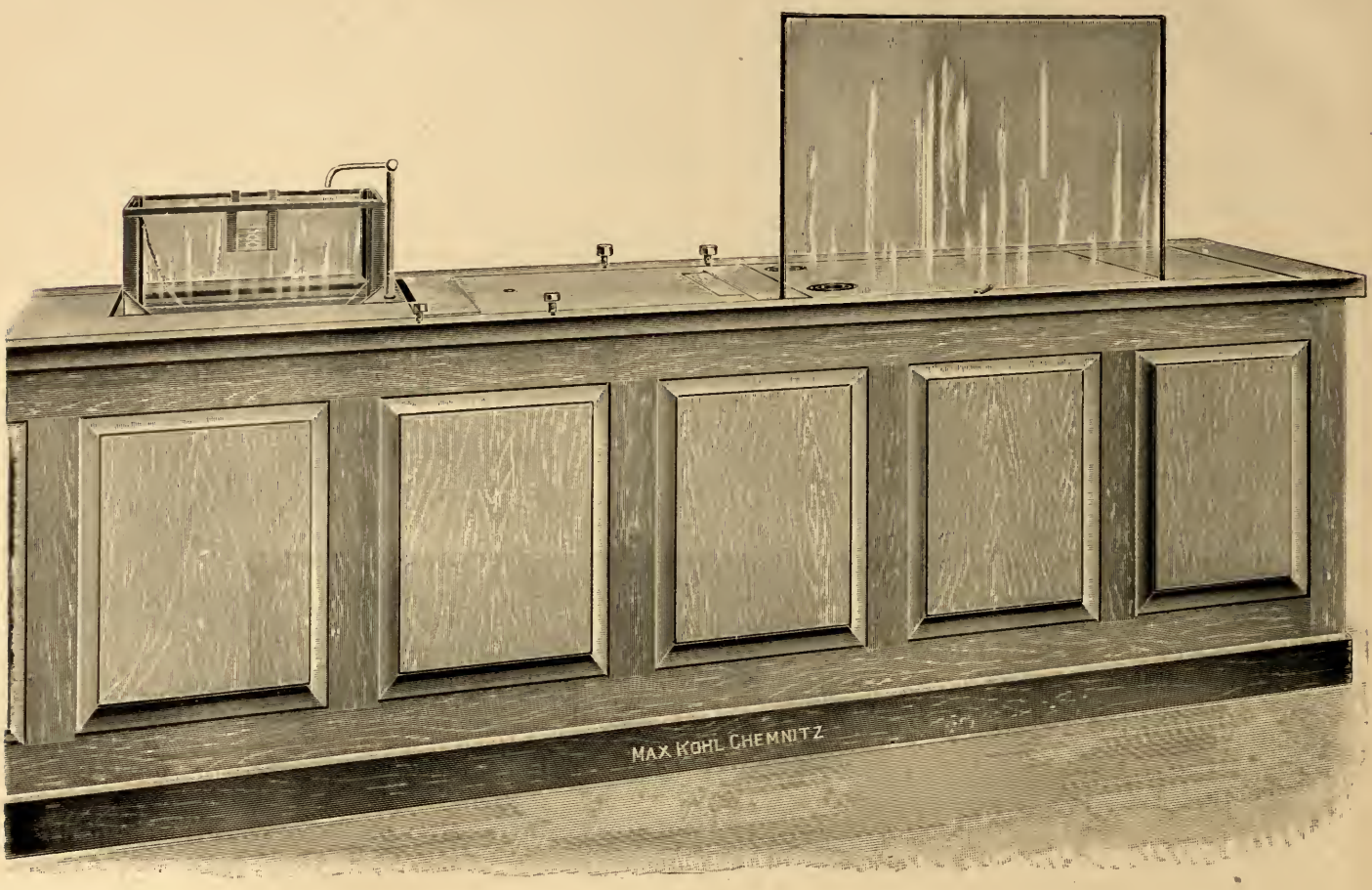
£. s. d.

Lecture Table (as suggested by W e i n h o l d), chiefly intended for instruction in Physics, but also adapted for Chemistry in the case of a common room being used for both Physics and Chemistry (W. D., Plate III and Figs 13, 14, 15) (see Fig. 50,003).

With oak top impregnated with linseed oil	List No.	**50,001**	**50,002**	**50,003**	**50,004**	**50,005**
	Length of Table m.	3	3.5	4	4.5	5
	Price of Table £	**21. 10. 0**	**24. 4. 0**	**27. 0. 0**	**29. 10. 0**	**32. 0. 0**
With teak top impregnated with linseed oil	List No.	**50,006**	**50,007**	**50,008**	**50,009**	**50,010**
	Length of Table m.	3	3.5	4	4.5	5
	Price of Table £	**24. 0. 0**	**27. 0. 0**	**30. 5. 0**	**33. 0. 0**	**35. 15. 0**

The approximate gross weights, with batten packing are: about 330 kg for a length of table of 3 m, 390 kg for 3,5 m, 435 kg for 4 m, 480 kg for 4,5 m and 550 for 5 m.

The table is 90 cm. in height and 80 cm. in width. The **top** is oak, 40 mm. thick, is composed of framework and pannellings, and is varnished with three coats of hot linseed oil or stained an acid-proof black (at a slight extra cost). At the left hand side of the table top a slate slab, 54 cm. in length and 54 cm. in width is let in, upon which work involving the use of acids can be carried out without in



50 003, 50 019, 50 021. 1 : 14.

any way damaging the table top. The **body** of the table is built of pitch pine, is stained and varnished and has an oak fillet at the base. The inner sides and the bottoms are of deal. With a length of 4 m. the table has 8 drawers, 2 cupboards, one box for waste paper, etc., 1 drawer for glass tubes, 1 wall bracket for taking gas burners, 2 tube flaps; **gas supply pipe** with 3 taps having unions bent upwards to prevent tearing of the hose; also 1 tap for the heating arrangement, and 1, having a wide bore, for combustion furnaces, for filling the gasometer, etc. There is also a **water supply pipe,** with 2 screw down taps (one being screwed for the hose pipe); **1 Length of piping** fitted with 1 tap, **for suction air; 1 length of piping** with 1 tap and a hose support, **for compressed air;** There are **2 porcelain sinks** in the table top with strainer let in and with lead waste pipe. One stoneware **draught channel** for gases and noxious fumes, **1 heater** for electrical apparatus, a **cavity** for working with mercury, **1 pneumatic trough** (zinc), with direct water outlet, overflow, outflow valve and bridge for suspending; **1 electric lead,** with two wood covered rails let in the table top, these rails having plug holes every 25 cm. These holes take the 4 plug terminals with insulated handles which are supplied with the table. A terminal connected up to the water supply pipe serves to make a good earth. The **covers** for the sinks and the draught pipe are constructed of iron and are let into iron rings. The lid of the pneumatic trough consists of a slate slab. The latter cover, and also the lid of the mercury trap and heater are lifted off by means of detachable handles.

£. s. d.

All pipe lines are laid ready as far as the floor.

Special Fittings for above Lecture Tables.

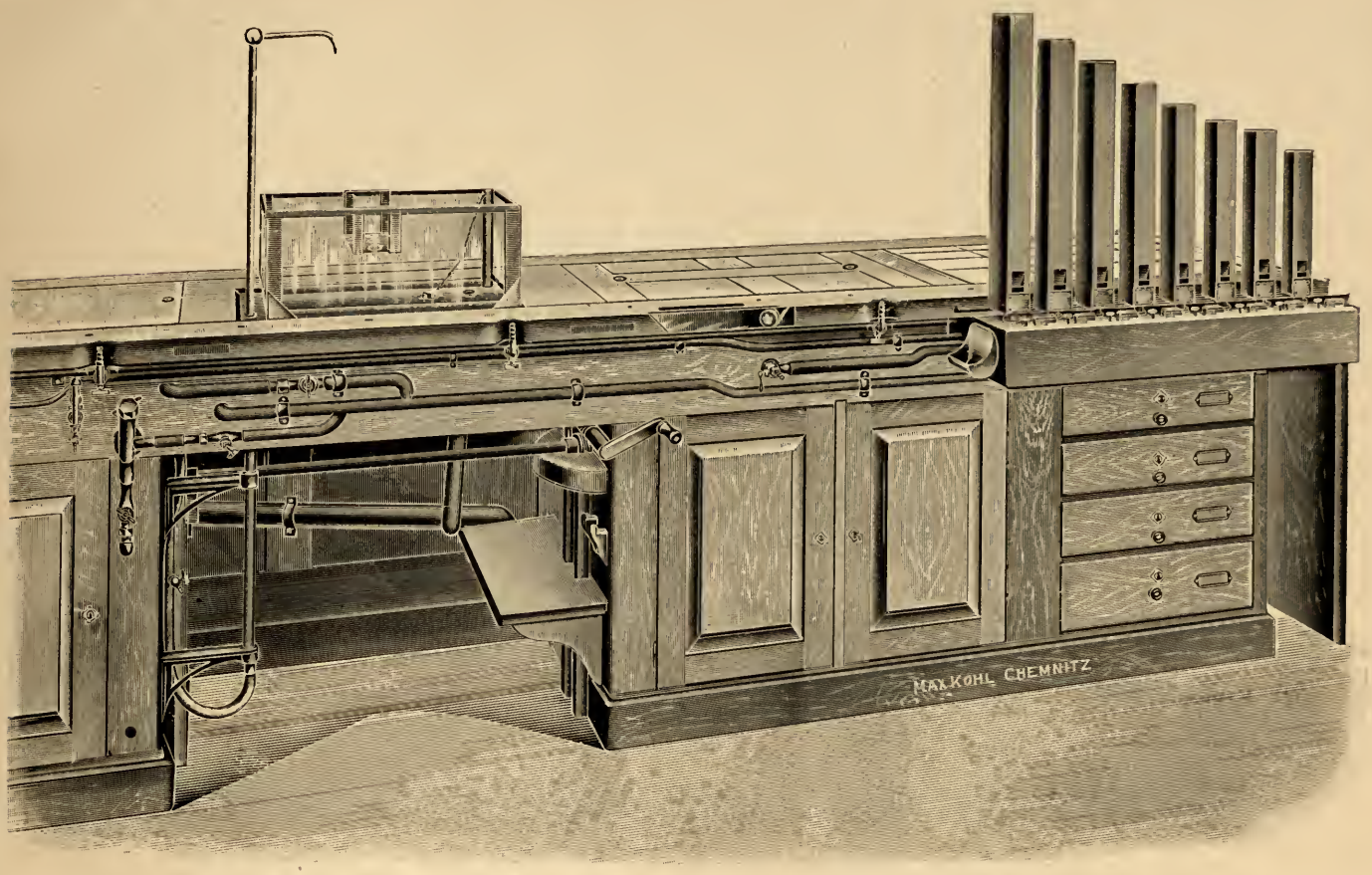
The special fittings can only be supplied at the prices quoted when they are ordered at the same time as the lecture table. When fitted later (if this is at all feasible) the price undergoes a substantial increase.

Extension Leaf.

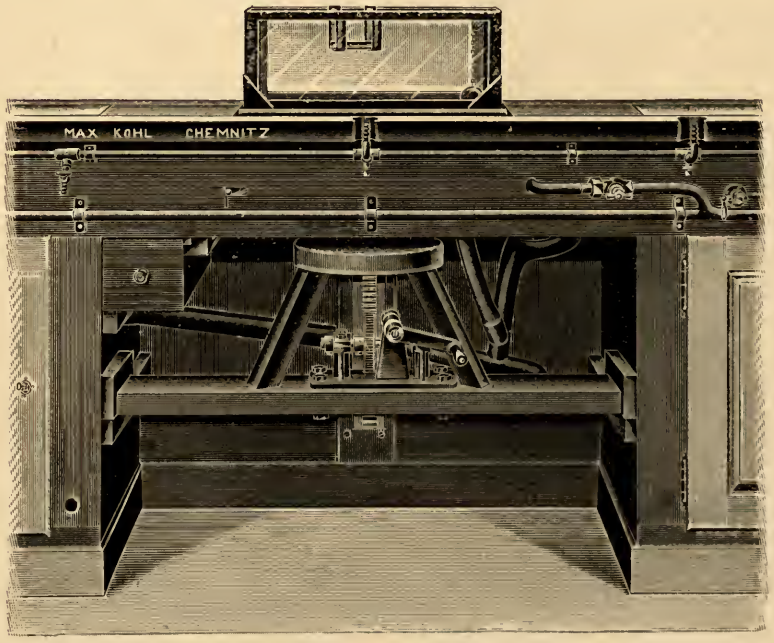
Extension Leaf		50	80 cm long
Oak	List No.	**50,011**	**50,012**
	Price £	**1. 1. 0**	**1. 8. 0**
Teak	List No.	**50,013**	**50,014**
	Price £	**1. 9. 0**	**2. 1. 0**

The table can be lengthened at one or both of the narrow ends by flaps 50 or 80 cm. in length, moving on hinges. The additional leaves are supported by lateral struts, and the former can be let down when this is so desired. Leaves can also be added to the longitudinal sides of table to widen it.

For staining the table top an acid proof black the extra cost per running metre is 0. 3. 6

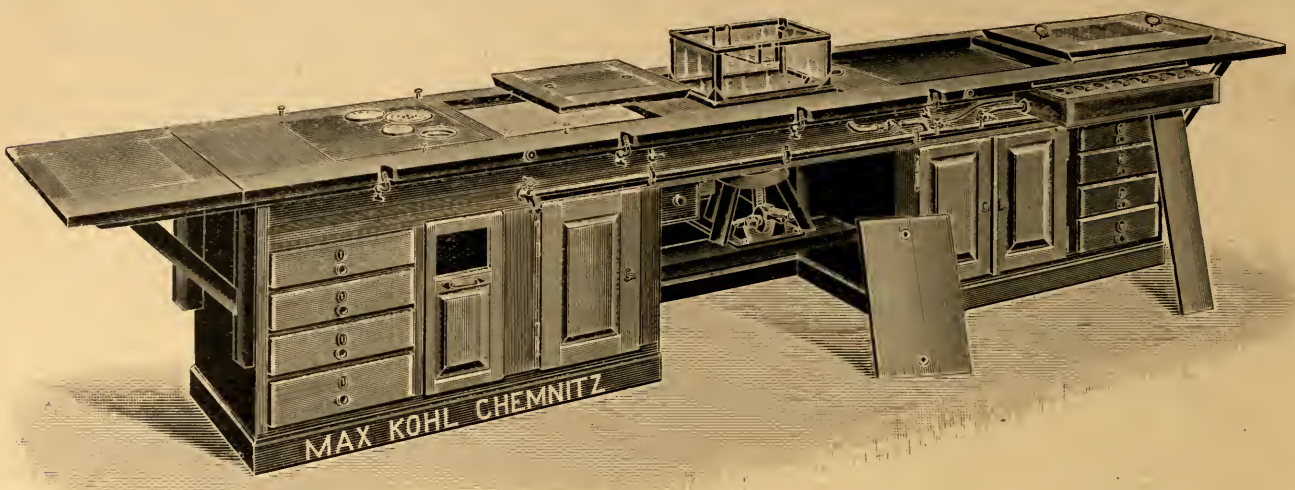


50,003, 50,019, 50 022. Set of 8 Labial Pipes (Diatonic scale). 1 : 15.



50 019. 1 : 14.

		£. s. d.
50,015.	**Low Pressure Water Pipe Line, with one tap** . . . . . Extra price For the above, self-filling reservoir No. 50,101 or overflow pipe No. 50,102 is necessary.	0. 14. 0
50,016.	**Steam Piping** with Jenkins valve cock . . . . . Extra price	1. 2. 0
50,017.	**Pneumatic Trough,** lead, built into a solid wood box, with inlet, outlet, lead valve and overflow Extra price as against zinc trough	0. 18. 0
50,018.	— The same, of stoneware, with inlet and outlet, lead valve and overflow. Extra price as against zinc trough	1. 0. 0
50,019.	**Copper Pneumatic Trough, can be lowered;** 50 cm. in length, 30 cm. in width, and 20 cm. in height, with plate glass disc (see figure), copper bridge, water inlet underneath, overflow and eduction valve . . . . . Extra price as against zinc trough	8. 0. 0



50 003, 50 011, 50 012, 50 019, 50 022. 1 : 23.

		£. s. d.
50,020.	**Glass Pneumatic Trough,** can be lowered, as No. 50,019, with polished rim, Length, 40 cm, width 25 cm, height 18 cm, with zinc bridge . . . . . Extra price as against zinc trough	4. 6. 0
	The trough is filled and emptied by a water hose.	
50,021.	**Explosion Slab,** can be lowered. Constructed of stout crystal glass, mounted in a brass frame (Figure). It is placed at the front of the table and the students are protected in the case of experiments in which explosions and spurting might take place . . . . . Extra price	6. 1. 0
	This explosion slab is 90 cm. in length, 60 cm. in height, and 6—8 mm. in thickness. By pressing a knob the slab is raised out of the table and remains in its highest position.	
50,022.	**Wind Chest** for blowing pipes, sirens, etc. in conjunction with the compressed air main (see Figure), with 8 valves; without pipes . . . . . Extra price	2. 4. 0
	The wind chest does not correspond with the figure, being built into the table top, and not built on top thereof. When not in use it is covered over with a sliding slab.	
50,022 a.	— The preceding, with 4 valves . . . . . Extra price	1. 7. 0
50,023.	**Passage** in the centre of the table . . . . . Extra	1. 13. 0
	This arrangement is only of value in the case of tables over 4 m in length and necessitates the laying of double lines of piping if taps are desired on both halves of the table.	
50,024.	Installing a third conductor rail in the table top in connection with 3-phase networks. . . . Extra	0. 14. 0
50,025.	Installing a third and fourth conductor rail in the table top in conjunction with the use of switchboard with 2 separate circuits . . . . . Extra	1. 7. 0
50,026.	**Connection Lead,** for connecting the table up with the experimental switchboard, from the metal rails in the lecture table to the floor, laid in conduit with brass covering. For connecting to 2 rails Extra cost	0. 11. 0
50,027.	— do., for connecting to 3 rails . . . . . Extra cost	0. 17. 0
50,028.	— do., for connecting to 4 rails . . . . . Extra cost	1. 2. 0
50,029.	**Heavy Current Lead** for 30 amperes direct current or monophase alternating current, laid separate from the rails let into the table. With double pole plug box . . . . . Extra cost	0. 17. 0
	The plug box is connected up with stout copper wires, which are laid in brass covered insulating conduit as far as the floor. These wires must then be carried from the floor to the wall, where they are connected below the switchboard to another plug box.	
50,030.	— The preceding, with 3-pole plug box . . . . . Extra	1. 0. 0

Lecture Table, completely free from iron, otherwise as previous model, with locks, keys, screws leads, etc. of **brass** instead of iron.

With oak top	List No.		**50,031**	**50,032**	**50,033**	**50,034**	**50,035**
	Length of Table	m.	3	3.5	4	4.5	5
	Price	£	**25. 12. 0**	**28. 18. 0**	**31. 7. 0**	**33. 11. 0**	**36. 6. 0**
With teak top	List No.		**50,036**	**50,037**	**50,038**	**50,039**	**50,040**
	Length of Table	m.	3	3.5	4	4.5	5
	Price	£	**28. 1. 0**	**31. 13. 0**	**34. 13. 0**	**37. 3. 0**	**40. 9. 0**

The gross weights are given only approximately and hold for batten packing: about 330 kg for a length of 3 m, 390 kg for 3,5 m, 435 kg for 4 m, 480 kg for 4,5 m, 550 kg for 5 m.

Special Fittings (see Nos. 50,011—50,030).

50,041. **Physics Lecture Table** (as suggested by Grimsehl, see Figure), 4 m. in length 29. 3. 0

This table is 4 m. in length, 90 cm. in height, and 80 cm. in width. The table top, which is quite smooth and not inlaid, is composed of 4 cm. thick oak frame and pannellings. It has an **extension** of 50 cm. at the left side which can be let down as desired. The top is impregnated

50 041. 1 : 32.

with three coats of hot linseed oil. The body is of pitch pine, carefully stained and varnished, and contains 8 drawers, 2 double-doored cupboards and 1 bracket for taking gas burners. The base fillets are of oak and are rounded off at the edges, do not become disfigured when knocked, and wear is reduced to a minimum. The table is fitted with a line of piping with four taps and straight hose unions; a line of water piping with two water taps with funnel arranged underneath; a semicircular basin at the right hand side with draining valve and waste pipe having a water syphon. Above this is a water tap with screwed union for hose pipes; pipes for obtaining vacuum with 1 hose tap; pipes for obtaining compressed air, with 1 hose tap; a double electric lead each part having 2 plug boxes at the two ends of the table, for the projection lamp; from the centre to right and left respectively each 1 plug box for 20 and for 6 amperes, and 3 terminals for connecting up the reflecting galvanometer, also 1 switch for the lamp of the latter. The leads, taps, plug boxes and switches on the long end of the table are all placed under the top of the table and carried down to the floor. £. s. d.

Lecture Table for Physics and Chemistry, iron parts reduced to a minimum, as suggested by Fredr. C. G. Müller.

List No.	50,042	50,043
Length m.	3	3.5
Price £	25. 6. 0	28. 12. 0

The approximate gross weights with batten packing are: about 330 kg for a length of 3 m, 390 kg for 3.5 m.

The table is 90 cm in height and 80 cm in width. The top is of oak 40 mm. thick and consists of frame and pannellings; it is stained an acid-proof black. The body is built of pitch pine and is carefully stained and varnished. It has 8 drawers, 2 cupboards with movable bottoms, 1 box for waste paper and one bracket for containing gas burners. Four drawers are zinc lined. The table has pipes for water, gas, for producing a vacuum, also for compressed air, and electric leads; 1 water sink, (porcelain) with drainer, 1 pipe for drawing off gases, 1 pneumatic trough (zinc) with zinc bridge, with direct water inlet and overflow. The electric lead consists of two wood covered brass rails placed close together and let into the table having plug holes every 50 cm. The latter take 4 plug terminals (supplied along with the table) fitted with ebonite handles. The rails are connected with a lead contained in a conduit, this lead ending in the centre of the table (where there is a free space left) to be connected there with a battery of accumulators which is placed at this part of the table. There is a meter scale on the front edge of the table top. The covers of the water outflow and of the gas off-take are constructed of brass and can be inserted in brass rings. The cover of the pneumatic trough consists of a slate slab, which is removed by means of a detachable handle.

The following are given in with the table: 1 water hose, 1.5 m. long with bent brass tube, and two slabs of oak, 80 × 80 cm. for laying on the table top.

50,044. **Blow Pipe Table,** 80 cm. in length, 60 cm. in width and 90 cm. in height, for standing on the preceding lecture table, with bellows, glass cutting knives, 5 tools (brass) and blow pipe burner. The top of this table is covered with asbestos. 4. 6. 0

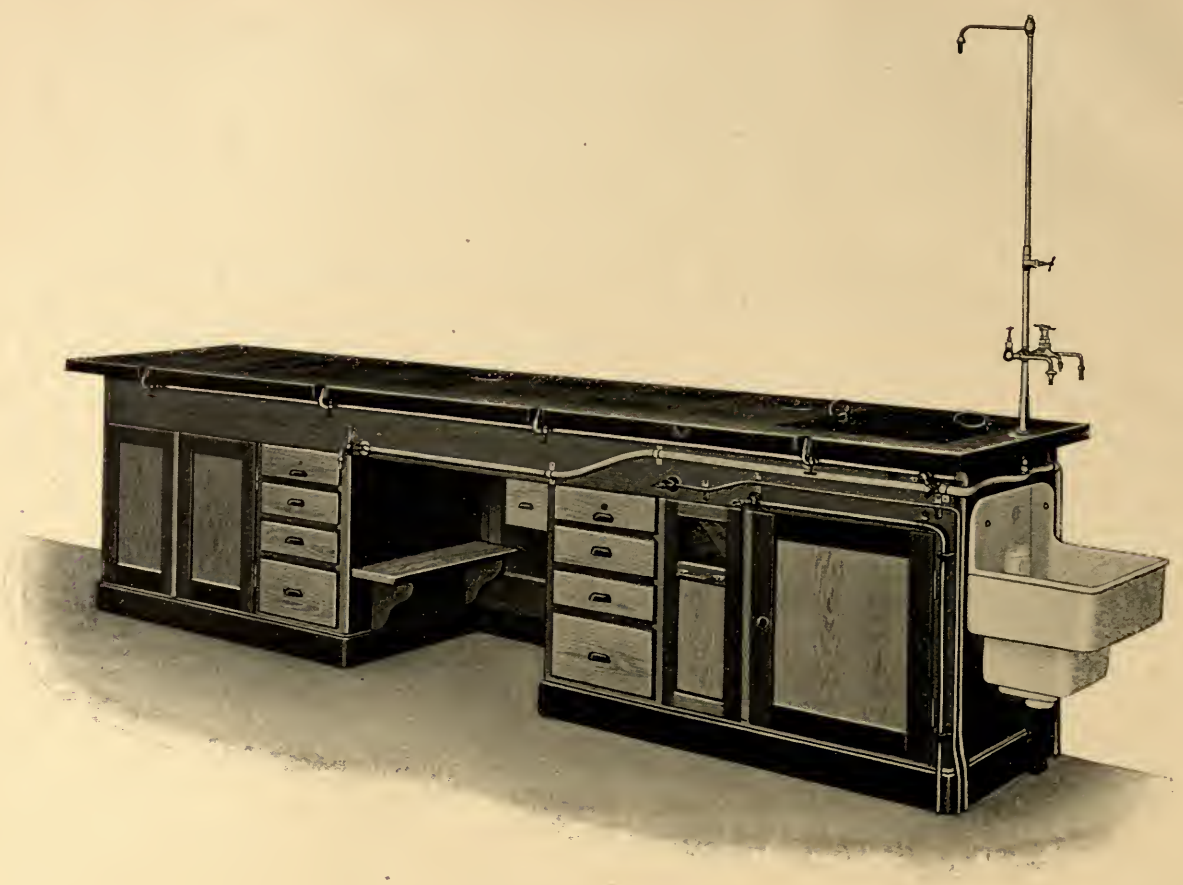
50,045. **Pneumatic Trough, with lowering device.** Length, 50 cm.; width 30 cm.; depth, 25 cm., with copper bridge, glazed with plate glass. The trough has direct water inlet from underneath, and overflow. . . . . Extra as against zinc trough: 8. 0. 0

Simple Lecture Table for Secondary and Continuation Schools.

List No.	50,046	50,047	50,048	50,049
Length of Table m.	2.5	3	3.5	4
Price £	12. 8. 0	14. 6. 0	17. 1. 0	19. 0. 0

The gross weights are given only approximatelly and hold for **lath-packing**: about 270 kg for a length of 2,5 m, 310 kg for 3 m, 340 kg for 3,5 m and 375 kg for 4 m.

The top is 30 mm. thick oak, composed of frame and pannellings, and thrice coated with hot linseed oil. The body is of pitch pine carefully stained and varnished; and the inner side walls and bottoms are constructed of deal. The table has 8 drawers and two cupboards; it has gas and water supply pipes and 2 to 4 gas taps (according to length) with hose unions curved upwards. On one of the narrow sides is a white porcelain basin with draining valve, siphon and waste pipe. The gas and water leads are laid ready on the table down to the floor.



50 052. 1 : 30.

Chemical Lecture Tables

(for High Schools, Colleges etc.).

£. s. d.

Chemical Lecture Table (Figure).

With oak top	List No.		**50,050**	**50,051**	**50,052**	**50,053**	**50,054**
	Length of Table	m.	3	3.5	4	4.5	5
	Price	£	**25. 12. 0**	**28. 18. 0**	**31. 13. 0**	**34. 2. 0**	**36. 17. 0**

With teak top	List No.		**50,055**	**50,056**	**50,057**	**50,058**	**50,059**
	Length of Table	m.	3	3.5	4	4.5	5
	Price	£	**28. 1. 0**	**31. 18. 0**	**35. 0. 0**	**38. 0. 0**	**41. 0. 0**

The approximate gross weights with lath packing are: about 390 kg for a length of 3 m, 450 kg for 3.5 m, 500 kg for 4 m and 550 kg for 4.5 m.

The table is 90 cm. in height and 80 cm. in width. Top of oak or teak 40 mm. thick is composed of frame and panels, and it is stained an acid-proof black. The body (the frame and panels of which are of pitch pine) is carefully stained and varnished. The bottom fillets are of oak. The body has with 4 m. length 8 drawers, 1 double-doored cupboard, 1 single-doored cupboard, 1 narrow drawer for glass tubes and one rack for containing gas burners. The table has a gas lead provided with 4 gas taps of 4 mm. bore and a tap of 8 mm. bore, for filling the gasometer and for heating the combustion furnaces. The gas taps are arranged in front under the table top and have hose unions bent upwards in order to prevent the hose tearing. The water lead ends in a tall nickelled standard with rotary outflow pipe, the latter serving for the filling of tall vessels and gasometers. Underneath this is a low pressure water standard with three water taps, two of the latter having screwed hose connections. On the same narrow side of the table is a laboratory basin (German design) of hard baked white earthenware, with a raised back wall, deepened bottom, overflow, drainer and stoneware valve for the purpose of carrying on continuous washing operations. Further, the table is fitted with piping with tap for compressed air, 1 pipe line with tap for air intended for obtaining vacua, a large and deep pneumatic trough (zinc) with zinc bridge, overflow pipe, draining valve and a slate slab as lid. In addition the table is provided with 1 draught pipe for gases and noxious fumes, 1 porcelain sink with strainer and lead waste pipe; 1 hollowing for working with mercury and 1 electric lead consisting of 2 wood covered metal rails let into the table, the rails having plug points every 25 cm. The holes take 4 plug terminals, with ebonite handles, supplied with the table. The lid of the sink and of the draught pipe are constructed of iron and are let into iron rings. All pipe lines are fixed complete down to the floor.

50 064. 1 : 25.

Special Fittings for the previously-listed Table.

	£. s. d.
50,060. **Lead Pneumatic Trough,** built into a solid wooden case, with overflow pipe and lead draining valve. Extra price as against zinc trough	1. 8. 0
50,061. **Tension Clips** for a steel flask intended for compressed air, etc. . . . . Extra	0. 8. 6

For other **Special Fittings,** see Nos. 50,011—50,030, pp. 10—12.

Lecture Table for Chemistry (as suggested by Arendt), Fig. 50,064.

With oak top	List No.		**50,062**	**50,063**	**50,064**	**50,065**	**50,066**
	Length of Table	m.	3	3.5	4	4.5	5
	Number of drawers		20	24	30	34	34
	Price	£	**45. 8. 0**	**50. 7. 0**	**55. 11. 0**	**60. 0. 0**	**64. 2. 0**
With teak top	List No.		**50,067**	**50,068**	**50,069**	**50,070**	**50,071**
	Length of Table	m.	3	3.5	4	4.5	5
	Number of drawers		20	24	30	34	34
	Price	£	**47. 17. 0**	**53. 2. 0**	**58. 17. 0**	**63. 16. 0**	**68. 4. 0**

The gross weights are given only approximately and hold for batten packing: about 500 kg for a length of 3 m, 550 kg for 3,5 m, 620 kg for 4 m, 680 kg for 4,5 m and 750 kg for 5 m.

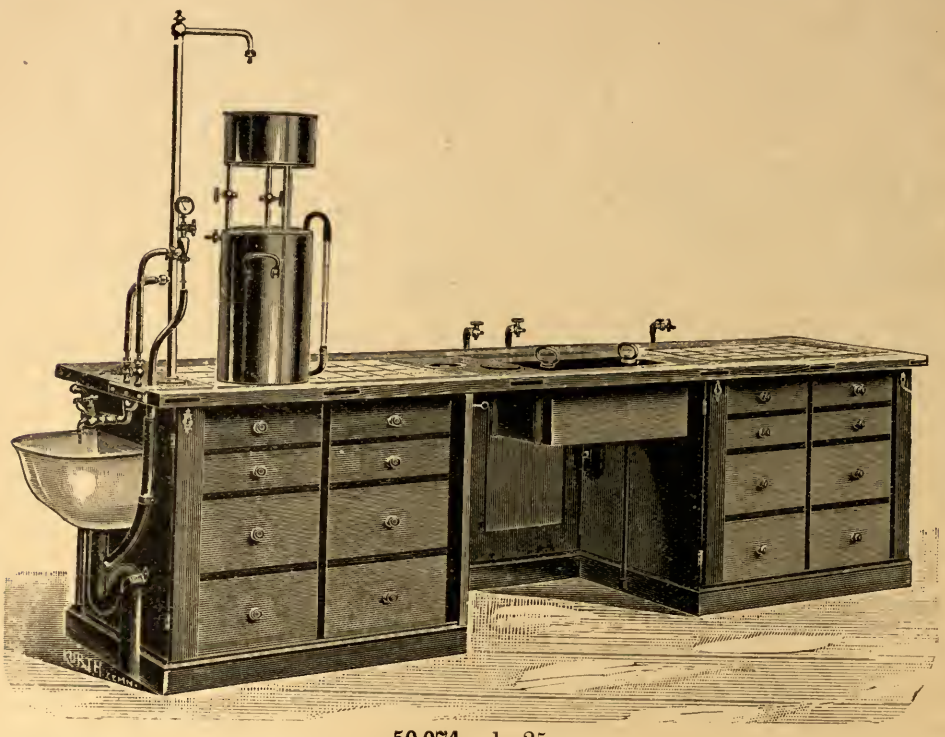
This table is 95 em. in height and 80 em. in width. The top is of oak or teak 40 mm. in thickness and is composed of frame and pannellings. The body (the frame and pannellings of which are of pitch pine) is carefully stained and varnished, it has oak bottom fillets, and has, according to the length, 20 to 34 drawers with various compartments which in part have sheet iron covers provided with name labels. The table contains a large pneumatic trough, gas draught pipes, waste pipes, 4 electric lead terminals with ebonite handles screwed over them, gas pipes with specially constructed gas taps and movable gas outlets arranged at the back of the table; water lead, water turbine, water air pump, large rectangular porcelain basin; leads for compressed air and for air for obtaining vacua; also leads for oxygen and hydrogen. 1 mercury board is given in with the table. The 3 upper rows of drawers of each half of the table can be closed simultaneously by a handle.

Chemistry Lecture Table, simple construction (Fig. 50,074, p. 16).

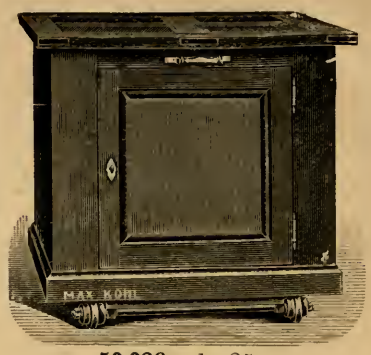
With oak top	List No.		**50,072**	**50,073**	**50,074**	**50,075**	**50,076**
	Length of Table	m.	3	3.5	4	4.5	5
	Price	£	**26. 8. 0**	**28. 12. 0**	**30. 5. 0**	**31. 18. 0**	**34. 8. 0**
With teak top	List No.		**50,077**	**50,078**	**50,079**	**50,080**	**50,081**
	Length of Table	m.	3	3.5	4	4.5	5
	Price	£	**28. 18. 0**	**31. 13. 0**	**33. 11. 0**	**35. 15. 0**	**38. 10. 0**

The approximate gross weights, with batten packing are: about 390 kg for a length of 3 m, 440 kg for 3,5 m, 480 kg for 4 m, 520 kg for 4,5 m and 570 kg for 5 m.

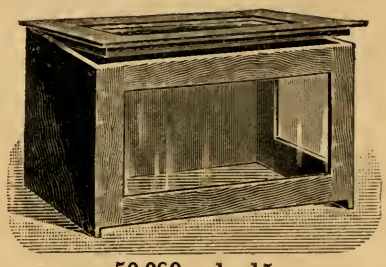
The table is 90 cm. in height and 80 em. in width. The top is of oak 40 mm. thick, is composed of frame and pannellings and is varnished with three coats of hot linseed oil. The body (the frame and pannellings being of pitch pine) is carefully stained and varnished; it has oak bottom fillets and has 8 deep and 8 shallow drawers. The shallow drawers are divided up into various large compartments. Each row of drawers can be closed with one lock. The table is fitted with a gas lead provided with 2 double hose cocks and a wide tap for filling the gasometers. The taps are fitted on the front side of the table some little distance above the table top. The water lead ends in a tall nickelled standard with rotary outflow pipe, which serves for filling the gasometers. In addition, a water tap and a porcelain basin with lead valve and waste pipe, are fitted on the narrow side of the



50 074. 1 : 25.



50 086. 1 : 25.



50 089. 1 : 15.

table. The table has a line of piping, with tap, for connection to the water blast. A nickelled metal water air pump with vacuometer is ready for use with inlet and outlet pipes to the water standard. In the centre of the table in a pneumatic trough of zinc, with zinc bridge, with direct water inlet, overflow pipe and draining valve. The cover of the trough consists of a slate slab. On the right hand side a slate slab 80 × 60 cm. is let into the table top for work involving the use of eorrosive fluids. Further, the table has a draught pipe for noxious gases and an electric lead, the latter eonsisting of 2 wood covered metal rails let into the table top. The rails have plug points and 4 plug terminals having ebonite handles. All pipe lines are laid ready down to the floor. | £. s. d.

The gasometer illustrated in the Figure is not included in the price.

Staining the table top an acid proof black. Extra per running metre 3. 6

50,082. **For laying the table top with White Glazed Porcelain Slabs** per square metre extra 1. 7. 6

For **Special Fittings** see Nos. 50,060 and 50,061 on p. 15 and Nos. 50,011—50,030 on pp. 10—12.

Accessories for the Lecture Tables.

50,083. **Travelling Table,** being an auxiliary to the Lecture Table (see Fig. 50,086), with 4 double castors (capable also of lateral movement), 1 m. in length, 80 cm. in width, 90 cm. in height. **Top of oak, body of pitch pine** and oak. With a small cupboard | 5. 5. 0

The castors are covered, and the table can be moved conveniently to any desired place.

In ordering, please supply exact details as to the inside width of the doors, in case it is desired to use the table both in the class room and preparation room: the table must be about 10 cm. narrower than the width of the doors. The doors must have no surface projecting above floor level.

50,084. — The preceding, with **teak top** . . . . . | 6. 1. 0

50,085. **Rubber tyres** fitted to the castors of the preceding table so as to make the table travel noiselessly . . . . . Extra cost | 0. 11. 0

50,086. **Travelling Table** as No. 50,083 (see Figure), with 4 rail rollers; oak top and with arrangement for connecting to the lecture table . . . . . | 6. 7. 0

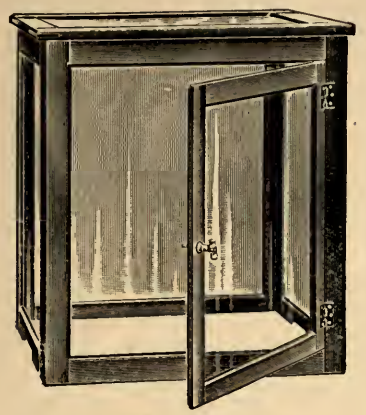
The table is fitted to a heavy iron truck having 4 accurately turned rollers, and can be pushed easily from the class room to the preparation room or museum upon a rail track let into the floor (see No. 50,088).

In ordering, please supply accurate data as to the width in the clear of the doors; the table must be 5 cm, narrower than the width of the doors.

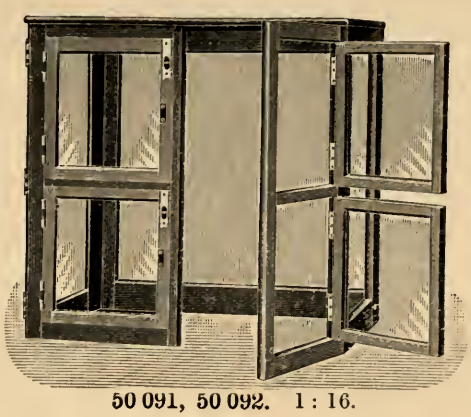
50,087. — The preceding, with **Teak Top** . . . . . | 7. 3. 0

50,088. **Rails** for above for letting into the floor. Price per 1 metre of track . . . . . | 0. 4. 6

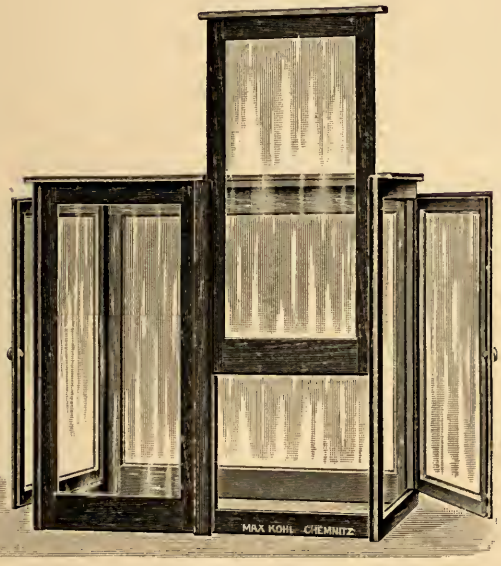
The distance from the lecture table to the middle of the museum is as a rule about 10 metres. On ordering, we send truck and drawing, for fixing of the rails in advance.



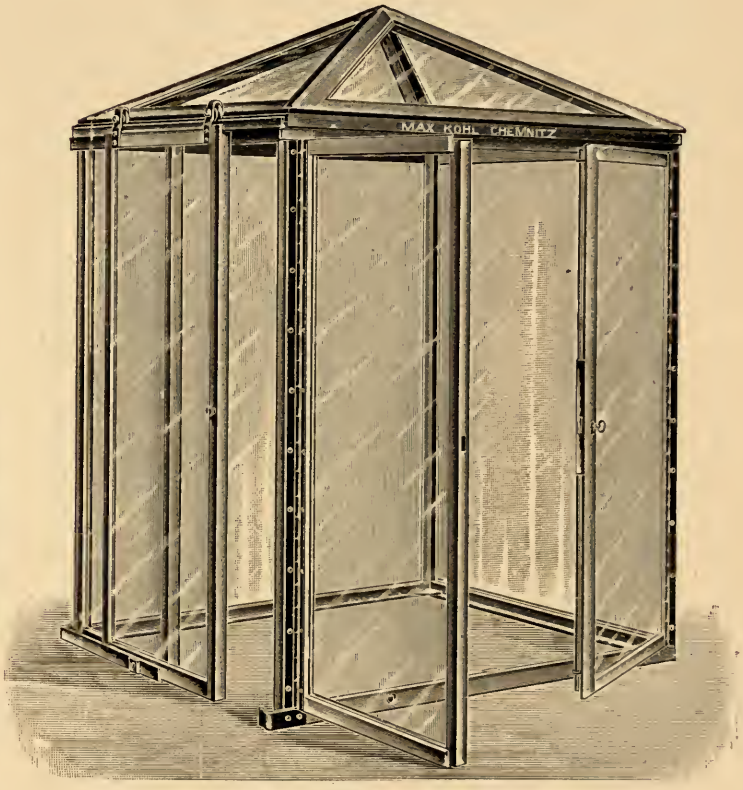
50 090. 1 : 15.



50 091, 50 092. 1 : 16.



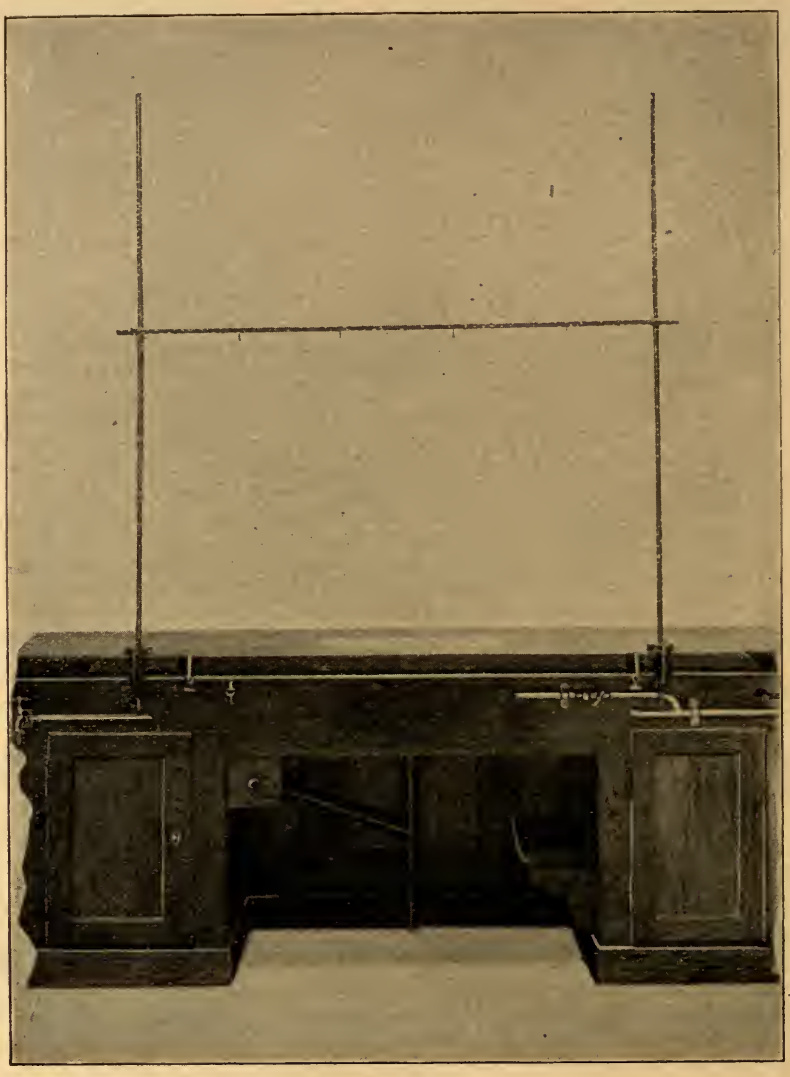
50 093. 1 : 13.



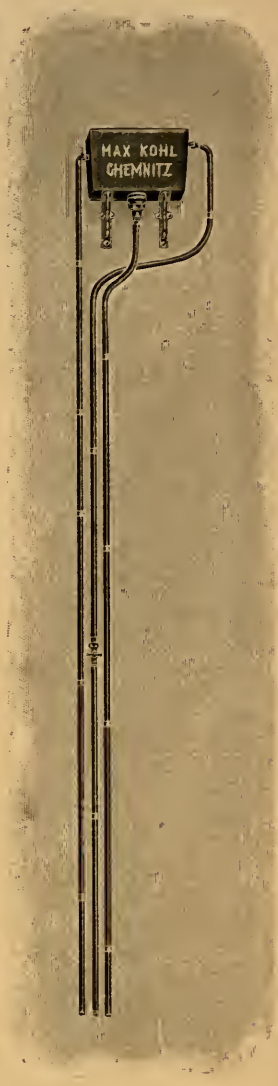
50 094. 1 : 10.

	£. s. d.
50,089. **Glass Case** for erection on the gas draught pipe of the Lecture Table, Weinhold's (W. D., p. 44 [p. 41]), Figure, 50 cm in length, 30 cm in width, 30 cm in height, with removable cover, wood parts of oak	0. 12. 0
This glass case serves for covering Bunsen cells, etc. For chemical experiments the following numbers are recommended.	
50,090. **Oak Stink Cupboard** (Figure). For placing on the gas draught pipe of the Lecture Table, with door and removable cover, 60 cm long, 50 cm deep, 70 cm high. The doors, front and side walls of the cupboard are glazed	1. 7. 0
50,091. **Collapsible Stink Cupboard,** for placing on the Lecture Table, Figure, with 2 doors each having two windows opening independently	3. 18. 0
The woodwork is of oak and the walls are glazed with reliable Rhenish glass panes. Height 70 cm; width 50 cm; length 70 cm.	
50,092. The preceding, with plate glass panes	5. 0. 0
50,093. **Stink Cupboard** (Figure), as suggested by Fried. C. G. Müller (M. T., p. 4), with 1 glass pane without cross bars in front; also with 2 sliding doors at the back, and 1 door at the sides, 65 cm high, 65 cm wide, and 40 cm deep	2. 5. 0
50,094. **Iron Stink Cupboard** with crystal glass panes (Figure), well constructed; this cupboard also serves as a protection from explosions and spurting . .	12. 0. 0
The cupboard is 70 cm long, 60 cm wide, and 80 cm high; it has a sliding door on one side and a double door with basquill lock on the adjacent side. Two of the sides are glazed without cross bar.	

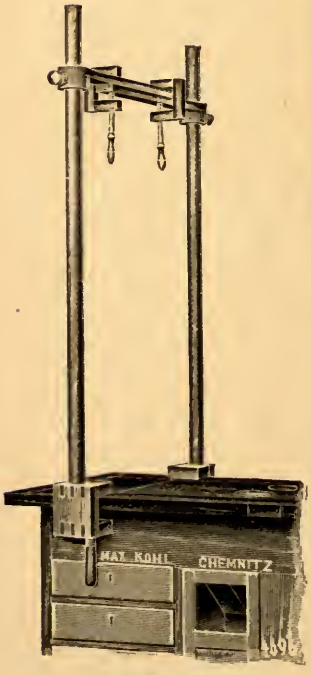
50 095. 1 : 10.



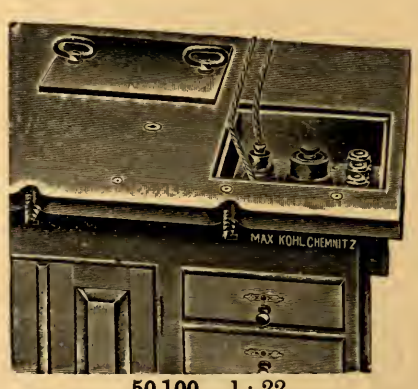
50 097. 1 : 22.



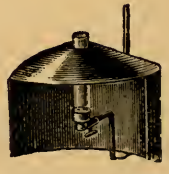
50 101. 1 : 30.



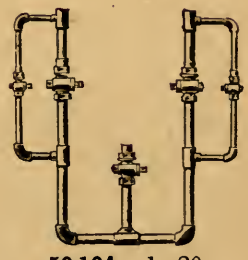
50 096. 1 : 25.



50 100. 1 : 22.



50 103. 1 : 15.



50 104. 1 : 20.

Max Kohl A. G., Chemnitz, Germany.

50,095. **Draught Pipe** for chemical experiments (Figure), for placing over the draught channel of the Lecture Table. With large funnel for collecting the gases; also with regulating valve and arrangement to allow of introduction of chemicals from the top of vessels placed underneath the pipe . . . . . £. s. d. 0. 17. 0

50,096. **2 Supports (oak)** (Figure), as suggested by Friedr. C. G. Müller (M. T., Fig. 2), for screwing on to the Lecture Table; 2 small adjustable clamps are given in with the support 1. 16. 0

50,097. **Iron Suspension Device,** for pendulums, pulley blocks, etc. (Figure), for screwing on to the Lecture Table, with adjustable cross bar 0. 15. 0

Cl. 11, 3897. 3899
3696, 3174, 12, 14.

50 105. 1 : 5.

50 107. 1 : 6.

50,098. **Iron Pendulum Stand,** for the Lecture Table for suspending pendulums, pulley blocks, electromagnets, etc. . . . . £. s. d. 0. 16. 6

For this purpose the lecture table must be provided with two bushes into which two columns can be screwed; the latter each has a clamp with hook upon which a cross bar may be placed.

50,099. **Sliding Slab,** for placing on the Lecture Table; 1.2 m long, of same width as the table, 20 mm thick (M. T., p. 4) 2. 0. 0

The slab is made of oak, being composed of frame and pannellings; it is furnished with fillets at the side which pass along the edge of the table. The slab runs on low rollers and acts as a protection to the table top. Apparatus set up on the slab can thus be easily moved to one side.

50,100. **Switchboard,** for letting into the lecture table or travelling table, for 2 circuits, with slate cover and plug handle for raising the latter (see Figure) 5. 0. 0

The switchboard is designed for connecting up to 2 circuits (alternating — or 3-phase — and direct current) and contains 5 single-pole fuses, 1 double-pole switch, 1 plug box with flexible for 2 leads, 1 3-pole switch and 1 plug box with flexible for 3 leads; all apparatus being mounted on marble slab. The leads necessary on the table are included in the price.

50,101. **Cistern for low-pressure water service** (Figure), with float and automatically closing valve (W. D., p. 16), without piping 1. 8. 0

The pipe carried to the right of the cistern serves as inlet, and the one connected underneath as waste, while the one connected above on the left serves as overflow in case the floating valve fails to act. The low pressure system can be connected with a special pipe line of the lecture table or that of an experimental bench. The cistern is fixed in the preparation room.

50,102. **Overflow Pipe,** with waste pipe (W. D., Fig. 8), for taking off water at high or low pressure at will at the lecture table 1. 5. 0

50,103. **Light Burner with large Shade,** for lecture table and blackboard, as suggested by Weinhold (W. D., Fig. 6), designed for incandescent light, Figure, with mantle and chimney 0. 11. 0

One lamp should be provided for every metre of table length.

50,104. **Gas Distributing Device,** ready screwed together (Figure), with 5 taps 1. 10. 0

The centre pipe is the main pipe with the main cock; the pipe to the left the lead to the lamps for the table; the pipe to the right the lead to the lamps for the auditorium. The object of the device is that the gas to the table and the lecture room or to each may be turned as low as possible without the lamps being extinguished altogether.

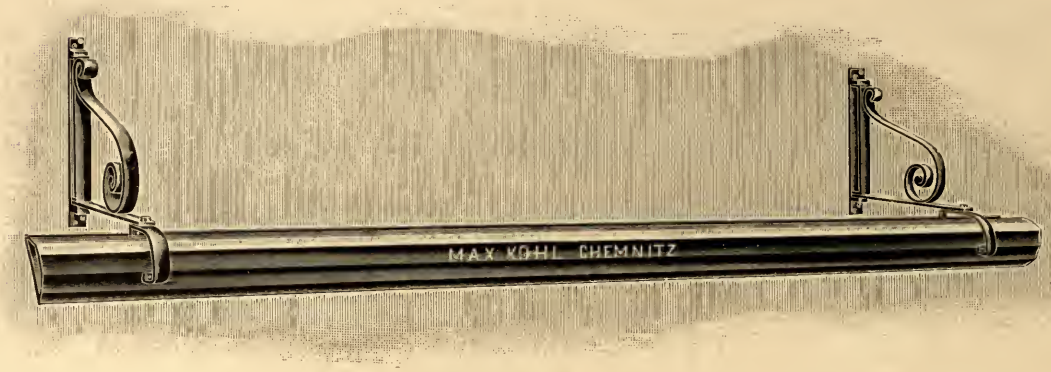
50,105. **Shade for electric glow lamps,** for shading the light on the side of the students, Figure with mount, nipple and holder; without glow lamp. 0. 3. 6

50,106. **Dimming Switch,** for slowly darkening the glow lamps over the lecture table, for 4 25-candle lamps or 6 16-candle lamps 1. 0. 0

50,107. **Nernst Lamp with large shade** (Figure), for lighting the lecture table and blackboard 1. 0. 0

The lamp is shielded from the lecture room. In ordering, please state pressure of circuit on which it is to be used. If this is not given, a 110 volt lamp will be supplied 1. 0. 0

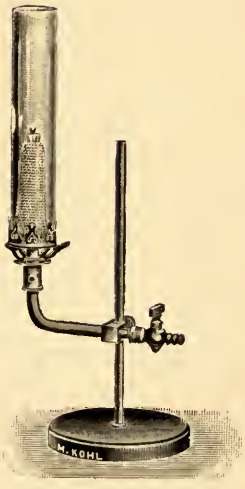
Experimental Switchboards (see special section).



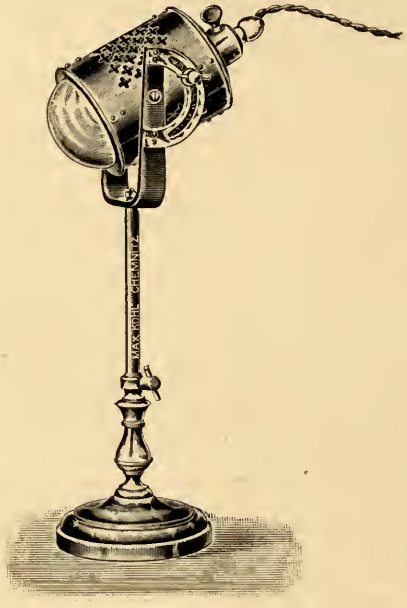
50 108, 50 110. 1 : 22.

50 113 a. 1 : 15.

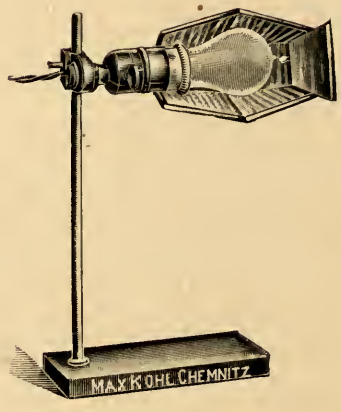
50 113 b. 1 : 15.



50 111. 1 : 8.



50 112. 1 : 6.



50 113. 1 : 8.

50 113 c. 1 : 15.

Electric Soffit Curtain (cf. Figure, for lighting (the lecture table and blackboard, plans, etc., with suspension bow for hanging on ceiling of room by a chain. £. s. d.

List No.	**50,108**	**50,109**	**50,109 a**	**50,109 b**	
Length m	3	4	5	6	
With	6	8	10	12	sockets without lamps.
Price £	**5. 5. 0**	**7. 0. 0**	**8. 15. 0**	**10. 10. 0**	

50,110. **Movable Arms** for preceding soffit curtains (Figure), on which the reflector shade is suspended, so that the reflector may be placed on the wall, and, when not in use, be laid completely on the arms . . . . . Price for 2 | 1. 0. 0

With these arms the soffit curtain is only suitable for lighting the blackboard.

50,111. **Table and Microscope Lamp,** with incandescent burner (Figure) . | 0. 12. 0

50,112. **Nernst Lamp** with **Condenser** (Figure) for brilliantly lighting small pieces of apparatus or parts of apparatus, for 220 volts . . . . . | 3. 6. 0

50,113. **Electric Table and Microscopic Lamp** (Figure) with corrugated glass mirror reflector, 16 candle lamp, on stand, with serpentine stone-base . . . . . | 0. 10. 0

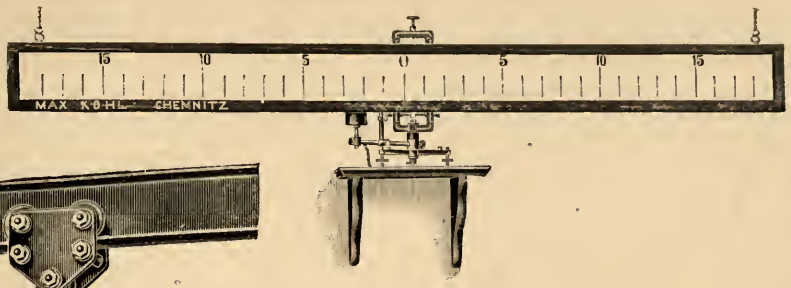
In ordering, please give pressure at which lamp is to work. In absence of instructions a 110 volt lamp will be supplied.

50,113 a. **Laboratory Table Lamp** (Figure), of bronzed iron, with vertically and laterally adjustable arm, and with shade holder, shade, tap socket and glow lamp (110 V.) . | 0. 10. 0

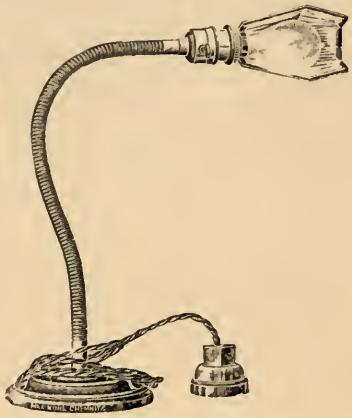
50,113 b. **Universal Work Lamp,** of bronzed iron, adjustable and rotary, with lacquered iron shade, wood handle, tap socket and 110 volt lamp . . . . . | 0. 10. 0

50,113 c. **Stand Lamp,** polished brass (Figure), adjustable, with white opaque shade and tap socket. With 110 volt lamp . . . . . | 0. 10. 0

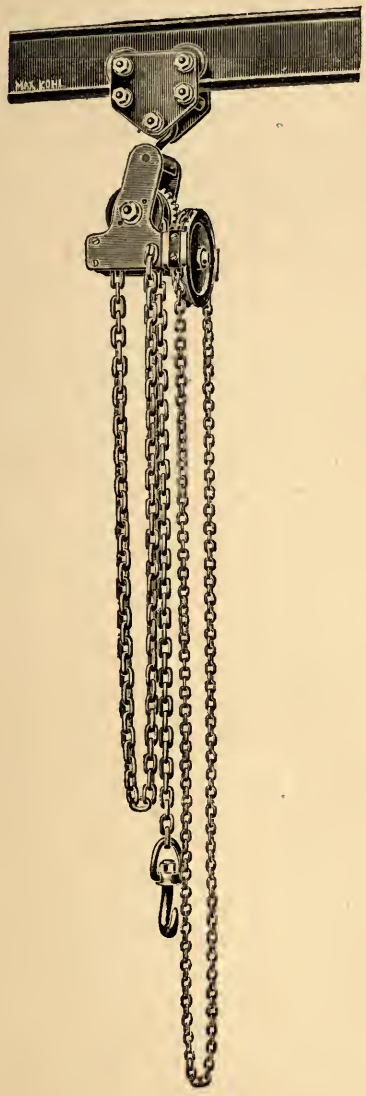
Cl. - 3828, 5171, 5173, 4187, 3762, 3763, 5172.



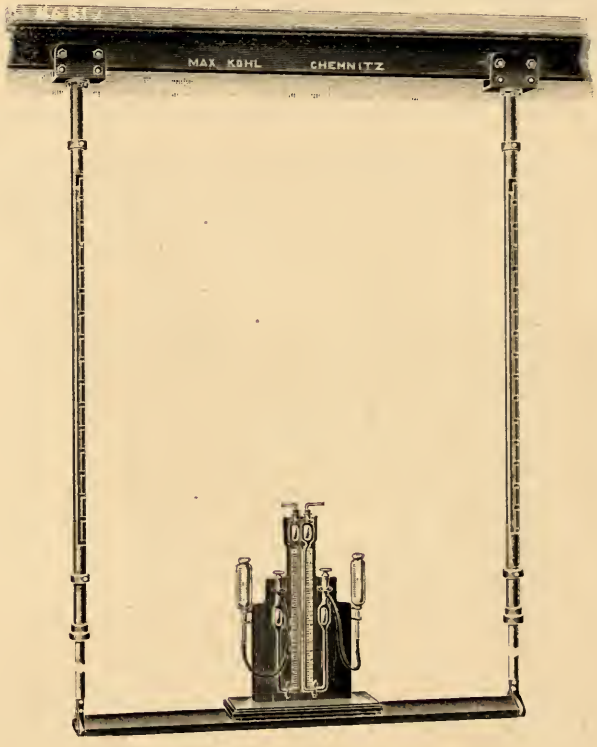
50 118, 50 124.
1 : 20.



50 114. 1 : 8.



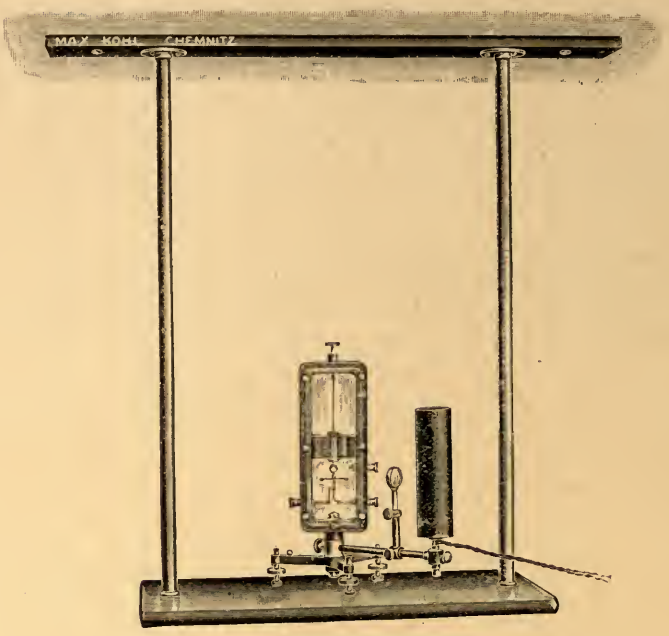
50 115, 50 116. 1 : 10.



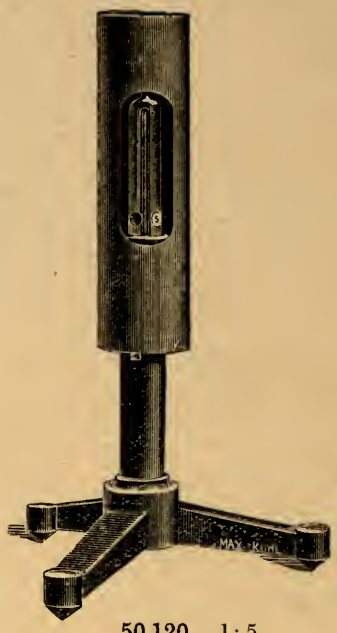
50 117. 1 : 12.

	£. s. d.
50,114. **Table Lamp** (Figure), with flexible standard, heavy base, socket with tap, flexible cord and plug box. Price, with reflector and glow lamp	0. 18. 0
In ordering, please state voltage of lamp desired. In absence of instructions, a 110 volt lamp will be supplied.	
50,115. **I-Beam with Traveller** (Figure) for raising and transporting heavy objects over the lecture table by means of the pulley block No. 50,116	1. 12. 0
The beam is 3 metres long and is, according to the construction of the ceiling, fixed with bolts or flanges. A traveller runs along the beam on 4 rollers.	
50,116. **Screw Pulley Blocks,** for a lifting capacity of 100 kg (Figure) for suspending from the traveller of the **I**-beam, with automatic catch	2. 5. 0
The pulley block is not an ordinary market product, but is specially constructed, in first class manner.	
50,117. **Suspended Board** for setting up apparatus, (Figure), with height adjustment every 5 cm by means of bayonet socket; **carrying bars with rollers** for moving along the rails intended for the pulley block. Price exclusive of thermoscope illustrated	6. 10. 0
50,118. **Wall Bracket** for the reflecting galvanometer (Figure). Price without galvanometer and scale	0. 8. 0

Cl. 5298, 2763, 30. 4681.



50 119. 1:12.



50 120. 1:5.

	£. s. d.
50,119. **Suspended Board** for the **Reflecting Galvanometer,** Figure, with nickelled brass rods and polished board. Price, without galvanometer	1. 10. 0
This suspension device is very practical, as the galvanometer is always ready for use, and cannot be touched. The slit of light formed by a glow lamp filament is projected by the galvanometer mirror on to a scale 4 to 6 m long; the movements of the light pointer can be easily read from the auditorium. The current is carried by 3 well insulated flexibles on a terminal board on the side of the lecture table. By employing Terminals 1 and 2 the thick windings of the moving coil are put into circuit, and the thin windings are connected up when Terminals 2 and 3 are used.	
50,120. **Electric Glow Lamp, on stand,** provided with protecting chimney (Figure) for reflecting galvanometers	0. 18. 0
The glow lamp is a single filament scale lamp. In ordering the voltage on which the lamp is to burn should be given. If this is not stated, 110 volt lamps are supplied.	
50,121. **7 metres triple flexible cord,** 6 porcelain insulators for connections from galvanometer to lecture table and 1 serpentine slab with 3 terminals	0. 12. 0
50,122. **Galvanometer Scale,** 4 m long, painted on linen, divided into decimeters, with metres figured, for fixing on to wall	0. 12. 0
50,123. — The preceding, 6 m long	0. 16. 0
50,124. **Transparent Galvanometer Scale,** 2 m long, of ground glass, mounted in wood frame, graduated every 5 cm, with lugs for hanging from ceiling (Figure on p. 21) . . .	0. 17. 0
This scale is suspended at a distance of about 2 m from the galvanometer. With its aid it is possible to arrange the galvanometer and scale in front of the audience.	
50,125. **Adjustable Ceiling Suspension** for **Reflecting Galvanometers** (Figure), with 10 m copper wire rope, windlass, and 2 rope pulleys, but without galvanometer or lamp . .	6. 10. 0
Between a tall frame composed of 4 metal tubes and wood cross pieces a similar (lower) frame can be adjusted in an up and down direction. With this object the latter frame can be hung upon a copper wire rope which is carried over pulleys to a windlass.	
50,126. **Anti-vibration Suspension for Reflecting Instruments** (as suggested by Julius), Figure, for fixing to the ceiling (Zeitschrift für Instrumentenkunde, **16**, 1896, p. 267)	18 15. 0
The lateral vane-shaped dampers are suspended in vessels which are placed alongside the device and filled with paraffin oil.	

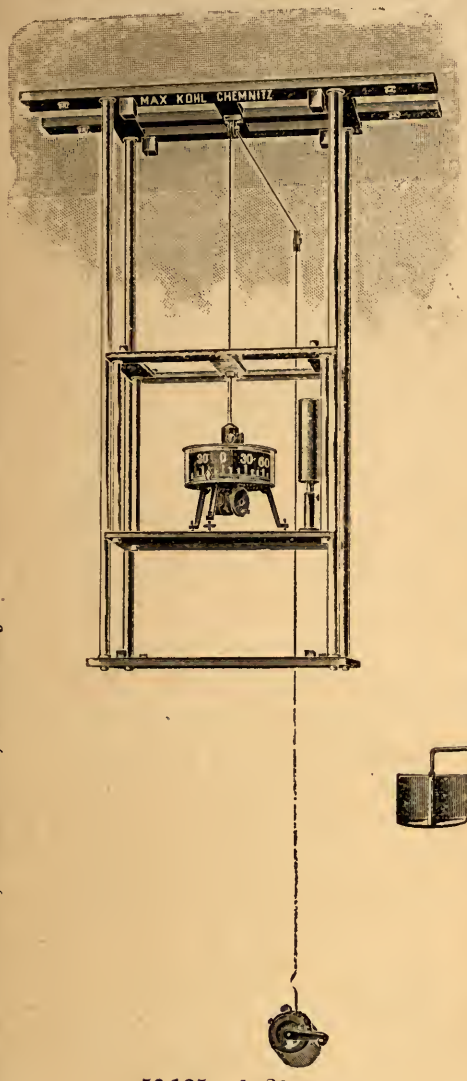
Water Air Pumps and Water Jet Blowers.

(Aspirators and Force Pumps.)

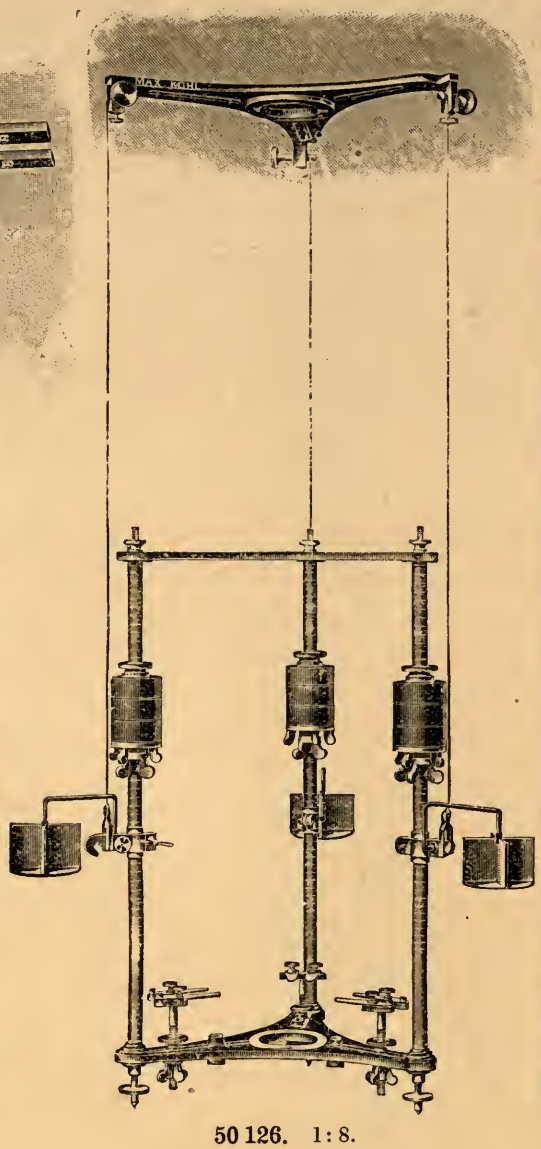
The following points should be taken into consideration in selecting the Water Air Pump:

For cases in which at least 2—4 atmospheres water pressure is available the pumps suggested by **Arzberger** and **Zulkowsky** should be chosen, these giving in a short time a vacuum up to 20 mm mercury. In this pump the water flows through an annular space and sucks the air through a tube connecting with the space.

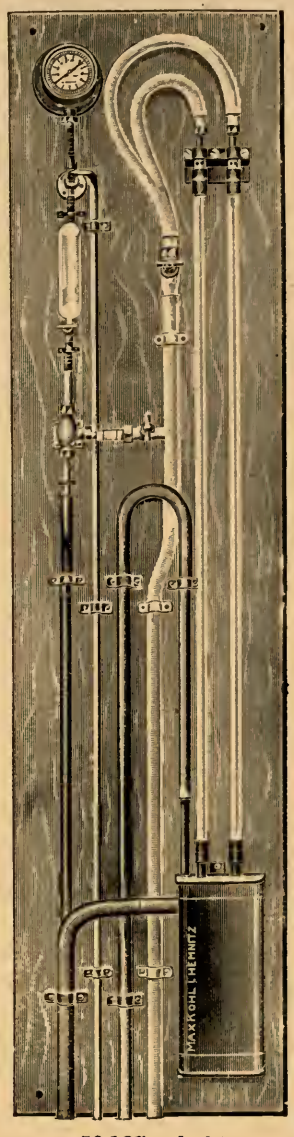
If no water pressure is available, **Bunsen's** pump must be selected, this rendering necessary a vertical fall pipe of at least 10 m long.



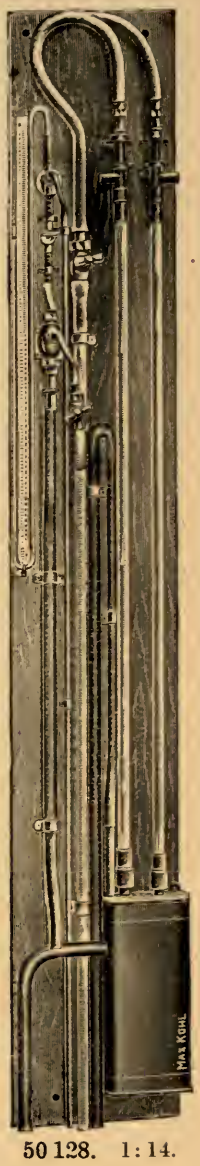
50 125. 1:20.



50 126. 1:8.



50 127. 1:14.



50 128. 1:14.

If in this case the Physics Room is not high enough above ground level, the pump should be erected in a higher storey. In case a water supply pipe is not laid on, it can also be fed from a water tank placed in the uppermost storey of the building.

50,127. **Water Air Pump and Water Jet Blower,** combined on a board (Figure) consisting of water air pump No. 50,129 (with canvas sack and Metal Vacuum Gauge) and Blower No. 50,144, with a screw down tap each for the pump and blower . . . . . £. s. d. 6. 0. 0

The board is 200 cm high and 48 cm wide. For this apparatus fitted with refuse trap, see No. 50,165.

In erecting it is only necessary to connect the suction and pressure leads with the leads on the lecture bench and to connect the water lead with the water waste pipe.

50,128. — The preceding, the air pump fitted with **mercury manometer** (Figure). Price, without the mercury for charging 5. 10. 0

In the illustration this pump is shown without water tank, the construction being very compact when available space is limited.

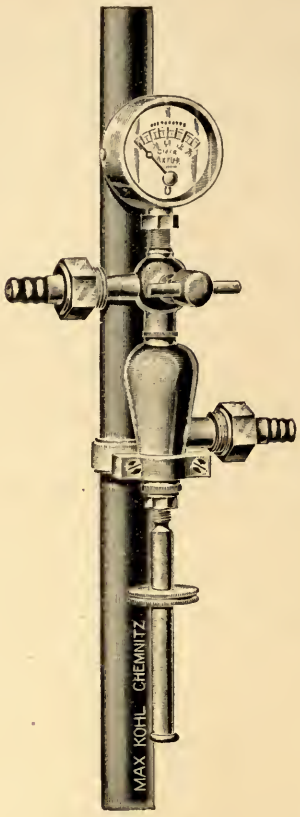
The board is 200 cm high and 35 cm wide.

50,129. **Water Air Pump** (as suggested by Arzberger and Zulkowsky) with water bag (see also Nos. 50,127 and 50,128), made of metal, nickelled, with glass cock, on polished oak board, with **metal Vacuum Gauge** of 100 mm scale-diameter, exhausting to a moderate degree at 10 m water-pressure (1 atmosphere), and to 20 mm mercury column at higher water-pressure (W. D., Fig. 16) 2. 15. 0

The water bag obviates the forcing of water into the air lead or the pressure gauge when the cock is inadvertently placed in the wrong position or when the water is suddenly released.

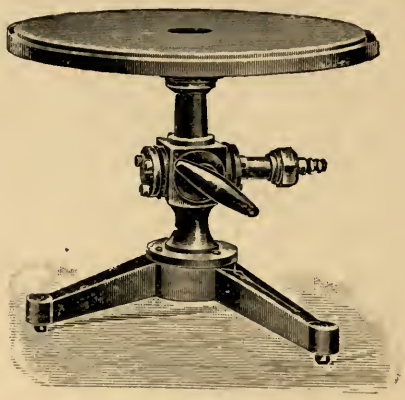
At a pressure of 3 atmospheres these water air pumps exhaust a receiver of 2.3 litres capacity to 18 mm mercury column in 10 minutes.

50 130. 1 : 8.



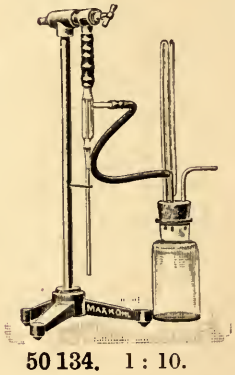
50 131. 1 : 3.

50 136. 1 : 10.



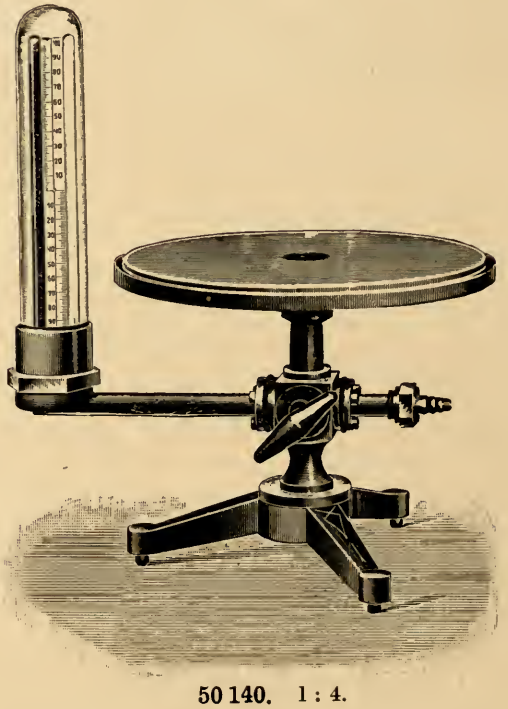
50 139. 1 : 5.

50 132. 1 : 10.



50 134. 1 : 10.

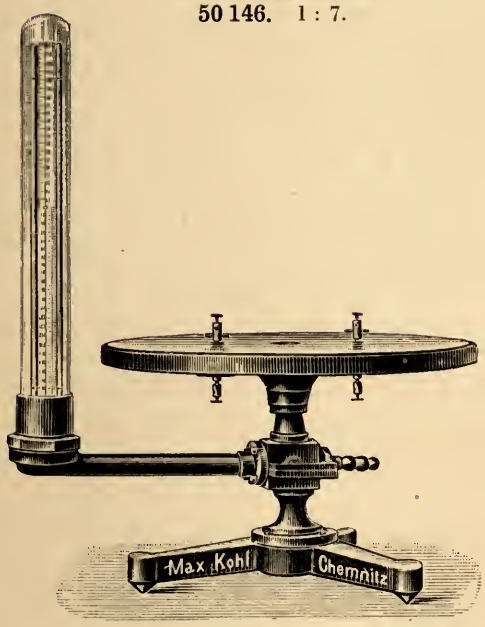
50 138. 1 : 8.



50 140. 1 : 4.

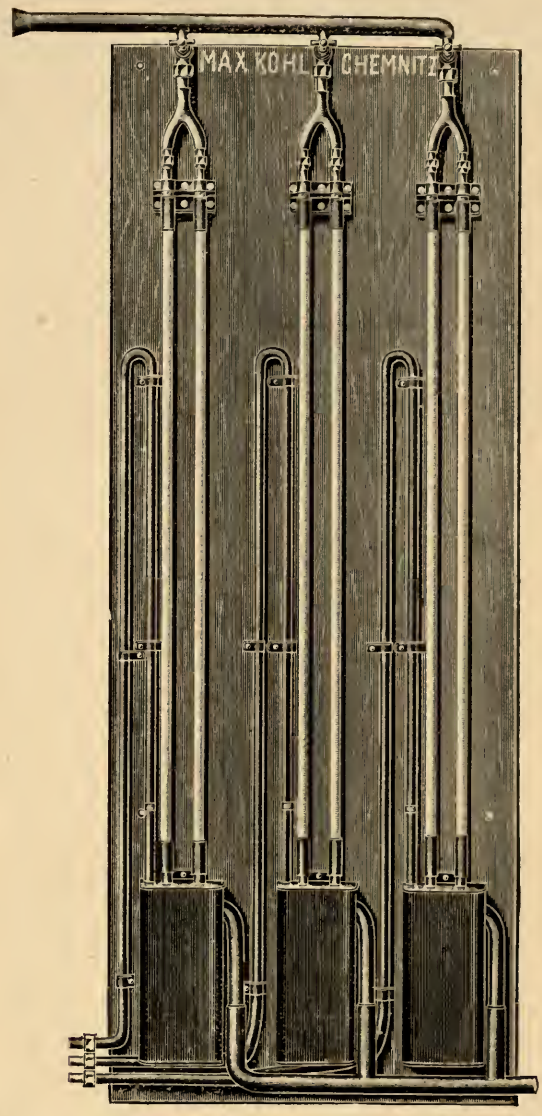
	£. s. d.
50,130. **Water Air Pump,** as No. 50,129, with **mercurial pressure gauge** (Figure), on polished oak board. Price without mercury for charging	2. 5. 0
50,131. **Water Air Pump** (Arzberger and Zulkowsky's), Figure, **with Metal Vacuum Gauge,** 50 mm in diameter and with screw clamp for fixing to a stand, water tap standard or the like. Price, without stand	1. 18. 0
50,132. — The preceeding, Figure, with stand, for placing on the table	2. 0. 0
50,133. — The preceeding, with wall dise	1. 17. 0
50,134. **Glass Water Air Pump** (Wetzel's), with stand (Figure), with cock, overflow vessel, barometric gauge and rubber hose reinforced with metal spiral . . . . . This air pump can only be used with a water pressure of 3—6 atmospheres; it works excellently.	1. 3. 0
50,135. — The preceeding, without stand . . . . . The air pump in this construction is intended for connecting directly to water hose taps.	0. 3. 6
50,136. **Water Air Pump** (Bunsen's), Figure, of metal, nickelled, **with Metal Vacuum Gauge** 100 mm diameter, on polished board, arranged for screwing on the wall, with water bag, but without fall pipe . . . . . This air pump does not need any water pressure, but a narrow fall pipe at least 10 m long is necessary.	2. 15. 0
50,137. — The preceeding, with **mercurial pressure gauge**	2. 5. 0

50146. 1 : 7.



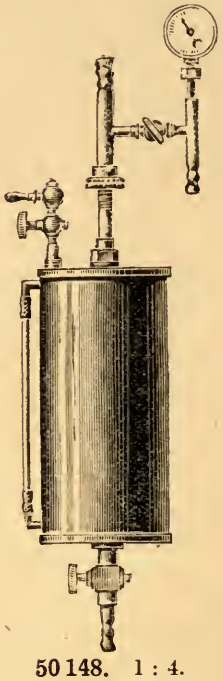
50141. 1 : 6.

50144, 50145. 1 : 16.

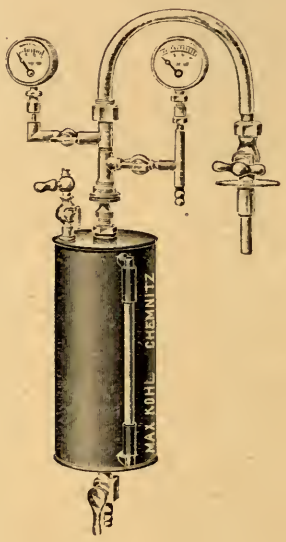


50147. 1 : 14.

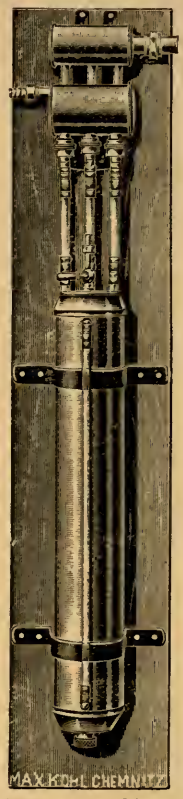
	£. s. d.
50,138. **Water Air Pump** (Stuhl's), Figure, of glass, on polished board; may be used for suction or for blowing	0. 16. 0
50,139. **Table for Water Air Pump,** 24 cm diameter, Figure.	1. 16. 0
50,140. — The preceding, **with barometric gauge** 200 mm in height, Figure . .	2. 14. 0
50,141. **Plate for the Water Air Pump** (Figure), 32 cm diameter, **with barometric gauge** 300 mm high, **electric lead** under the receiver, detachable plug clamps on the plate, and steel tap with brass handle.	5. 5. 0
50 142. — The preceding, **smaller model,** without electric lead, **28 cm** diameter . .	4. 15. 0
50,143. **Rubber hose for above,** reinforced with wire spiral, and braided. Price per metre	0. 3. 6
50,144. **Water Jet Blower,** Figure (W. D., Figs. 23 and 24), with 2 tubes (see also Nos. 50,127 et seq), without pipe union (see No. 50,145)	1. 10. 0
The blower is used for glass blowing, and is specially suitable for blowing pipes and sirens in conjunction with the employment of a wind chest. The blower works very well with 10 m water pressure (1 atmosphere). As it delivers large volumes of air at medium pressure, it is preferable to any injector blower.	
50,145. **Pipe Union** (see Fig. 50,144), for connecting up the water jet blower with the water lead, with screw down tap for the blower	0. 10. 0
50,146. **Water Jet Blower** (as suggested by Fried. C. G. Müller), Figure, of glass	0. 10. 0
50,146 a. — The preceding, new construction (M. T., Fig. 90)	1. 0. 0
50,147. **3 Water Jet Blowers,** mounted on one board, for laboratories provided with a number of laboratory benches	5. 0. 0



50 148. 1 : 4.



50 149. 1 : 7.



50 150 — 50 161. 1 : 16.

50 164 a. 1 : 10.

50,148. **Water Air Pump and Water Jet Blower,** Figure, with water gauge, cut-off tap for the aspirated air, and vacuum gauge, tap with movable point for the hose, for the compressed air, and with delivery cock; cylinder bronzed . . . . . £. s. d. 2. 6. 0

This apparatus sucks about 20 litres of air per minute with 3 atm. water-pressure and 10 litres water-consumption per minute.

50,149. — The preceding, **with pressure gauge and pipe union,** with tap (Figure), for placing over the water basin of the lecture table 3. 10. 0

Large Water Jet Blower; can also be used as a Water Air Pump, Figure, for Chemical and Physiological Laboratories.

	With	1	2	3 injectors
Necessary width of piping mm		13	19	25
Of **Sheet Zinc,** bronzed	List No.	**50,150**	**50,151**	**50,152**
	Price £	**3. 0. 0**	**3. 15. 0**	**4. 10. 0**
Of **Sheet Copper,** bronzed	List No.	**50,153**	**50,154**	**50,155**
	Price £	**3. 10. 0**	**4. 5. 0**	**5. 0. 0**

— The preceding, with **lead pipes** and **glass tube** for observing the pressure of the water column to be overcome.

	With	1	2	3 injectors
Necessary width of piping mm		13	19	25
Of **Sheet Zinc,** bronzed	List No.	**50,156**	**50,157**	**50,158**
	Price £	**3. 15. 0**	**4. 10. 0**	**5. 5. 0**
Of **Sheet Copper,** bronzed	List No.	**50,159**	**50,160**	**50,161**
	Price £	**4. 5. 0**	**5. 0. 0**	**5. 15. 0**

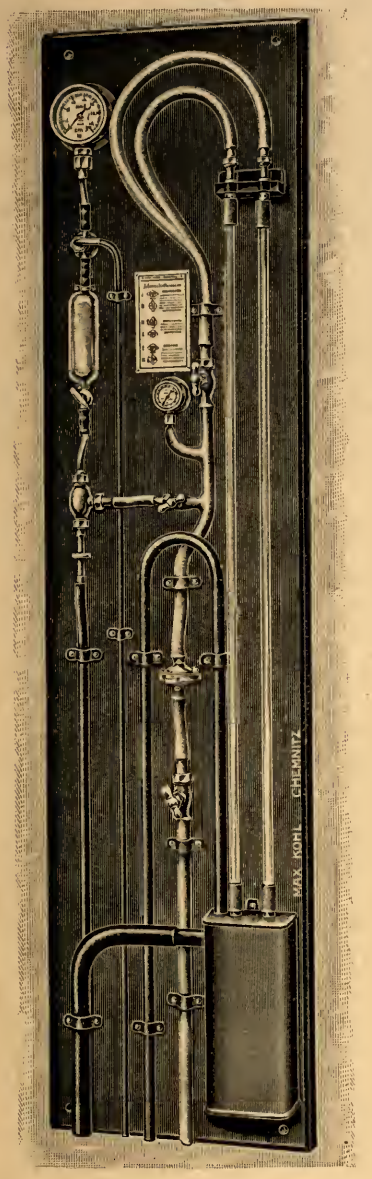
For above:

50,162. **Spring Vacuum Gauge,** with silvered scale, 55 mm diameter, on iron base, with 2 hose unions . . 0. 18. 0

50,163. **Non-return Valve** (for screwing on) 0. 5. 0

50,164. **Pressure and Vacuum Gauge** (Landolt's), as Figure 50,164 a, for measuring the pressure of the compressed and rarified air, 80 cm long, with opaque glass scale let into glass, graduated in $^1/_2$ cm, on polished wood board, for fixing on wall. With **T**-shaped hose piece without cock 0. 15. 0

50,164 a. — The preceding, **with 3-way cock** in the centre of the **T**-piece (Figure) 0. 18. 0



50 165. 1 : 14.

50 166, 50 181. 1 : 22.

50,165. **NEW! Water Air Pump and Water Jet Blower,** mounted on one board, Figure, consisting of Water Air Pump No. 50,129 (with water bag and **metal vacuum gauge** of 100 mm scale diameter) and Blower No. 50,144 with 1 refuse trap, 1 screw down tap each for the pump and the blower and **1 pressure gauge** for showing the water-pressure . . . . . £. s. d. 7. 5. 0

The board is 200 cm high and 48 cm wide. The nets of the waste trap may be removed for cleaning.

Blackboard Frames.

50,166. **Blackboard Stand with Cupboard Substructure** (Figure), constructed of pitch pine, with **1 blackboard 1.8 m** long and **1 m** high 10. 15. 0

The blackboard is of deal; it consists of frame and pannellings and is covered on the front with black linoleum; it has an even, dull black, non-reflecting writing surface, is suspended on gut strings, balanced by iron weights, and can easily be moved in an up-and-down direction. The body of the frame forms a cupboard having 3 double doors and 3 drawers for taking chemicals and the like, and an oak slab at the height of the table.

The blackboard frame is arranged in such manner that the sliding window of the stink cupboard is placed behind the blackboard, and on the room being darkened the blackboard screens off the light passing through the window of the stink cupboard.

50,167. — The preceding, **with 2 blackboards** 12. 5. 0

In this construction one blackboard balances the other, so that a stink cupboard placed in the wall behind the frame is not accessible. If it is desired to have a stink cupboard behind the frame, the 2 blackboards must be balanced independently of each other. If this is necessary, the price of the frame is **increased** by about £ **1. 5. 0.**

50169. 1 : 20.

50175. 1 : 23.

	£. s. d.
50,168. **Blackboard Frame, on two columns, with 1 blackboard** and with oak table top . .	6. 15. 0
50,169. — The preceding, **with 2 blackboards,** Figure . . . . . See observation under No. 50,167.	8. 0. 0
50,170. **Blackboard Frame with Cupboard Substructure,** as No. 50,166, but **smaller,** with **1 blackboard 1.5 m** long and 1 m high	9. 10. 0
50,171. — The preceding, **with 2 blackboards** . . . . . See note under No. 50,167.	10. 13. 0
50,172. **Blackboard Frame on Pillars,** as 50,168, but **smaller,** with **1 blackboard 1.5 m** long and 1 m high	6. 0. 0
50,173. — The preceding, with **2 blackboards** . . . . . See note under No. 50,167.	7. 5. 0
50,174. **Blackboard** (as suggested by Fried. C. G. Müller) (M. T., p. 6), with **pillar substructure,** with 1 fixed and 1 movable wood slab, standing alone . . . . . The slabs are 1.50 m wide and 1.05 m high; various objects and utensils can be hung on the back. The foot supports, carried behind, are firmly screwed down to the floor.	8. 0. 0
50,175. **Blackboard with Stink Cupboard,** Figure, without the battery illustrated . . . The **blackboard frame** is 3 m high; the blackboard itself is of deal, is composed of frame and pannellings and is covered on the front with black linoleum; width 1.30 m; height 1 m. It can be	19. 5. 0

moved with ease in an up and down direction, and has thin red vertical and horizontal lines every 10 cm, which are easily visible, but only a short distance away. £. s. d.

The **stink cupboard** is 1.50 m long, 70 cm deep and about 2.30 m high. It is constructed of pitch pine. The upper part is glazed and has a sliding window in front suspended on gut strings, being maintained in any desired position by counterpoises. The top (which is sloping) is glazed. The water resulting from precipitation is collected in a lead gutter arranged in front, and this water is conducted to a lead vessel placed laterally. The table top is a polished slate slab mounted in oak frame. The **substructure** is built as a cupboard for taking a battery of accumulators. The cupboard is in communication with the draught pipe proper by holes drilled in the table top; thus the gases which are generated while the accumulator is charging escape through the draught pipe. In order to accelerate the dissipation of the poisonous gases and to prevent their entry into the school room, an electrically-driven ventilator is fitted in the wall at the back of the upper part of the cupboard. By means of a hand wheel the accumulators can be switched on from the outside for the various purposes for which they are intended to be used. The stink cupboard has water inlet and waste, the cock being placed under the table on the outside. The outlet orifice is placed inside the cupboard at the back, above a lead basin let into the slate slab. A gas supply lead with two supply points has likewise 2 taps outside; the orifices, in the form of hose unions, being inside the cupboard. A third tap is intended for the draught flame. The various leads are laid on complete to the floor. The back is open, and the cupboard should be placed close up against the wall, and before erecting the cupboard, the wall must be plastered with cement or laid with tiles.

50,176. **Blackboard T-square,** with centimetre graduations, 1 m long (W. D., Fig. 48 [Fig. 44]) 0. 3. 0

50,177. **Blackboard Triangular Set Square,** graduated 0. 3. 6

50,178. **Blackboard-Triangle** 0. 4. 0

50,179. **Blackboard Ruler** 0. 1. 6

50,180. **Wood Compasses** with brass bow 0. 8. 0

50,181. **Wall Stink Cupboard** (or hood for escaping gases), Figure on p. 27, 1.2 m long, 0.9 m high, 0.6 m deep, lined with 4 polished slate slabs, with holes for the gas used for heating and lighting, and with opening to the draught flue (see also Plate II, p. 5) 12. 0. 0

The wall stink cupboard has both on the class room and preparation room sides a sliding window of the size of the portion of wall cut away, to allow of the cupboard being opened and closed. In the preparation room the cupboard has a table substructure with oak top, while in the Class Room the substructure of the blackboard fulfils the object of table.

If desired, the cupboard can be done out with glazed slabs, in which case we supply a porcelain shutter for building into the wall, for shutting off the lower orifice of the draught flue. For the purpose of obtaining good ventilation, it is advisable to have square acid-proof clay pipes for building or fixing into the wall, with additional pieces for closing at the roof.

On erecting the building, a suitable opening should be provided in the wall.

Darkening Apparatus.

General Remarks. The devices consist of **roller blinds of black, light-tight felt** fixed to shafts composed of Mannesmann tubes. The rods rest in iron wall bearings placed above the windows. At the lower end the blinds have weighting bars and move over guide bars and between broad wood frames of ⊏ shaped section. These frames are so constructed that they completely surround the windows. When a number of windows in a row or on more than one side of a room are to be darkened simultaneously, the iron rods are coupled together or connected above the corners of the room by couplers. For facilitating transport the frames are delivered in single sections which have to be assembled on receipt.

The substantial construction of the bearings and the powerful transmission shafts, which can be made to any size, are an absolute necessity. The question of cheapness should not be allowed to decide, but if the devices are to work continuously with certainty, the main question is construction as regards the woodwork of the frames, the material and the transmission parts.

The **material** of which the curtains are made is of primary importance. This is manufactured expressly for the purpose; it is absolutely light-tight and moth-proof, and consists of 3 layers bound together — a product of many years' experience. The fabric is 3—5 mm thick. This thickness is necessary to obviate any chance of the curtains shrinking and to offer sufficient resistance to the draught. The disadvantages of darkening the windows by roller blinds can always

Stink Cupboards — see pages 48 to 52.

be traced to the employment of material which is unsuitable for the purpose. By using our system of darkening it is possible to exclude the light entirely over surfaces to 5 metres width and 9 metres height.

The darkening devices can also be supplied of simpler construction. In this case the blinds consist of black, impregnated sail cloth and on three sides of the window the framing is fitted with cornices. The price is reduced by about a quarter in this construction.

As the price of the device is calculated according to the space to be obscured and the length of the transmission parts, it is necessary when sending inquiries to give an elevation and section of the window wall and to state the height and width of the window bay, of the distance apart of the bays, and their distance from the windows and the walls, so that we may be enabled to quote the price correctly. If there are iron girders over the windows, or pipe-lines, heating units, or the like in the neighbourhood of the windows, these should be shown in the drawing.

We shall be glad to submit drawings, prices and references as to work already carried out by us in this connection.

	£. s. d.
50,182. **Window Darkener** (Weinhold's), **for working by hand** (W. D., Plates I and II and Fig. 2 A, B, C), without rope pulley, wire rope or winder; according to the size of the windows. Roller Blinds of felt with inlaid fabric	Price on application
In the hand-operated darkeners a rope-pulley with wire rope is fixed on the shaft of the blind, the latter being rolled up and down by a winder. This winder has an automatic clutch and remains in any desired position. The handle of the windlass is detachable.	
50,183. — The preceding, **simpler, with blinds of impregnated sail cloth.** Framing on three sides of the window, with cornice. The price is about a quarter lower than in No. 50,182.	
50,184. **Rope Pulley,** 13 cm diameter	0. 9. 6
50,185. — The preceding, 20 cm diameter	0. 13. 6
50,186. **Winder,** for 1 window, with automatic clutch and detachable handle	0. 13. 6
50,187. — The preceding, **larger,** for a number of windows	0. 19. 0
50,188. **Wire Rope,** 3 mm diameter . . . . . Per metre	0. 0. 5
50,189. — The preceding, 5 mm diameter . . . . . Per metre	0. 0. 9
50,190. **Skylight Darkener,** for large rooms having Skylight.	Price on application
The roller blind is fixed to massive wood shafts having wheels at both ends. The wheels run on rails.	
50,191. **Darkeners, motor-driven** (Figure), these being operated rapidly and conveniently by simply switching on a switch or pressing a button: the window or windows being darkened in a few seconds and the motor automatically switched off. The above can be supplied on application on giving details of the conditions prevailing, drawings, etc.	Price on application
In this arrangement the operation of darkening can be carried out **from any desired position of the room and all windows can be darkened simultaneously.** If the windows lie on different sides of the lecture room, the driving shafts are connected with each other by special coupling pieces. The blinds are rolled up and down automatically in a few seconds by means of an electric motor fitted with worm gearing Nos. 50,194—50,196. The operation can be quickly and conveniently effected in two ways — either by means of a switch or press buttons.	
In the arrangement provided with switches, the 3-pole commutator with the requisite fuses are mounted on a marble panel (No. 50 197), the latter being fixed in any convenient position in the lecture room — as a rule on the wall behind the lecturer. It is only necessary to throw the switch up or down, and the blinds move "sympathetically" up and down with the hand lever, the corresponding direction of rotation being imparted to the motor. By placing the switch lever in the central position the blinds can be brought to a standstill at any desired height. On reaching their highest or lowest position, the current is cut out by an "end" circuit breaker (No. 50,200). In cases in which a motor of more than $^1/_4$ HP. is used, a reversing starter (No. 50,198) is used instead of the 3-pole switch. The blind roller is driven from the motor by means of a worm gearing and sprocket chain.	
When the blind or blinds are controlled by press buttons a small switch panel is also necessary (see No. 50,199) with 3 differently coloured buttons. The contacts of the buttons are connected to a device (Fig. 50,199 B) which can be placed in any desired part of the room, and these	

50191. 1 : 36

contacts alternately switch two pairs of electro-magnets in the circuit, the armatures (mounted on a common axis) of which translate their motion to a mercury circuit breaker. This latter acts as a switch for the direction of rotation of the motor. The press button switch can be fixed in any desired position of the lecture room or lecture table. The switch panel (carrying Nos. 50,197 and 50,199 combined) contains two lever switches for the darkening of 2 rows of windows and a press button control for the skylight darkener.

£. s. d.

We have had a number of such devices at work in our factory for many years, and these have proved entirely satisfactory. We can also submit references to a large number of such apparatus constructed for use outside our works.

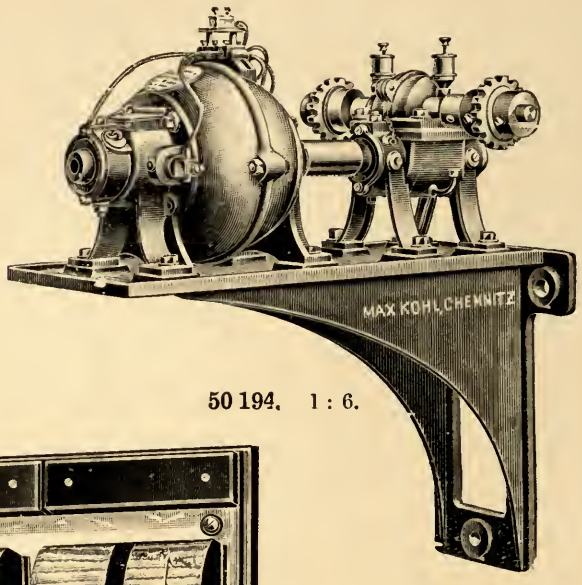
When inquiring for detailed estimates, we would respectfully ask that the necessary drawings of the buildings and plans showing the situation may be forwarded.

The price of the apparatus above described is composed of the prices of the following articles; the cost for erecting is in each case quoted for separately.

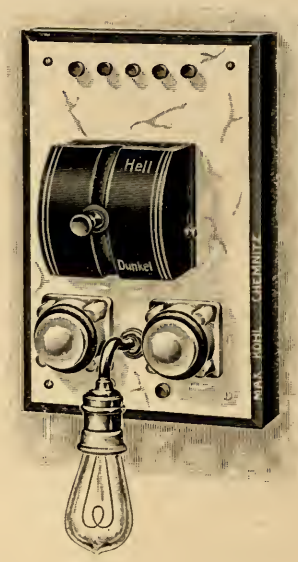
50,192. **Blind, of black absolutely light-tight felt with special covering of fabric,** together with weighting bars, wood frame, shafts, wall bearings, cramp irons and rag bolts for fixing, according to size of windows . . . . . Price on application

Or:

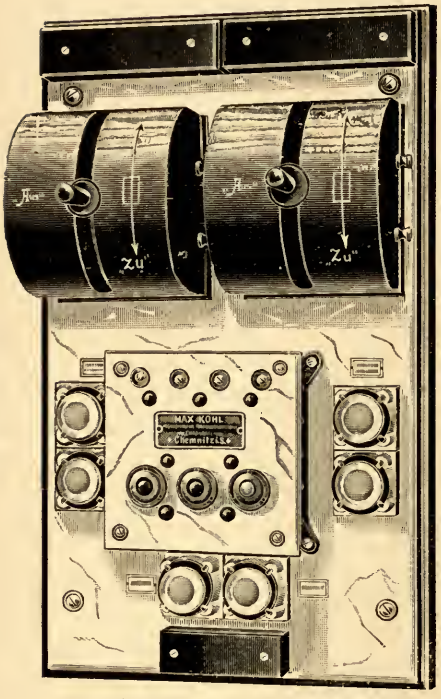
50,193. **Blinds, of black impregnated Sail Cloth,** together with accessories named above; according to size of windows . . . . . Price on application



50194. 1 : 6.

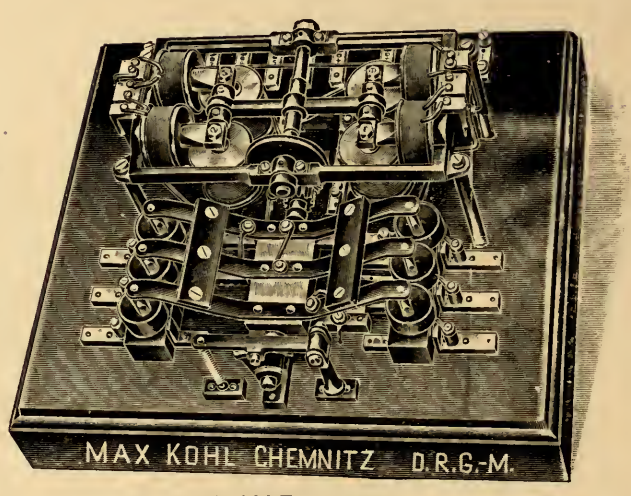


50197. 1 : 7.



50197, 50199. 1 : 8.

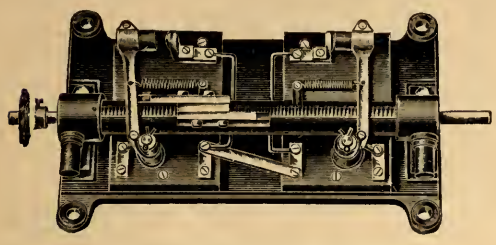
50199 A. 1 : 5.



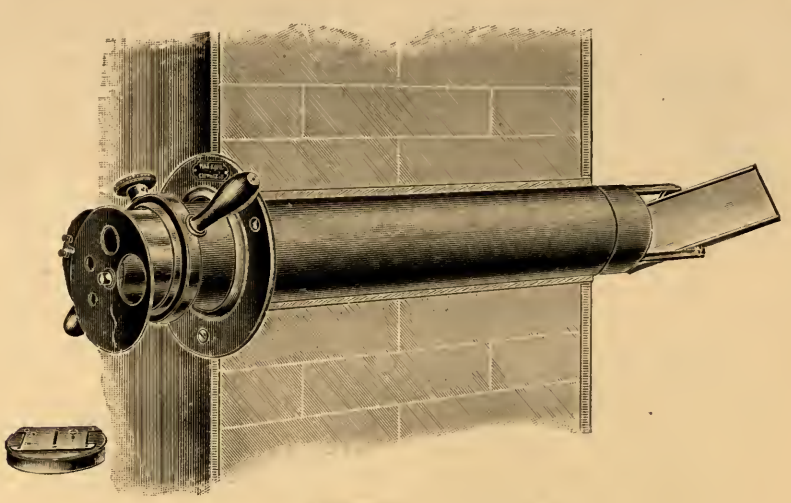
50199 B. 1 : 6.

	£. s. d.
50,194. **Electric Motor with Worm Gearing, on Wall Bracket,** Figure, with 2 cog wheels for driving and 1 sprocket chain. **Capacity of motor, $^1/_4$ HP, for 110 V. Direct Current,** with slate terminal board and terminals, for 1 window	Price on application
If the pressure of the network is other than 110 volts direct current, this must be mentioned when ordering. For a voltage above 220, or for three phase current, the price of the motor is increased.	
50 195. — The preceding, **output, $^1/_2$ HP., for a number of small windows,** 110 V. Direct Current	Price on application
50,196. — The preceding, **1 HP., for a number of very large windows.**	Price on application
50,197. **Threepole Lever Switch,** Figure, enclosed, together with 2 fuses, 7 terminal bolts and control lamp, mounted on marble slab	Price on application
This switch is used only **for motors up to $^1/_4$ HP.** For larger motors, the following reversing-starting switch is employed.	
50,198. **Reversing Starter,** enclosed, 2 fuses, 1 2-pole rotatory switch for 10 amps. and a control glow lamp with holder, for motors **of more than $^1/_4$ HP.**	Price on application
50,199. **Press Button Controller,** Figure A, mounted on marble slab, and **electro-magnetic commutating device,** Figure B	Price on application
50,200. **Automatic "End" Circuit Breaker,** for Direct Current, Figure, Lever with carbon contacts in shielding case, operated by sprocket wheel and chain from the worm gearing	Price on application
50,201. — The preceding, **for 3-phase current;** each lever having 2 carbon contacts	Price on application

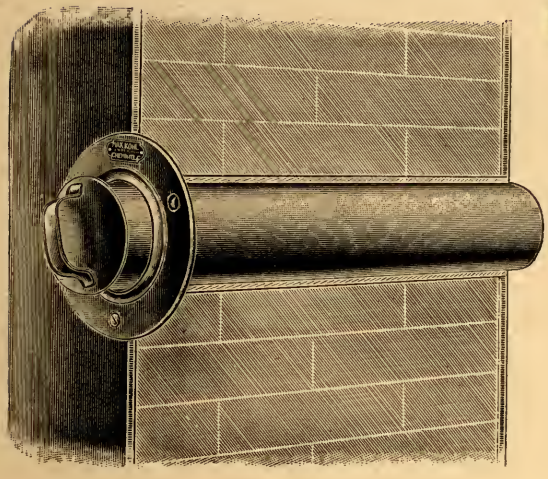
Cl. 35, 52 5.
3191, 3192, 4194.



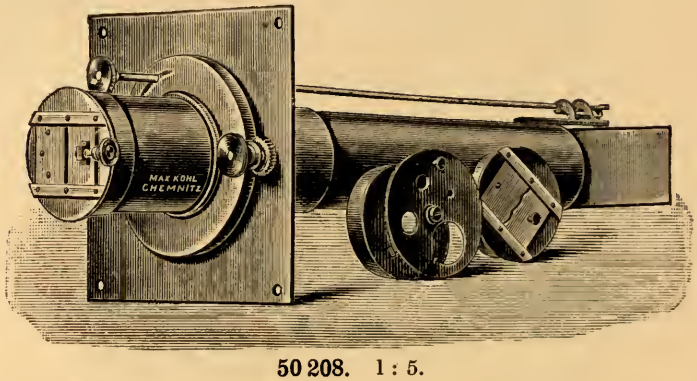
50 200. 1 : 7.



50 205 A. 1 : 8.



50 205 B. 1 : 8.



50 208. 1 : 5.

£ s. d.

50,202. **Small Cupboard for Chemicals,** for storing the reagents necessary for hand use . . 2. 8. 0

A wall cupboard for suspending, made of deal, stained and varnished, with glazed double doors; 60 cm wide, 80 cm high, 15 cm deep, with 4 adjustable shelves of crude glass with polished edge. The wood parts are coated a light-blue oil-colour inside.

Wall Heliostats, Figs. 50,205 A and B.

For walls up to	54	66	78 cm thick
List No.	**50,205**	**50,206**	**50,207**
Price £	**4. 0. 0**	**4. 15. 0**	**5. 10. 0**

The brass heliostat tubes can be slid without friction in a zinc tube (Fig. A), fitted in the wall, and can be easily turned about in the latter. When the heliostat is not in use the opening in the wall is closed by a cylindrical closing plate (Fig. B). If the Physics Room is inconveniently situated, a number of openings in different directions can be made so as always to have sun-light. The heliostat is arranged for horizontal rotation by hand. The mirror is focussed by means of a gut cord stretched by a spring, and a knob. The mirror holder has on one side a good silvered glass mirror, and on the other side a black mirror for diffraction experiments. The following are included with the heliostats: — an attachment, with adjustable slit, and an attachment with diaphragm disc with round holes of varying size and with serpentine slit.

An additional attachment with adjustable slit having micrometer screw and divided drum involves an increase in price of about 0. 10. 0

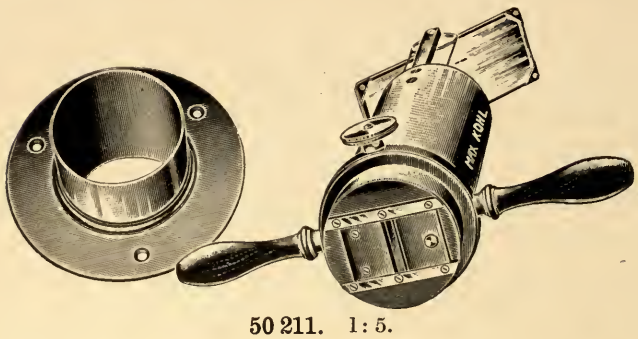
Wall Heliostat, Figure, horizontal motion by rack and pinion. Mirror motion by endless screw. With 1 silvered and 1 black glass mirror; also with 1 slit attachment with micrometer screw and divided drum, and 1 diaphragm annex, all brass; arrangement of tube and construction as Nos. 50,205—50,207, arranged for use with the solar microscope.

For wall to	54	66	78 cm thick
List No.	**50,208**	**50,209**	**50,210**
Price £	**6. 10. 0**	**7. 5. 0**	**8. 0. 0**

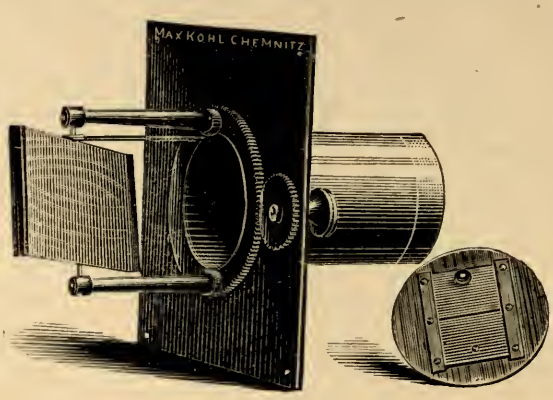
The special annex with serpentine slit shown in the figure, is not supplied with the heliostat; the diaphragm attachment, however, is provided with such a slit (cf. the diaphragm annex in Fig. 50,214).

A solar microscope can be directly attached and does not turn along with the mirror when the latter is being focussed.

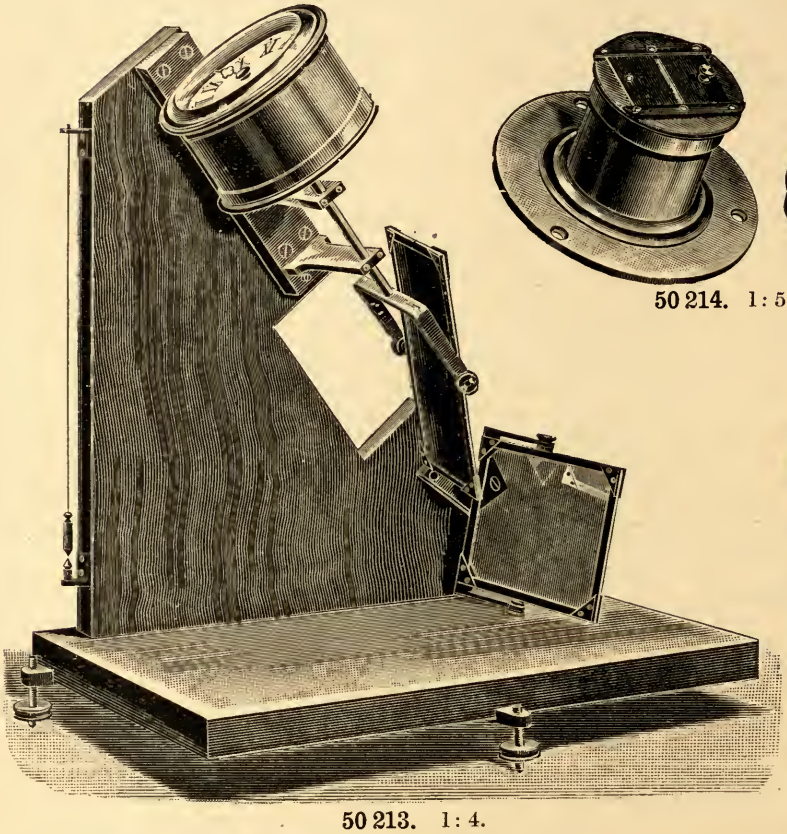
For Large Chemical Cupboards, see pp. 53 and 54.



50 211. 1:5.

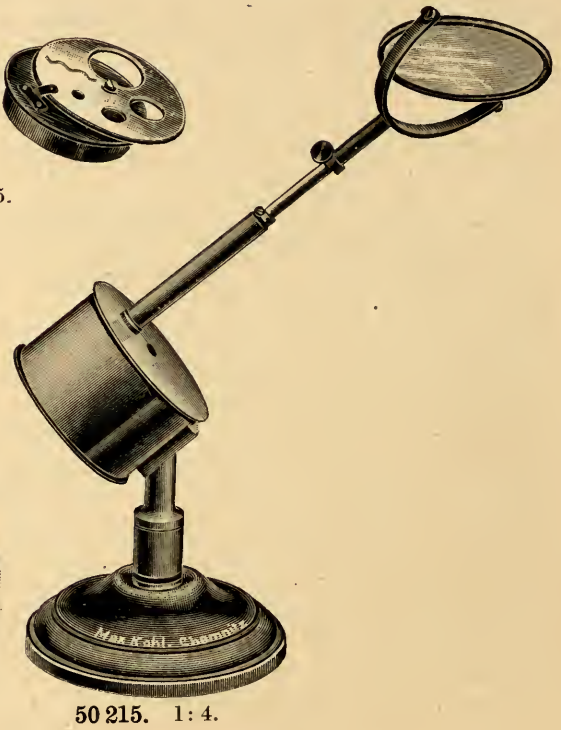


50 212. 1:5.



50 213. 1:4.

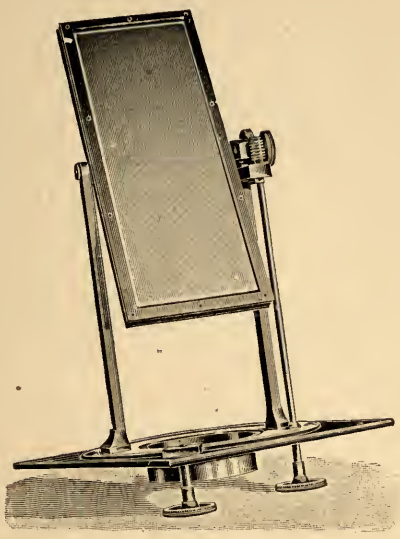
50 214. 1:5.



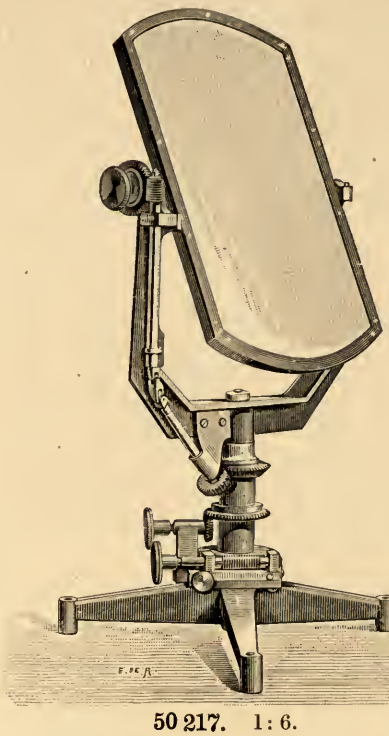
50 215. 1:4.

	£ s. d.
50,211. **Shutter Heliostat,** Figure, movement as in Nos. 50,205—50,207, simple construction, with a silvered mirror and with an attachment with slit	3. 0. 0
50,212. **Shutter Heliostat,** Figure, endless screw, horizontal motion; arranged to allow of the use of the solar microscope; constructed entirely of brass.	6. 0. 0
50,213. **Clockwork Heliostat** (Müller's), Figure (Zeit. f. d. phys. u. chem. U., **8**, p. 354. — M. T., Fig. 124); easily set up	5. 15. 0
50,214. **Special Attachment** for screwing on the Shutter, Figure, with slit and with Diaphragm Disc, for preceding heliostat	2. 0. 0
In addition to containing the diaphragm apertures, the disc has a serpentine slit, for showing that the spectrum is nothing else than a number of slit images in parallel.	
50,215. **Clockwork Heliostat,** Figure, simple, consisting only of a clockwork movement (the axis of which is mounted on a base at the polar height of the place) and a mirror moving in a hinge	4. 5. 0
A special universal motion mirror No. 50,226 is necessary for the heliostat.	
50,216. **Shutter Heliostat,** Figure, fixed by means of four screws. Size of mirror, 270×105 mm; with 2 motions and 2 mirrors, one of the latter being black	8. 0. 0
50,217. **Stand Heliostat,** Figure, mirror 180×350 mm, double worm gear movement, on iron base	8. 10. 0
A universal motion mirror No. 50,226 or 50,226a is necessary for the heliostat.	
50,218. **Condenser,** 90 mm diameter, with metal mount, Figure, for attaching to the wall or window heliostats	1. 5. 0

Cl. 40, 42, 44, 43, 45.

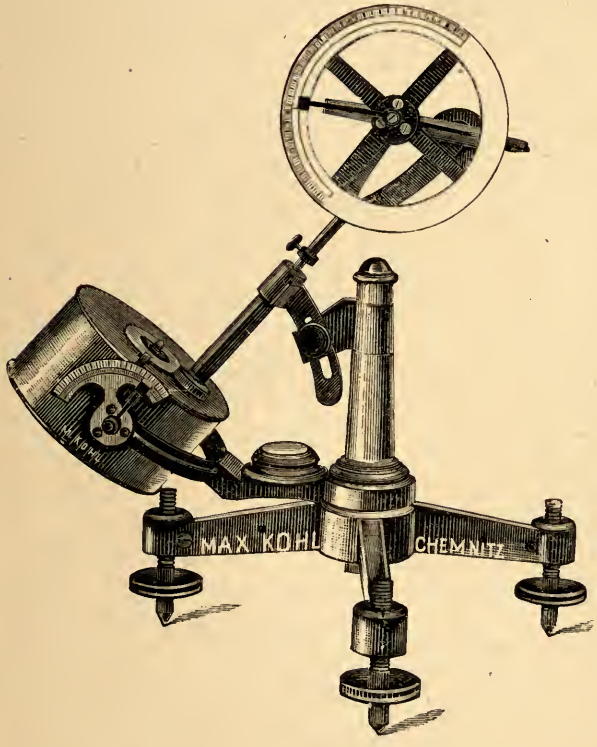


50 216. 1 : 6.

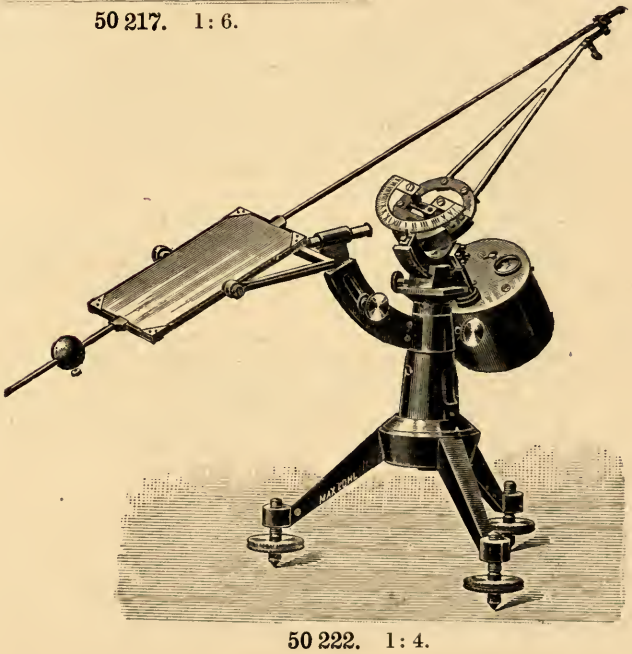


50 217. 1 : 6.

50 218. 1 : 4.



50 219. 1 : 4.

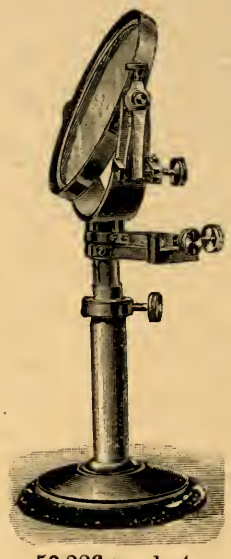


50 222. 1 : 4.

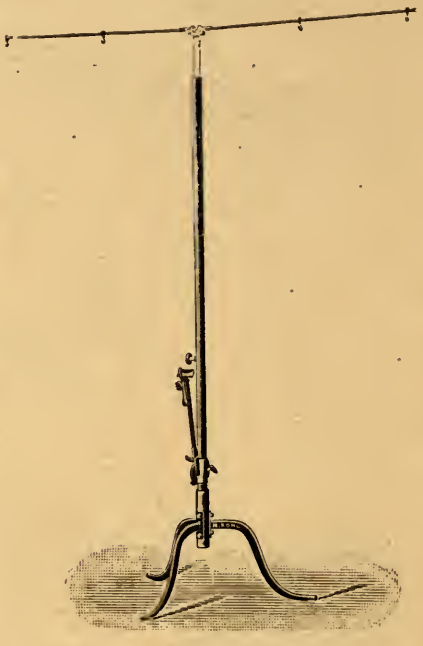
	£ s. d.
50,219. **Heliostat** (Meyerstein's), Figure, with variable polar height, on metal stand, clockwork in metal case, with protractor and dip circle, with a black and a silvered mirror, each 100 mm diameter	8. 0. 0
A universal motion mirror No. 50,226 or 50,226 a is necessary for the heliostat.	
50,220. — The preceding, mounted on wood board, clockwork in wood housing, with divided circle and dip circle; with 2 mirrors of 100 mm diameter, board fitted with levelling screws and spirit level	7. 0. 0
50,221. — The preceding, without dip circle	6. 0. 0
50,222. **Clockwork Heliostat** (Fuess's), Figure; mirror quite plane, 85×190 mm, with large clockwork motion	20. 0. 0
50,222 a. — The preceding, simpler, and slightly smaller (Zeit. f. d. phys. u. chem. U., **9**, 1896, p. 157)	12. 10. 0
50,223. — The preceding, heavily constructed, with 100×225 mm mirror.	26. 10. 0
50,224. — The preceding, with 300×150 mm mirror, for vegetable physiology purposes, etc.	30. 0. 0

For Universal Motion Mirrors for above Heliostats, see Nos. 50,226 and 50,226 a.

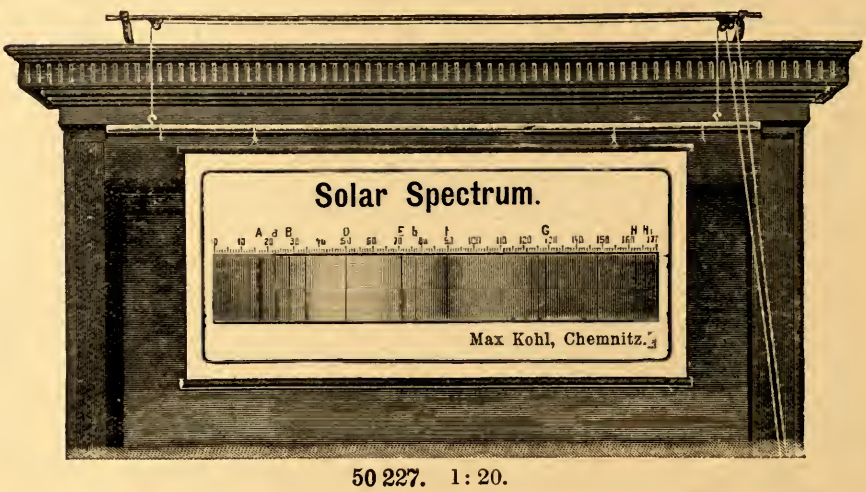
50225. 1:6.



50226a. 1:4.



50232. 1:25.



50227. 1:20.

50,225. **Large Clockwork Heliostat** (Foucault's), Figure, with round mirror, 300 mm diameter; substantially constructed, first class clockwork movement, round spirit level on base for focussing with adjustable pole height . . . . . £ s. d 45. 0. 0

50,226. **Universal Motion Mirror,** for Heliostats Nos. 50,215, 50,217, 50,219—50,225, for transmitting the sun's rays into the room 1.10. 0

50,226 a. **Plane Mirror with coarse and fine adjustment,** on stand, for transmitting the light from the heliostat into the axis of the instrument, Figure 4. 0. 0

Hoist for Maps, Drawings, Tables, etc. Figure, for fixing to the blackboard frame or wall; without Spectrum Plate.

List No.	50,227	50,228	50,229	50,230	50,231
Length m	1.5	2	3	4	5
Price £	**0. 18. 0**	**1. 0. 0**	**1. 5. 0**	**1. 12. 0**	**2. 0. 0**

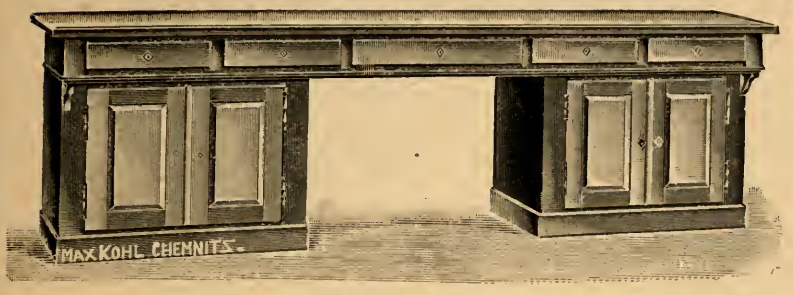
50,232. **Map Stand** (Jungels's), Figure, with slope adjustment 1.10. 0

The map stand is easily adjusted; by a single handle the two arms can be brought from the vertical to the horizontal position. When not in use, therefore, the apparatus occupies very little space; by turning and lengthening, the oblique adjustment can be used in any position. It is therefore possible to keep the maps stretched taut in any oblique position.

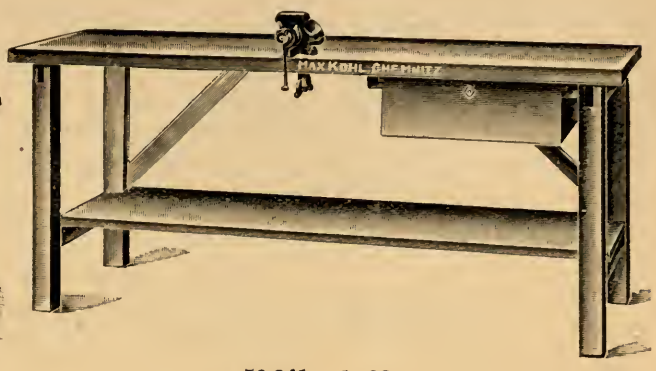
The apparatus is entirely of **iron** up to the supporting bar and can be used for all sizes of maps.

50,233. **Portraits of famous Physicists, Chemists** and other Philosophers; being photogravures in oak frames . . . . . Price each 0. 8. 0

1. Bunsen, R. W. — 2. Darwin, Ch. — 3. Dvořak, A. — 4. Faraday, M. — 5. Fischer, A. — 6. Franklin, B. — 7. Fresenius, K. — 8. Gauss, K. F. — 9. Helmholtz, H. v. — 10. Hertz, H. —



50 238. 1:30.



50 241. 1:23.

11. Hoff, J. H. van t'. — 12. Hofmann, A. W. v. — 13. Kekulé, F. A. — 14. Kelvin, Lord. — 15. Liebig, J. v. — 16. Maxwell, J. C. — 17. Mendeléef, D. J. — 18. Mitscherlich, E. — 19. Müller, J. — 20. Nernst, W. — 21. Newton, J. — 22. Ohm, G. S. — 23. Ostwald, W. — 24. Ramsay, Sir W. — 25. Reichenbach, K. v. — 26. Röntgen, W. K. — 27. Rose, H. — 28. Schönbein. — 29. Siemens, W. v. — 30. Steinheil, C. A. — Thomson, Sir W. (see 14). — 31. Tyndall, J. — 32. Watt, J. — 33. Weber, W. E. — 34. Wöhler, F.

50,234. — The preceding, in Heliogravure, **without frame** . . . . . Price each 0. 2. 6

1. Berthelot, C. L. — 2. Berzelius, J. (steel engraving). — 3. Bunsen; Rob. — 4. Carnot, S. — 5. Clausius, R. — 6. Dalton, J. (steel engraving). — 7. Fechner, G. Th., Monument in Leipzig. — 8. Gerland, G. — 9. Gibbs, J. W. — 10. Guldberg, C. M., and Waage, P. — 11. Helmholtz, H. v., in his 40th year. — 12. Ditto, in old age. — 13. Hittorf, W. — 14. Hoff, J. H. van t'. — 15. Ditto, and Ostwald, W. (in Ostwald's study, 1900). — 16. Horstmann, A. — 17. Kopp, H. — 18. Landolt, H. — 19. Mach, E. — 20. Ostwald, W., from a bronze relief by C. Seffner (see also No. 15). — 21. Raoult, F. M. — 22. Richter, J. B. — 23. Scheele, C. W. — Waage, P. (see No. 10). — 24. Wöhler, F.

50,235. — Ditto, as No. 50,234 (1—24), the whole series 2. 5. 0

50,236. **Busts of Physicists and Chemists,** 65 — 70 cm high, artificial construction, no plaster casts:

	£ s. d.		£ s. d.
1. Berzelius	2. 10. 0	9. Liebig	2. 15. 0
2. Faraday	3. 5. 0	10. Mitscherlich	2. 15. 0
3. Franklin	3. 10. 0	11. Newton	2. 15. 0
4. Galvani	3. 5. 0	12. Rose	3. 10. 0
5. Gauss	2. 15. 0	13. Siemens	3. 10. 0
6. Helmholtz	3. 10. 0	14. Volta	3. 5. 0
7. v. Hofmann	5. 0. 0	15. Watt	3. 0. 0
8. v. Humboldt, A.	2. 15. 0		

The preceding busts are uniform in size and finish.

50,237. **Wall Bracket** for Busts 1. 5. 0

Equipment of the Preparation Room and Workshop.

Work Table for the Preparation Room, Figure. £ s. d.

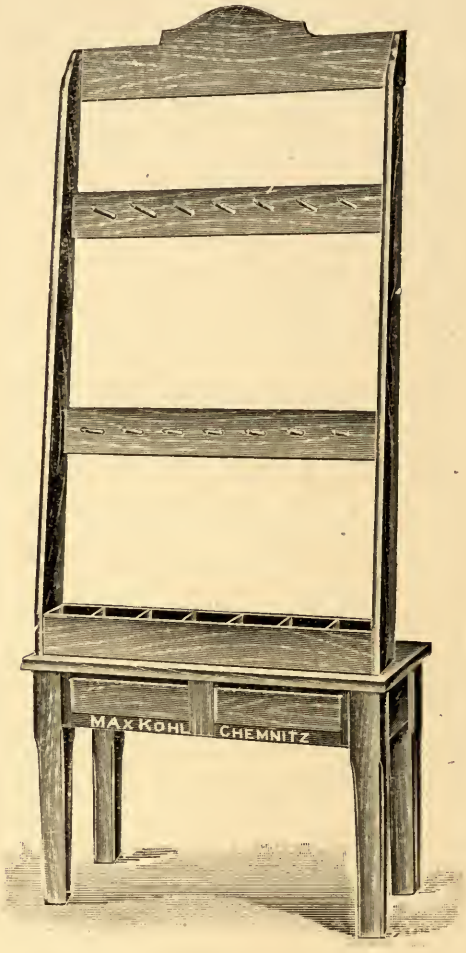
List No.	50,238	50,239	50,240
Length of Table m	2	2.5	3
Price £	7. 5. 0	8. 15. 0	10. 0. 0

The work table is 90 cm high and 70 cm wide. The **top** is of oak, 30 mm thick, composed of frame and pannellings. The **body** is of deal, and has 3 to 5 drawers according to the length, and underneath each drawer a small cupboard, somewhat set back; the centre is open. The table is intended to be set against the wall. It is advisable to have a gas lead carried along the wall over the table, and to have there a few hose stopcocks.

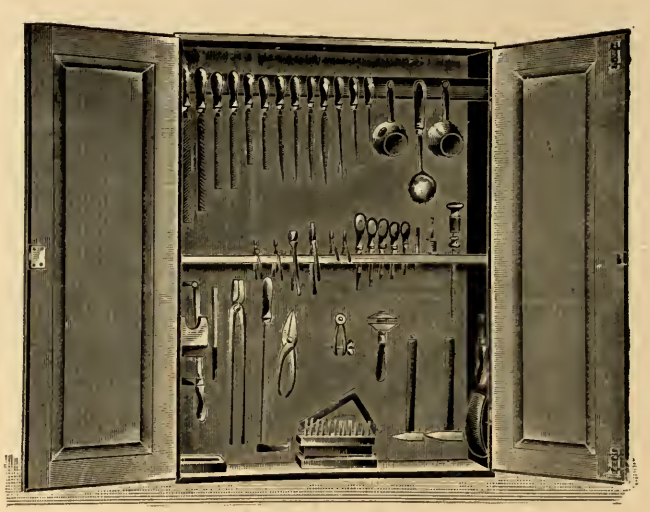
If desired, the table is supplied fitted with gas and water leads and with a basin. The gas lead has 2 substantial gas cocks with conical fluted hose ends. The water lead terminates in a nickelled brass standard with 2 nickelled water taps, and underneath these is a large half round porcelain basin, which is placed on one of the narrow ends of the table, with lead valve and waste with seal.
Extra price 2. 12. 0

50,241. **Work Table** (Figure), (M. T., p. 15) 2. 10. 0

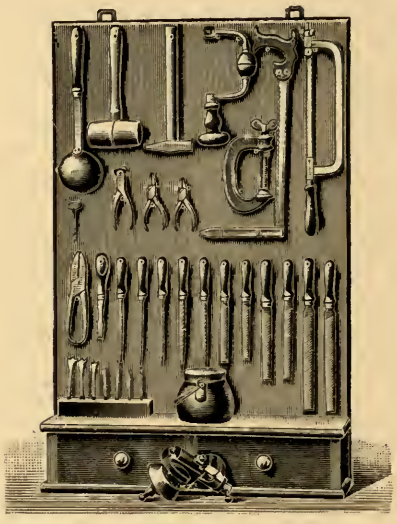
The table is 1.8 m long, 80 cm high and 65 cm wide; it is of deal, with top 40 mm thick; it has 1 drawer, with lock, running in oak supports. It rests on massive legs with a board traversing its length underneath, as in figure. The price does not include a vice.



50 244. 1:17.



50 246. 1:20.



50 248. 1:15.

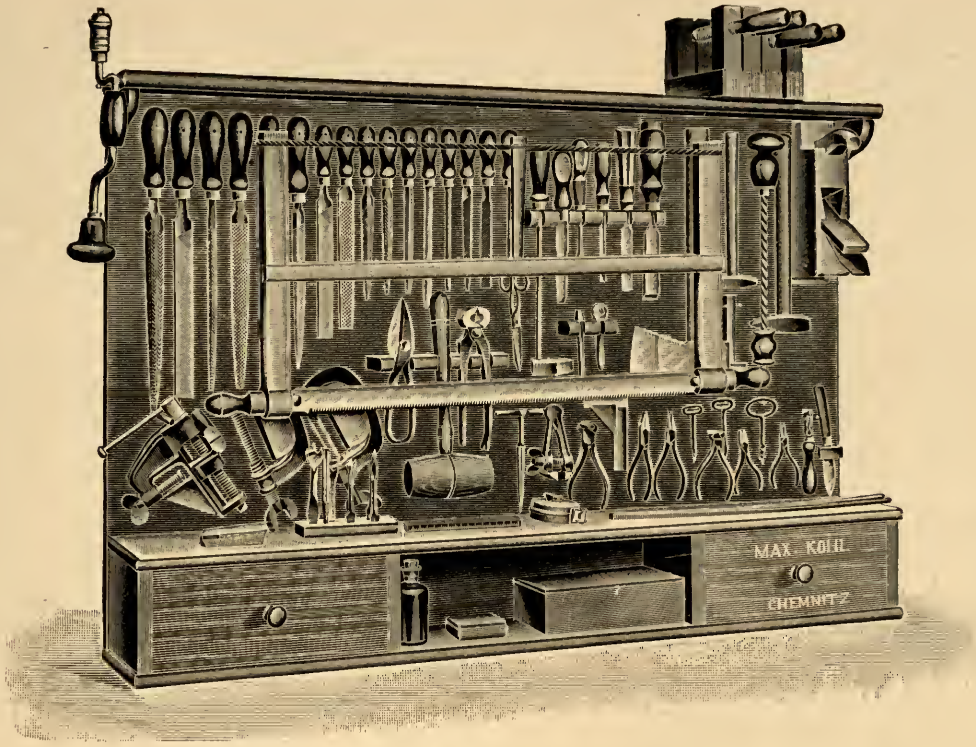
	£	s.	d.
50,242. **Parallel Vice,** turnable and detachable; width of jaws, 80 mm; distance between jaws, 90 mm; weight, 8 kg (M. T., p. 15)	1.	7.	0
50,243. **Small Anvil with Horn,** for placing on work table (M. T., p. 15)	0.	18.	0
50,244. **Wall Rack** for glass tubes and rods (Figure), standing on small table, 2 m high	2.	15.	0
50,245. **Cupboard,** 1 m wide, 90 cm high, 60 cm deep, with 6 shallow drawers for wires, terminals, hose-piping, corks, etc.	3.	10.	0
50,246. **Tool Cupboard with Mechanic's Tools,** Figure, with double doors, pannelled, with lock and key, stained and varnished, 1.2 m high, 0.9 m wide	8.	0.	0

The following tools are hung up ready for use in the cupboard: A selection of files, consisting of 4 bastard files 30, 25, 20 and 16 cm long; 3 smooth files 25, 20 and 16 cm long; 2 each round, half-round, three-cornered and square files 16 and 12 cm long; 2 oval files 16 and 12 cm long; 1 hand vice; 1 pair of flat pliers; 1 pair of round pliers; 1 pair of cutting nippers; spring callipers (1); spring bow dividers (1); 2 hammers of different sizes; 1 soldering iron; soft solder and acidfree solder; 1 pair metal shears; 1 pair zinc jaws for the parallel vice; 1 fine whetstone; 1 try square; 6 screw drivers of various sizes; 1 melting pot; 1 pair forge tongs; 2 pots, for wax, putty and sealing wax; 1 drill box with bow and breast board; 1 spiral drill with 12 bits; 1 pair pipe tongs; 1 oilcan; 1 adjustable spanner; 3 bottles brass lacquer, yellow, black and green; 3 varnish brushes; 1 level; 1 metal saw frame; 6 metal saw blades for brass; 6 do. for iron; 1 good die plate with taps; 1 set spiral bits; 12 sheets emery paper.

If a lathe is fitted up, the following are added to the tools: 4 hand steel tools; 4 slide rest tools; 1 spherical tool; and 1 tool for wood turning . . . . . Extra price 0. 12. 0

50,247. **Tool Cupboard with Joiner's Tools,** constructed same as above	4.	10.	0

The cupboard contains the following tools: 2 saws, 1 frame saw with extra thin blade; 1 pad saw; 3 planes; 3 chisels; 3 gouges; 3 wood try squares; 1 breast drill; 6 centre bits; 6 gimlets; 1 hammer; 1 pair pliers; 1 whetstone; 1 marking tool; 1 glue pot; 1 brush; 6 cramps; various sorts of screws and nails; 200 grammes glue; 12 sheets sand paper; 1 turning tool and 1 spherical tool for wood turning; 1 half-round and 1 flat wood rasp; 1 saw file; 1 tool for slant cuts.



50 249. 1: 12.

	£ s. d.
50,247 a. **Tool Cupboard with Mechanic's and Joiner's Tools,** of pine, with double doors, with lock and key, stained and varnished outside, 1.05 m high; 0.75 m wide	5. 10. 0

The following good quality tools are hung up in the cupboard: 8 metal files; 1 wood file; 1 wood rasp; 1 hand vice; 1 pair flat pliers; 1 pair round pliers; 1 pair cutting pliers; 1 metal saw with 3 metal saw blades; 1 pair metal shears; 1 steel hammer; 1 wood hammer; 1 spiral drill with 6 metal bits; 1 adjustable spanner; 1 pair spring callipers; 1 spring bow divider; 1 melting ladle; 1 soldering iron with soft and other solders; 4 screw drivers; 1 plane; 1 key-hole saw; 1 hand saw; 1 breast drill with 3 centre bits; 3 gimlets; 3 ripping chisels; 1 gouge; 1 oilstone; 1 glue pot.

50,248. **Wall Board with Mechanic's and Joiner's Tools,** with 2 drawers (Figure) . . . 3. 15. 0

The wall board contains 1 steel hammer; 1 wood hammer; 1 pair cutting pliers; 2 wire snips; 11 files; 1 metal saw; 1 key-hole saw; 3 screw drivers; 1 chisel; 1 pair shears; 1 melting ladle; 1 glue pan; 1 gimlet; 1 breast drill with 7 bits; 1 set cork piercers; 1 small vice; 1 cramp.

50,249. **Large Wall Board with Mechanic's and Joiner's Tools,** Figure 7. 0. 0

The wall board is made of pine, has two drawers and carries the following tools: 16 files for metal and wood; 1 soldering iron, solder, flux; 2 screw drivers; 3 wood chisels; 1 hatchet; 1 breast drill with 6 bits; 1 steel hammer; 1 plane; 1 breast drill with 4 bits; 4 wood cramps; 1 small parallel vice for screwing on the table; 2 American cramps; 1 pair shears; 1 wooden hammer; 1 pair nippers; 1 reamer; 1 punch; 1 spanner; 1 large and one small hand vice; 1 pair each small and large nippers; 1 pair each small and large flat pliers; 1 pair each large and small round pliers; 2 gimlets; 1 cork piercer; 1 knife; 1 pair scissors; 1 back square; 1 joiner's saw; 1 ruler; 1 tape measure; 1 box with nails; 1 whetstone.

50,250. **3 Wall Boards** with drawer for tools, etc. (M. T., p. 15), without tools 3. 10. 0

50,251. **Tools for Metal Working** (M. T., p. 15), for preceding wall boards. 12. 10. 0

9 flat files of different sizes and fineness; 2 half-round files; 2 triangular files; 3 round files; emery paper and cloth; 3 hammers; 1 wooden hammer; 1 pair pincers; 1 pair cutting nippers; 2 pairs flat pliers; 2 pairs round pliers; 1 pair crucible tongs; 1 hand vice; 1 pair tweezers; 1 pair shears; 1 American hand drilling machine with 1 set twist drills; 4 punches; 3 reamers; 3 cold chisels; 1 centre punch; 1 metal saw; 2 saw blades; 1 die plate with 2 taps; 1 die stock; 1 draw-plate; 3 screw-drivers; 1 universal spanner; 1 slip; 1 hone; 1 glazier's diamond; 1 each hard wood and lead block; 1 surface-plate; 21 shanks, assorted.

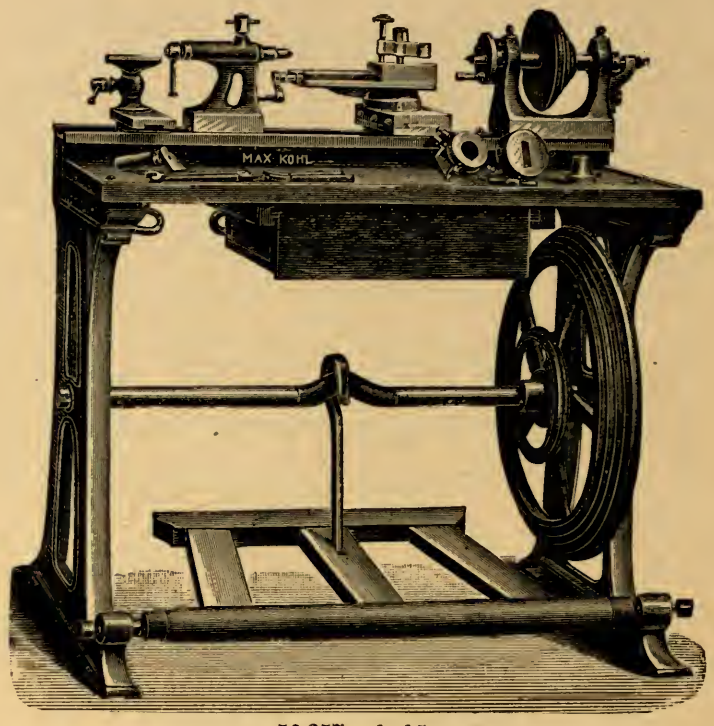
50,252. **Tools for Woodworking,** etc. (M. T., p. 16) 1. 15. 0

1 saw with narrow blade; 1 compass saw; 1 half-round rasp; 1 smoothing plane; sand paper, 1 breast drill with 12 centre bits and 12 augers; 4 gimlets; 3 ripping chisels; 3 gouges; 1 small hatchet; 1 kitchen knife; 1 pair scissors.

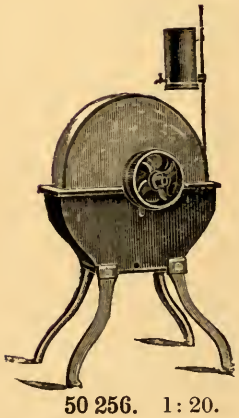
50,253. **Measuring and Drawing Set** (M. T., p. 16) 5. 15. 0

1 metre ruler; 1 folding metre ruler; 1 tape measure; 1 vernier caliper with vernier; 1 screw micrometer; 1 iron straightedge; 1 wood back square; 1 iron back square; 1 pair iron compasses; 1 set of drawing instruments; 1 drawing board; 1 T-square; 2 triangular set squares; 1 box of water-colours with brushes; 1 small box with patterns, brush and colour; 1 set of number stamps; 1 writing diamond.

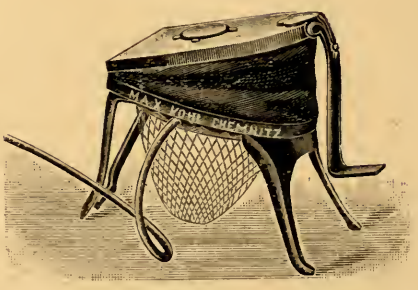
50 255. 1: 10.



50 257. 1: 15.



50 256. 1: 20.



50 268. 1: 18.

50 269. 1: 8.

50 270. 1: 10.

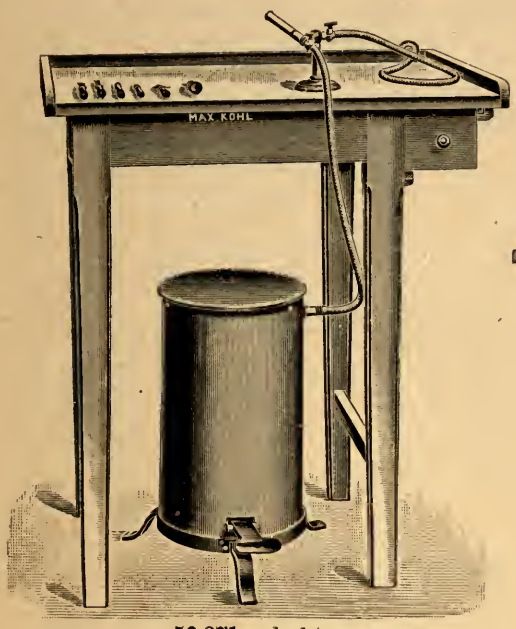
Max Kohl A. G., Chemnitz, Germany.

	£ s. d.
50,254. **Various Materials** (M. T., p. 16)	6. 10. 0

Wood in the form of planed mouldings and boards of different shape and thickness; fret-wood; ordinary and fine pasteboard; papers; some panes of window glass; a silvered sheet of plate glass 20 × 10 cm; 3 reels blind cord; 2 reels cotton twist, coarse and fine; 1 reel silk twist; insulating tape in metal box in the form of wire and sheet of various thicknesses; rolled thin iron and brass rods; finest iron and brass wire on small reel; sheet metal for patterns; tool steel in form of sheet and wire; lead in lumps; sheet lead; soft solder; hard solder (powered) and silver; soldering fluid; a selection of screws, especially small brass screws, with round and conical heads, and wire nails, with box; knitting needles, sewing needles; drawing pins; rivets; screw-in hooks; cramps, etc.; emery of varying fineness; brimstone; French chalk; rouge; black sealing wax; rosin putty; patent glue with glass bell and slab (M. T., p. 18); small can with lubricating oil; bottles with light and dark lacquer, boiled oil varnish, spirit, petroleum, benzene; 3 brushes.

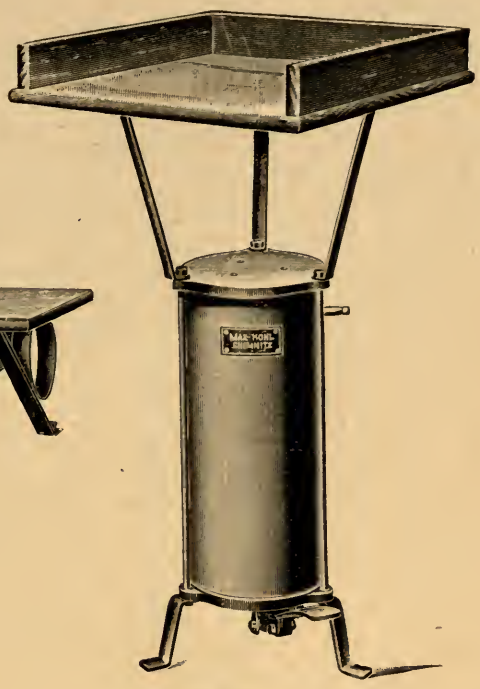
50,255. **Tool Board** with 2 drawers, with the tools necessary for keeping the **chemical apparatus** in repair and for ordinary use (Figure)	3. 5. 0

8 files and wood rasps of varying size; 4 different size screw drivers; 4 gimlets (different sizes); 1 ordinary bit; 1 nail puller; 1 pair cutting nippers; 1 pair flat pliers; 1 pair round pliers; 1 hand vice; 2 steel hammers (different sizes); 1 wood hammer; 1 file brush, 1 melting ladle; 1 pair of paper scissors;



50271. 1:14.

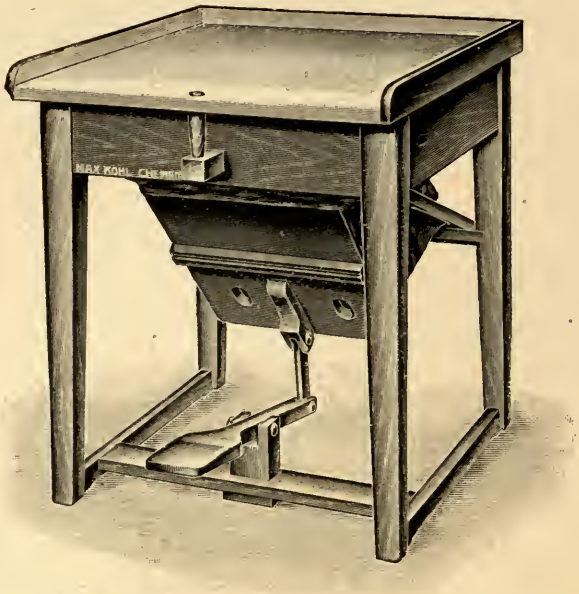
50267. 1:12.



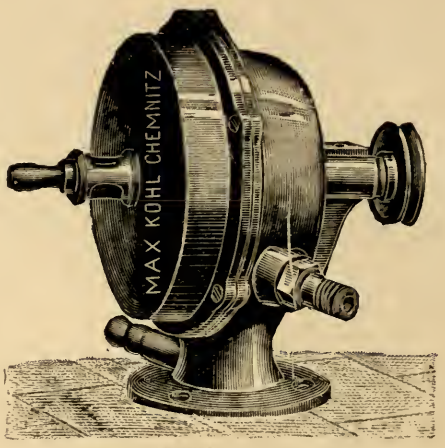
50272. 1:12.

1 knife for cutting corks; 1 set of 12 cork piecers; 1 sharpener for cork piercers; 2 brushes and cleaner for cleaning bottles, glasses, etc.; pair crucible tongs; pair mercury tongs; some sheets emery and glass paper; assortment of nails and 1 oilstone for sharpening tools.

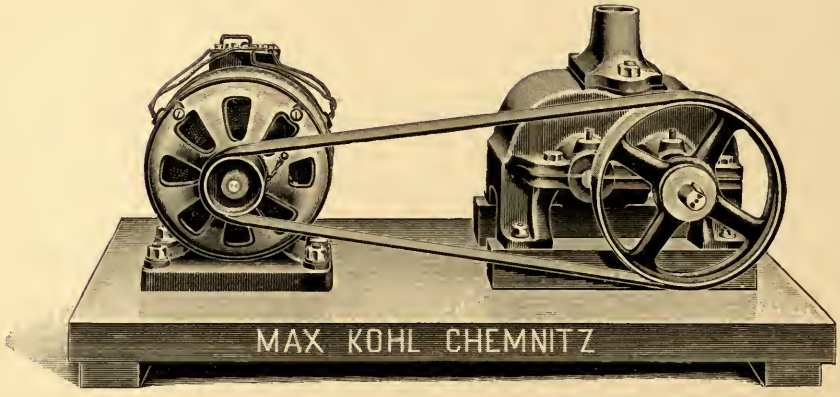
	£ s. d.
50,256. **Grindstone,** 400 mm diameter, with iron treadle frame, flywheel and trough, for grinding tools and glass, Figure :	2. 0. 0
50,257. **Slide Rest Lathe,** for foot drive (Figure); length of bed, 1000 mm; length that can be turned, 500 mm; height of centres, 130 mm	19. 0. 0
Accessories: Combined slide rest with steel spindle and adjustable gun metal nuts; rest with 2 T's; tailstock; driving plate with dog; screw chuck with 8 hardened steel screws; 2-jaw chuck; boring rest to fit tailstock; tray with drawer; gut band; spanners.	
50,258. — The preceding, height of centres, 100 mm; length that can be turned, 600 mm	16. 5. 0
50,259. **Self-centring drilling and turning chuck,** with flange for screwing on	2.10. 0
50,260. **Flange,** for screwing on wood discs	0.12. 0
50,261. **12 Cylindrical Wood Chucks,** with pin for inserting in the screw chuck	0. 5. 0
50,262. **10 Slide Rest Tools** (M. T., p. 17)	0.12. 0
50,263. **2 Hollow and 2 Flat Steel Tools** for Metals (M. T., p. 18)	0. 2. 6
50,263 a. **2 Angular and 1 Flat Tool for Metals** (M. T., p. 18)	0. 3. 8
50,264. **6 Wood Handles**	0. 1. 3
50,265. **40 Twist Drills with Wood Block,** 35 from 1—10 mm, in regular stages, 5 for Whitworth screws (M. T., p. 18)	1. 2. 0
50,266. **Emery Disc,** on wood axle (M. T., p. 18)	0. 9. 0
50,267. **Wall Bracket for carrying the Balance** (Figure), 60 cm long, 40 cm wide, formed of oak board, with drawers, resting on 2 lacquered iron supports	0.18. 0
50,268. **Blower** (Figure), for treadling, gives a regular blast, on feet, with protected rubber bellows between the feet . . . . . Price, with hose	2. 0. 0
50,269. **Rubber Bellows,** for treadling, with foot strap and long length of tubing, Figure	0.12. 0
50,270. **Blowing Device,** for treadling, for small work, with regulator, Figure	1.10. 0
50,271. **Blower's Table,** for glass blowing, with cylindrical bellows, 25 cm diameter, Figure, with glass cutting knife and 5 brass shapers; table top lined with asbestos, with blast burners and 2 lengths tubing	4.15. 0
50,272. **Cylindrical Bellows** in Iron Housing of 30 cm diameter, with a table top laid with asbestos, 45×45 cm, with blast burner and 1 length tubing	3.18. 0
50,272 a. — Ditto, 35 cm diameter, with blast burner and 1 length tubing	4. 5. 0



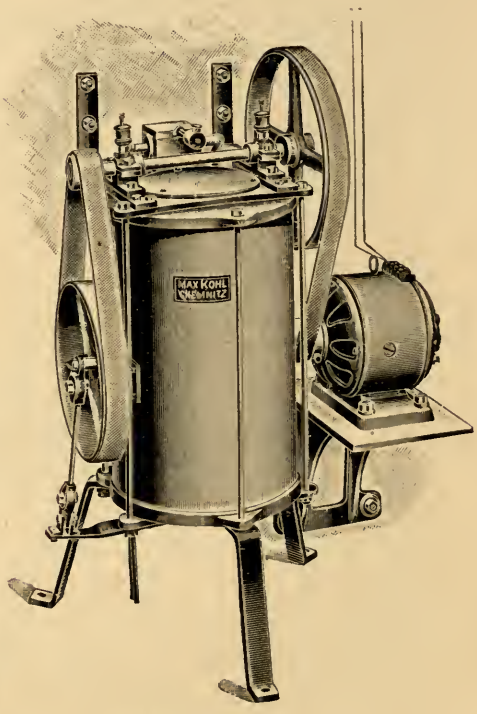
50 273. 1: 14.



50 274. 1: 4.

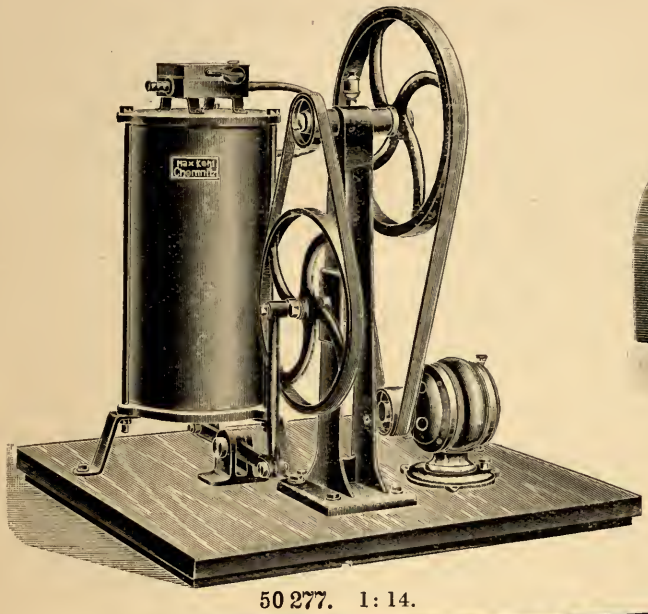


50 279. 1: 8.

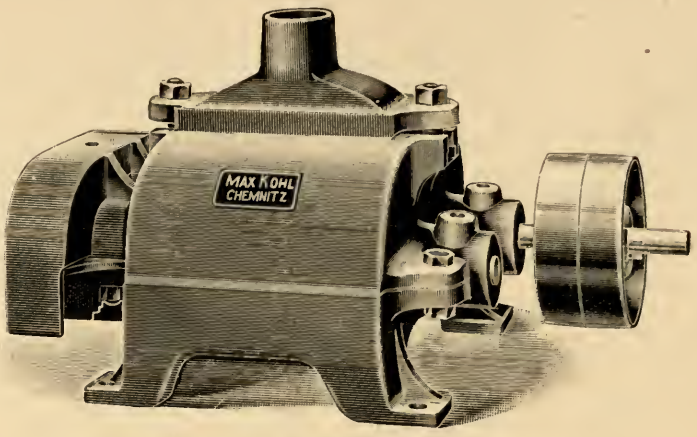


50 275. 1: 13.

	£ s. d.
50,273. **Blowing Table,** Thuringian form, Figure, of pitch-pine, substantially constructed; table top 75 × 75 cm, inlaid with asbestos, with good leather bellows with springs .	3. 15. 0
50,274. **Portable Blower with Turbine,** Figure, for steam, water and cord drive, for blower's tables, combustion furnaces, melting furnaces, annealing ovens and soldering apparatus	3. 5. 0
The blower proper consists of a small ventilator, the wheel of which is provided with perforated vanes, which thoroughly intermix the gas and air before they enter the burner. The flow of gas and air can be so regulated that a quantity of oxy-hydrogen gas burns with a green-centre flame.	
50,275. **Cylindrical Blast,** driven by $^1/_6$ HP. Electric Motor for 110 V. D. C., Figure, for Supply Voltages to 110 volts	15. 10. 0
A gearing is built on to the cylinder for reducing the motor speed. The housing can be fixed to the wall by 2 iron clips, the motor is fixed to a wall bracket. Prices on application for motors for other kinds of current and voltages.	
50,276. — The preceding, **smaller construction,** without motor (cf. Fig. 50,277), blower and gearing are fixed on one base . . . . . Price without motor	7. 0. 0
50,277. — The preceding, with $^1/_8$ HP. Direct Current Motor for 110 V., Figure	11. 0. 0
50,278. **Root's Blower,** Figure, for belt drive, with loose pulley.	4. 16. 0
50,279. — The preceding, Figure, with Motor, on one base	14. 5. 0



50277. 1:14.



50278. 1:6.

50282. 1:27.

Equipment of the Museum.

50,280. **Glass Cupboard** (standing alone) **for storing Physical Apparatus and Scientific Preparations,** Figure on p. 44; **3 m long, 2.3 m high, 0.85 m clear depth;** constructed of pine, with 6 dust-proof double doors, fitted with bascule locks, with 4 shelves resting on notched ledges. Side walls, doors and top glazed. The cupboard is lacquered outside, and is coated inside with light-blue oil paint. Fig. 50,280 shows the cupboard without the front doors. Without apparatus . . . . . £ 23.15.0

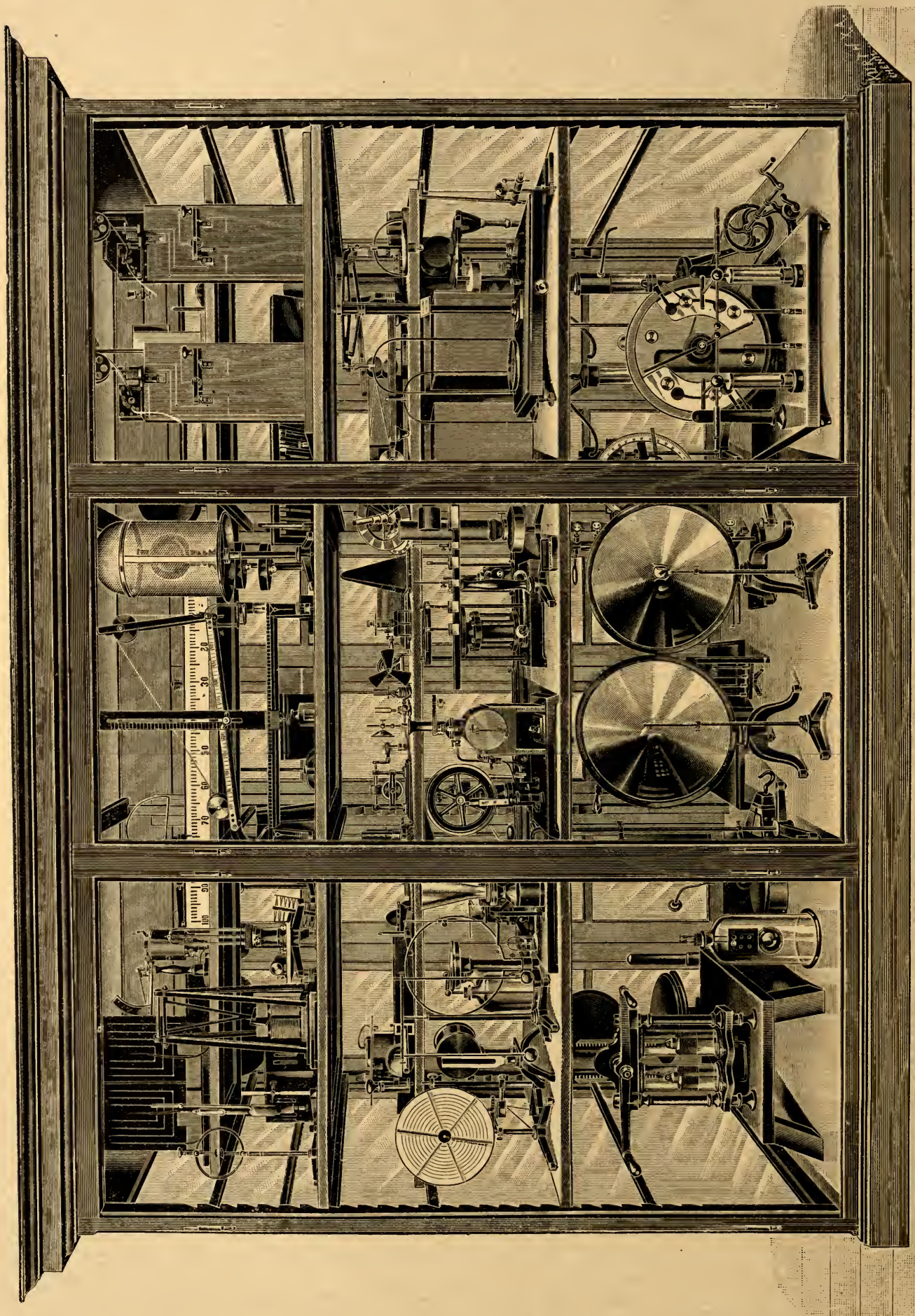
50,281. — The preceding, **2.3 m long, 2.3 m high, 0.85 m clear depth,** with 4 double doors, otherwise as previous item 18.15.0

50,282. **Wall Cupboard for storing Physical Apparatus and Scientific Preparations;** 3 m long, 2.3 m high, 0.6 m clear depth, Figure, with 3 dust-proof double doors, fitted with bascule locks, otherwise as preceding 17.10.0

50,283. — The preceding, **2.3 m long, 2.3 m high, 0.6 m clear depth,** with 2 double doors, otherwise as preceding 14. 1.0

For Description, see No. 50,285.

(1. 3210, 3212. 5288.



50 280. 1: 14.

50 284. 1:27.

50,284. **Wall Cupboard with sloping top, for storing Physical Apparatus,** Figure; **3 m long,** 2.3 m high, **0.6 m clear depth;** constructed of pine; with 3 dust-proof double doors with bascule locks; side walls, doors and top glazed . . . . . £ 16.16.0

Construction as No. 50,280.

50,285. — The preceding, **2.3 m long,** 2.3 m high, **0.6 m clear depth,** with 2 double doors, otherwise as preceding 13.15.0

The cupboards are substantially built, and the doors close in such manner as to exclude all dust, and have bascule locks. The cupboards are lacquered externally, being coloured a light-blue inside; they are therefore very bright inside and quite easy of inspection. The shelves can be adjusted upon notched fillets, and are constructed as frames with pannellings so as not to warp. The arrangement of the shelves is such that high and low pieces of apparatus can stand in each compartment and be easily removed. The base mouldings are of oak, rounded off at the corners. **The cabinets cannot be compared with the ordinary product of the cabinet-maker.** All cupboards are despatched in sections.

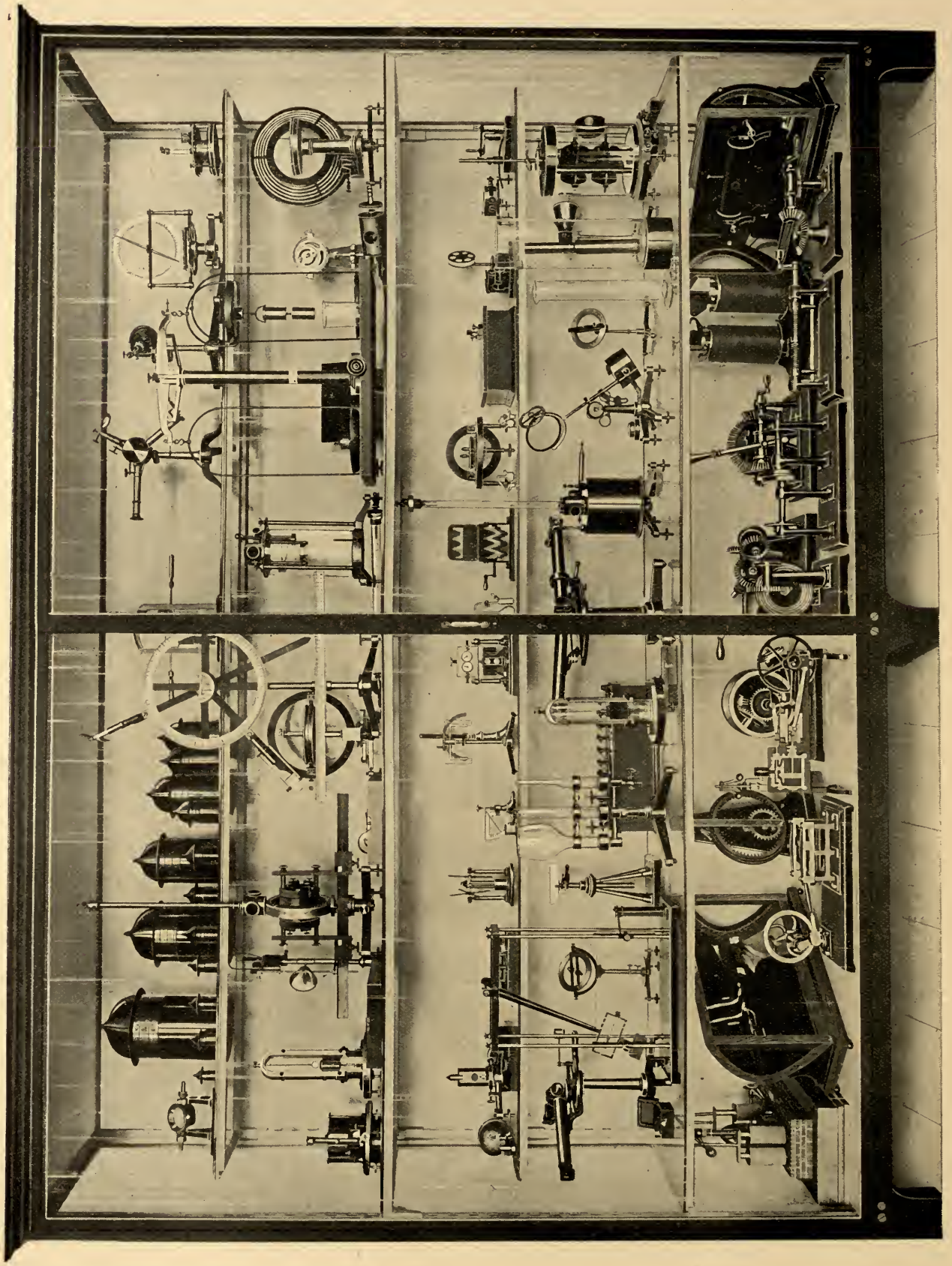
50,286. **Iron Museum Cupboard (standing alone) with crystal Glass Glazing, for Physical Apparatus and Scientific Preparations and Models,** newest and best construction, assembled of the narrowest possible iron frames; quite dust-proof, especially the doors, so constructed that they may be despatched in parts and assembled on the spot. Construction similar to wall cupboard Fig. 50,288.

The cupboard rests on 6 feet, has sheet metal shelves, and a cornice running round the top, and on each side a double door with safety bascule locks. The doors and walls are glazed with thick crystal glass, in one piece, thus dispensing with cross-bars; the top is ornamental glass. The cupboard contains 8 shelves of stout crystal glass of half the length of the cupboard. The shelves rest on adjustable perforated iron rails. 4 shelves take up half the depth and 4 the entire depth of the cupboard. The iron parts are coloured black.

If desired, the cupboards are also provided with screen so that the objects stored may be protected from the direct light.

Length 3 m; height 2.5 m; depth 1 m . . . . . } Prices on Application

50,287. — The preceding, **length 2 m;** height 2.5 m; depth 1 m . . . . . }



50 288. 1:15.

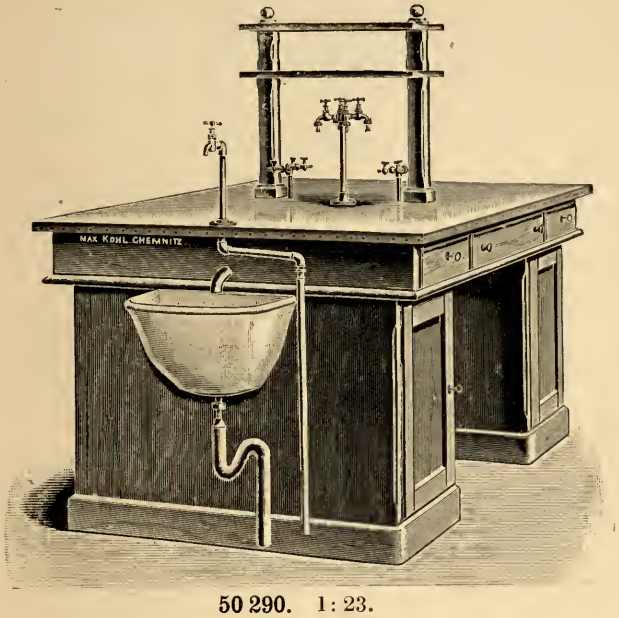
Max Kohl A. G., Chemnitz, Germany.

50,288. **Iron Collection Cupboard (Wall Cupboard glazed with Crystal Glass) for Physical Apparatus and Scientific Preparations,** Figure, same construction as the independent cupboards, with sheet iron back wall. The shelves for half the depth of the cupboard rest upon carriers of half the depth of the cupboard.

Length 3 m; height 2.5 m; depth 0.6 m . . . . . } Prices on Application

50,289. — The preceding, **length 2 m**; height 2.5 m; depth 0.6 m . . . . . }

£ s. d.



50 290. 1 : 23.

50 292. 1 : 9.

Equipment of the Students' Laboratory and Students' Work Room.

£ s. d.

50,290. **Students' Work Table, for Chemistry,** Figure 18. 0.0

The table stands alone, is 1.80 m long, 1.20 m wide, 0.90 m high and is arranged for 4 students.

For each student a lock-up drawer and a cupboard with sliding partition are provided, also one broad drawer for each two students. The keys for each drawer are different. The table top is of deal, being composed of frame and pannellings, and is inlaid with sheet lead 1.5 mm thick. The table has gas and water leads; for each 2 seats there are 2 gas hose cocks and 1 water tap. The table has a trough-shaped cavity in the centre, the water which is spilled collecting there and being carried off by a lead pipe. Above the gas and water taps is a reagent stand with 2 partitions. At one of the narrow ends of the table is a half-round porcelain basin with lead valve and waste pipe with plugs. Above this is the water supply tap, which is arranged conveniently for the installation of water jet pumps. The body of the table is stained and varnished.

50,291. **Students' Work Table, for Chemistry,** Figure on p. 48 . . . . . 38.10.0

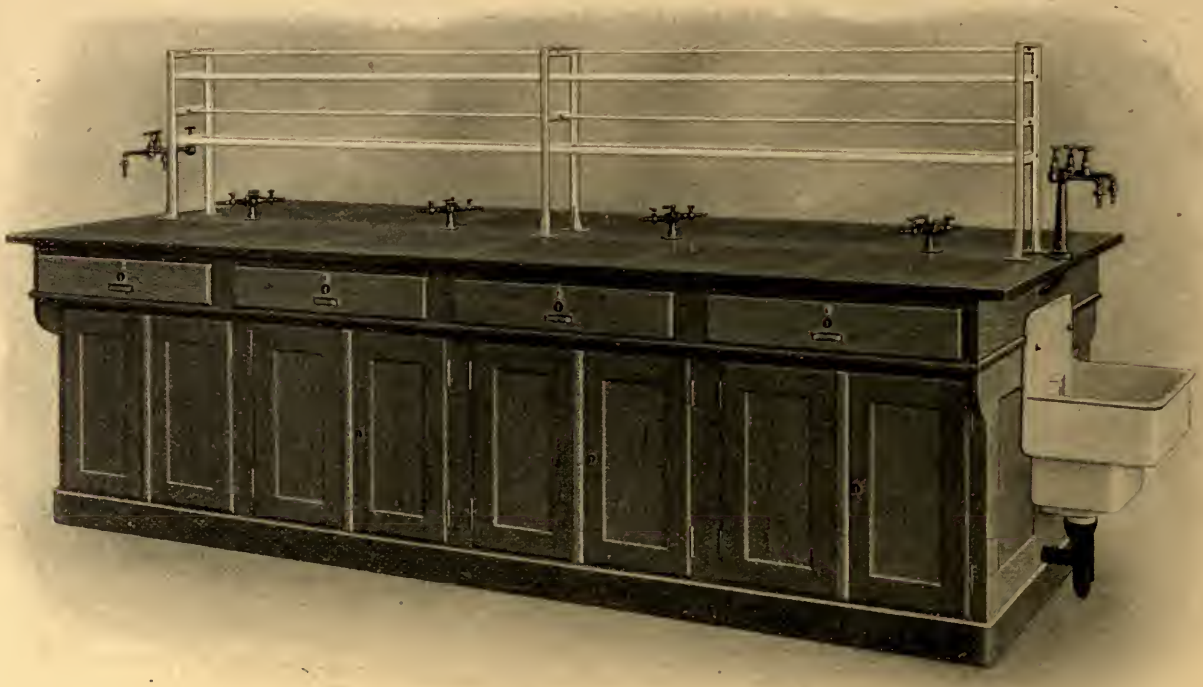
The table, which stands away from the wall, is 3 m long, 1.40 m wide, 0.90 m high, being intended for 8 students. The top is of oak 30 mm thick, and is composed of frame and pannellings; it is coated with hot linseed oil or stained an acid-proof black (for a small extra charge). The body is of pitch-pine, stained and varnished, and the inner side walls and bottoms are of red deal; the bottom beading is of oak. At each side along the length of the table are 4 drawers above; and underneath these, set back somewhat, 4 small cupboards with shelves. A white enamelled wrought-iron bottle rack is fixed on the table top, this being 2.80 m long, 60 cm high, 18 cm wide, and has 2 glass shelves running the entire length. The glass shelves rest in angle iron supports, the angle iron projecting about 5 mm to prevent the bottles falling off. The stand can be washed. The table is fitted with gas and water leads. For each place there are 2 gas hose cocks, and each 4 gas taps are fixed to a short stout brass column. These gas tap columns are fitted to the table top below the bottle stand, and at each place, the gas lead itself being mounted underneath the table top on the partition of the table. At each narrow end of the table the water lead has a stout nickelled brass standard with 3 nickelled water taps, two of each being screwed to take hose. Under these taps are white hard-baked stoneware laboratory basins with raised backs and deepened bottoms, overflow, and stoneware plugs. The pipe-lines are laid ready to the floor. The places are numbered consecutively. The drawer and cupboard locks of one place are alike, but differ from those of each other place. In view of facility of transport the table is constructed in two portions, which are placed alongside against the back wall and screwed together on the spot.

We also supply these work tables in a more complete form, fitted with gas draught-tubes, taps for the water lead, waste pipes, and filtering device for each place, and with water air pumps on both sides of the table. We shall be glad to submit prices and illustrations if desired.

We also supply tables for 4 students, constructed as above, these consisting of the table just described, cut across (for isolated tables) or divided lengthwise (for standing against a wall).

50,292. **Laboratory Stool, with fixed seat,** Figure 0. 6.3

The stool consists of a round hollow alder-wood top screwed on to a three-legged iron support. The wood top is polished, the iron parts being lacquered white.



50 291. 1:20.

	£ s. d.
50,293. **Revolving Stool for Laboratory use,** Figure	0. 14. 0
The seat of polished alder is screwed on to a 42 cm long threaded spindle; the latter passes through a tube having a female thread, the tube being fixed to a three-legged iron support. The seat can be raised **as much as 70 cm.** The iron parts are lacquered white.	
50,294. — The preceding, with rest, Figure	1. 0. 0
50,295. — do., **with leather covered back**	1. 7. 0

Stink Cupboards.

The framework of the stink cupboards is constructed either of pitch-pine or (at proportional additional cost) of iron.

The cupboards with wood framework are supplied either with the body **of table form** or **cupboard form.** The body has rounded oak beadings, which do not become unsightly when knocked and which last well. As regards iron stink cupboards, we have only listed those with **table form body.**

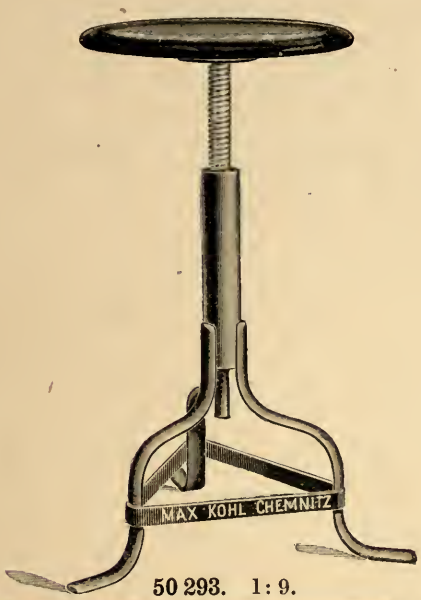
The iron frame cupboards combine compactness with a small amount of space required by reason of our using the smallest possible iron rails for the construction thereof. The whole of the apparatus contained in the cupboard can easily be inspected from any part of the work room; even complete or partial closing of the windows does not detract from the view. For these reasons iron stink cupboards are peculiarly adapted to chemistry class rooms.

The upper part of all stink cupboards is glazed, it has one or more sliding windows in front hung on gut strings, which can be retained in any desired position by iron counterpoises, and easily opened and shut. The large sliding windows are each fitted with a small catched windows, in order that work can be carried on in the cupboard without opening the whole window. The roof is sloping and is glazed and has a lead gutter in front, in which the precipitated water collects, being carried away to a lead receptable arranged laterally. The wood cupboard has an oak table top, into which an acid-proof polished slate slab is inserted.

The back of the cupboard is free; when ordering, therefore, the room wall must be cement plastered or covered with glazed tiles.

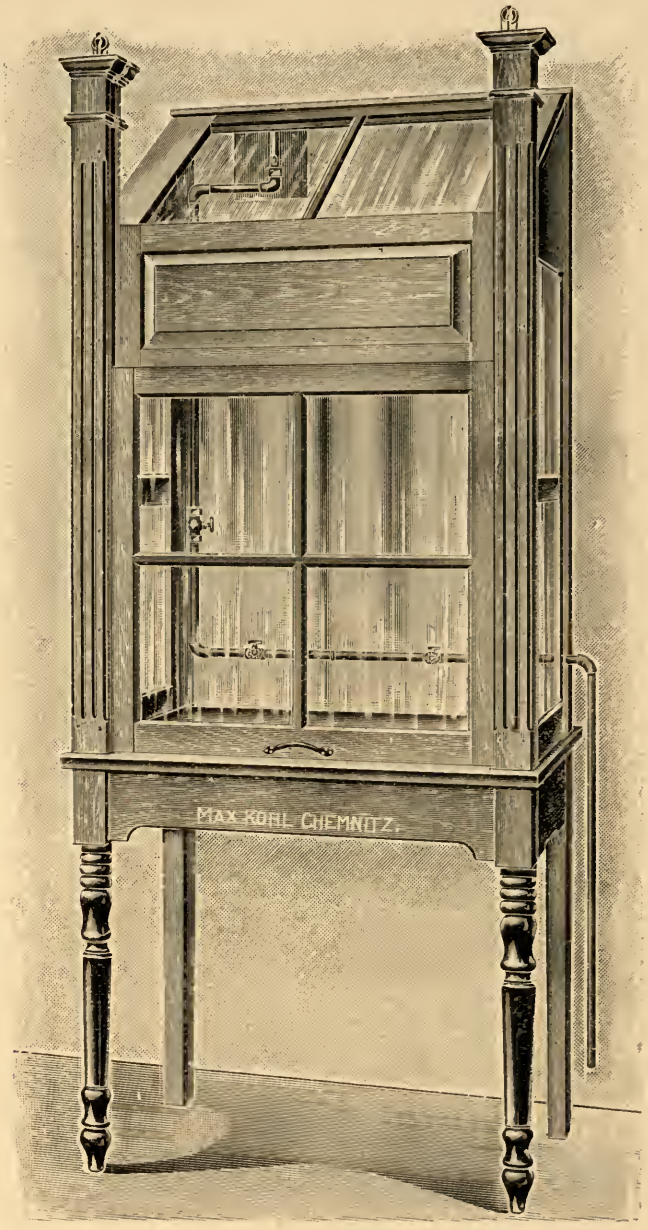
The noxious fumes lighter than the air are carried off through an opening in the wall under the roof of the cupboard, flowing finally into the draught flue. For heavy gases there is a channel immediately above the table top, which can be closed by a porcelain slab (see No. 50,315, Figure, on p. 52). For obtaining good ventilation we recommend the employment as draught pipes of square-section acid-proof clay pipes Nos. 50,316—50,318, which can be well and safely built into the walls.

For (Wall) Stink Cupboards see p. 29, No. 50,181.



50 293. 1 : 9.

50 294. 1 : 15.



50 296. 1 : 15.

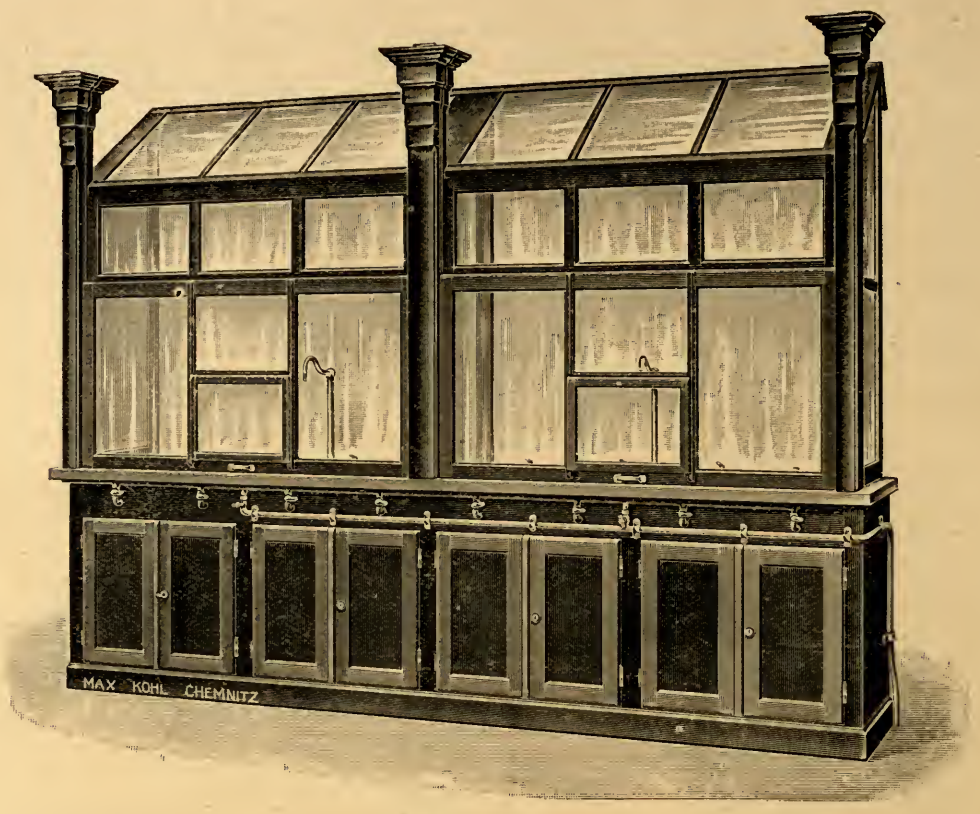
At the convergence of the flue, in the open, the acid-proof clay attachments Nos. 50,319—50,321 can be added. The joint is effected by acid-proof cement. In view of the internal and external dimensions of the pipes, and the laying thereof, it is desired that we may be communicated with **before starting on the masonry.** The draught in the flue is accelerated by a special Bunsen burner to be fixed in the flue itself; the tap for the "draw" flame is fixed alongside the cupboard. The "draw" flame is ignited by means of a small spirit lamp on a rod, or by an electric ignition device. A movable gas bracket with burner or with electric light unit can be fitted in the cupboard. In the case of the large cupboards with a number of compartments the above fittings should be provided for each compartment separately. **If desired, we submit estimates for all the fittings mentioned.**

If desired, and at a proportionate increase in price, gas leads for heating and lighting, and for the "draw" flame are laid ready to the floor; this applies also to leads for water, aspirated and compressed air, steam, electricity, the leads terminating inside the cupboard in a corresponding number of hose supports or plug contacts, the taps being placed outside the cupboard in front. It is advisable to provide in the cupboard, or outside, a water delivery tap and a discharge funnel, of lead.

If desired, in the case of cupboards with more than one compartment, one section can be provided with a sand bath (No. 50,311), and another with a water bath (No. 50,312).

	£	s.	d.
50,296. **Stink Cupboard with Table Substructure,** Figure, 1 m long, 0.6 m deep, 2.3 m high, with 1 sliding window (without drop window), wood frame support	6.	12.	0

See the introductory remarks on p. 48.



50299. 1:31.

50,297. **Stink Cupboard with Cupboard Substructure,** Figure, 1.15 m long, 0.7 m deep, 2.3 m high, framework of pitch-pine, with gas and water leads . . . . . £ s. d. 12.10.0

The gas and water leads are supplied ready mounted; the gas lead terminates in 2 hose unions inside the cupboard, the taps being fitted outside on the front. The cupboard has a water tap standard inside and a water outlet, and a water tap outside.

The illustration differs somewhat in the construction of the leads.

Stink Cupboards with a number of Compartments, Cupboard Substructure, Figure.

List No.	50,298	50,299	50,300	50,301	50,302
Length of Stink Cupboard	2	3	3	4	4 m
Number of Compartments	2	2	3	3	4
With Gas and Water Leads and with Slate Table top £	**21. 10. 0**	**25. 10. 0**	**29. 15. 0**	**33. 12. 0**	**39. 15. 0**

The stink cupboards are supplied in various lengths, 2.60 m high, 0.70 m inside depth, being constructed of pine. They consist in the upper portion of 1—4 compartments, separated by glass partition walls. The lower part contains double-doored cupboards, and has rounded base fillets of oak. The table top is of oak, being let in with polished, acid-proof slate slabs. Each compartment has 2 gas taps and 1 standard with water tap, lead water waste with strainer and lead waste pipe. All compartments have large sliding windows in front, each sliding window being provided with a small drop window in order to allow of using the cupboard without the necessity of opening the large window. Regarding other details of construction, see the introductory remarks on p. 48.

It is advantageous to have a number of water outlets.

If desired, one compartment of the cupboard can be fitted with a sand bath, No. 50,311 (£ **1. 13. 0**), and another with water bath, No. 50,312 (£ **4. 4. 0**). The sand bath consists of a flat box of lead covered sheet iron, which is fitted in place of the slate slab, and which is heated underneath by gas. The water bath consists of a water box of metal, rings being let into the upper cover plate. The box is heated by gas flames underneath.

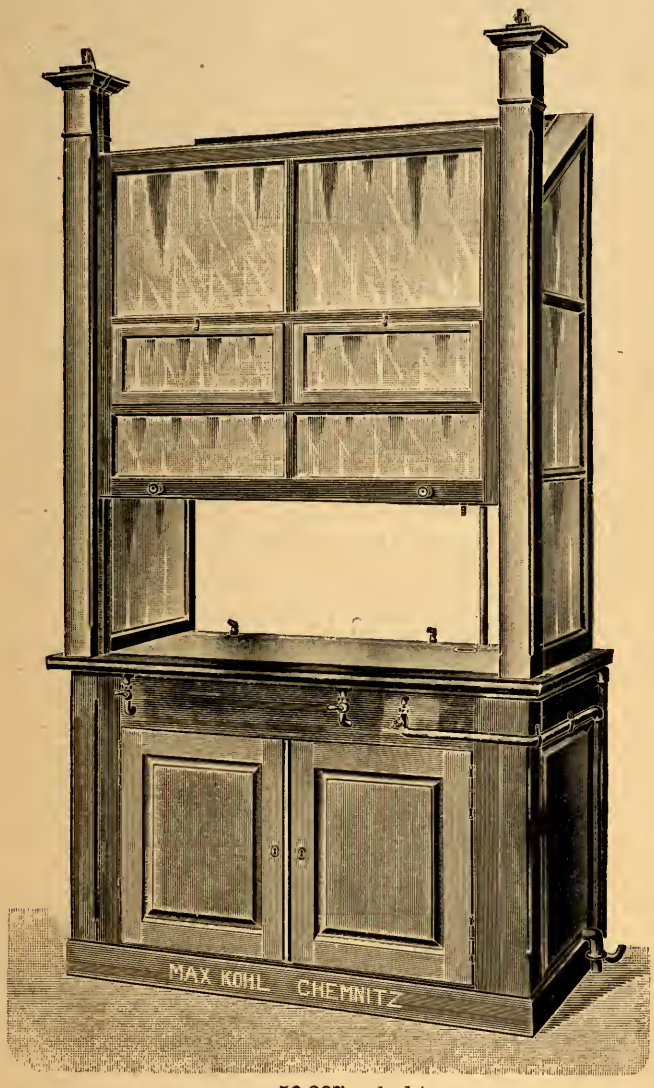
Iron Stink Cupboards (cf. Figs. 50,303 and 50,306 on p. 52).

These cupboards combine ease of inspection with small amount of room requisite.

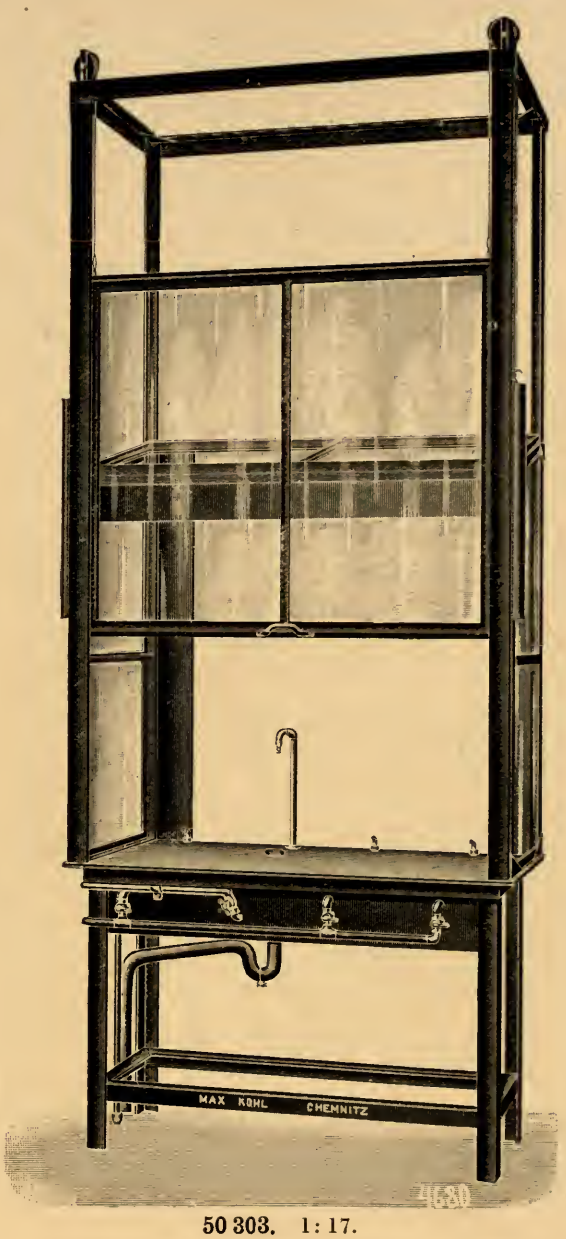
See introductory remarks on p. 48 for details of construction.

Iron Stink Cupboards with one Compartment

List No.	50,303	50,304	50,305
Length m	1.00	1.30	2.00
Depth m	0.70	0.70	0.70
Height m	2.80	2.80	2.80
Price with Leads £	**16. 10. 0**	**19. 5. 0**	**22. 0. 0**



50 297. 1: 14.



50 303. 1: 17.

Iron Stink Cupboards with a number of Compartments

List No.	50,306	50,307	50,308	50,309	£ s. d.
Number of Compartments	2	2	3	3	
Length m	2.00	3.00	3.00	4.00	
Depth m	0.70	0.70	0.70	0.70	
Height m	2.80	2.80	2.80	2.80	
a) Without Leads £	**23. 5. 0**	**28. 5. 0**	**33. 0. 0**	**38. 10. 0**	
b) With Leads £	**29. 15. 0**	**34. 15. 0**	**43. 0. 0**	**48. 10. 0**	

Cupboard No. 50,309 has two small compartments each 1 m long at the right and left and 1 large compartment 2 m long in the centre. The partitions are of glass. In the case of No. 50,306, the partition is of sheet iron; this can also be made of glass, if desired. Cupboards Nos. 50,306 to 50 308 have 2 or 3 equally large compartments, each compartment having a sliding window.

The iron stink cupboards are also supplied in any other length or depth desired, and are also constructed as travelling cupboards, so as to bring them close to the audience or to set them to one side (see No. 50,378).

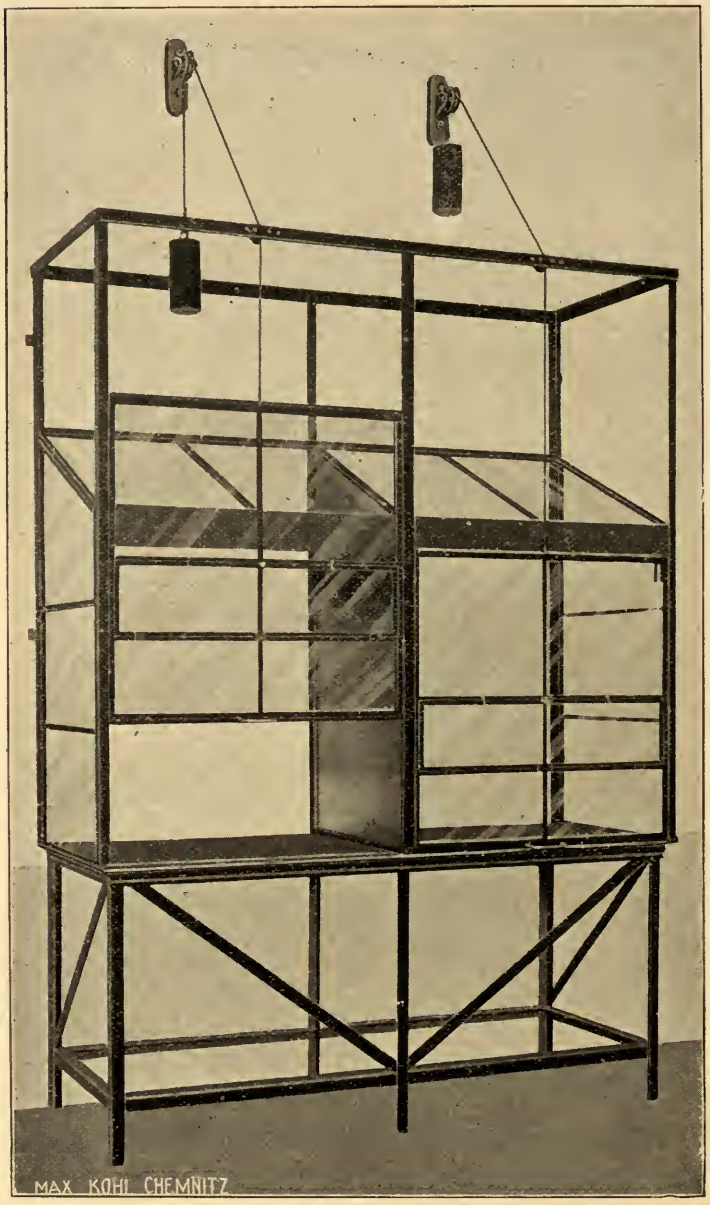
Accessories for Stink Cupboards.

50,310. **Water Discharge Funnel with Water Discharge Pipe underneath,** inside the Stink Cupboard; the taps for these being outside the cupboard under the table top. Extra price 1. 13. 0

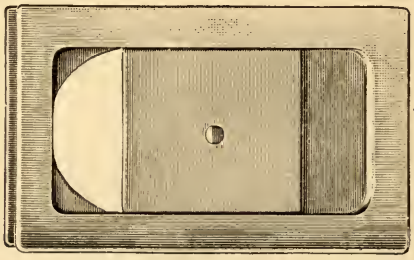
50,311. **Sandbath with Gas Burner,** built into the stink cupboard . . . . . Extra price 1. 13. 0

The sand bath consists of a flat box of lead-covered sheet iron, being fitted in place of the slate slab and heated underneath by gas.

Stink Cupboard in combination with Blackboard (see No. 50,175, p. 28). Cl. 3200, 4680.



50306. 1:25.



50315. 1:8.

50314. 1:20.

50320. 1:11.

50,312. **Water Bath with Gas Burner,** built into the Stink Cupboard; max. diameter of the circular opening, 33 cm . . . . . Extra price | £ s. d. 4. 4. 0

50,313. **Smoke Pipe,** F. C. G. Müller's (M. T., p. 7) . . . . . | 0. 11. 0

50,314. **Iron Table** with Hood and Flue Valve, Figure, size 1.5×0.6 m . . . . . | 7. 5. 0

The table is laid with hydraulic cement fire-proof slabs and has an intermediate partition of oak in iron frame.

50,315. **Porcelain Damper** for draught channels, Figure, for closing the lower aperture of the draught channel, to be fitted in the wall over the table top of the stink cupboard | 0. 10. 0

50 323 A. 1:16.

50 323 B. 1:16

Draught Pipes of acid-proof glazed Clay, of square section with sloping rebate, permitting of a good packing with acid-resisting cement. £ s. d.

Section cm	9.5 × 10	9.5 × 16.5	15.5 × 15.5
Thickness of Wall cm	1.5	1.5	2
List No.	**50,316**	**50,317**	**50,318**
Price per running meter (in 70 cm pieces) £	**0. 2. 9**	**0. 3. 10**	**0. 6. 6**

In view of the draught leads having to be built in, kindly communicate with us before completing the masonry.

Annexes of acid-proof glazed clay, Figure, for placing over the draught pipes, which terminate in the open.

List No.	**50,319**	**50,320**	**50,321**
Inside Measurements cm	9 × 10.5	9.5 × 16.5	15.5 × 15.5
Prices £	**0. 11. 0**	**0. 15. 6**	**1. 5. 0**

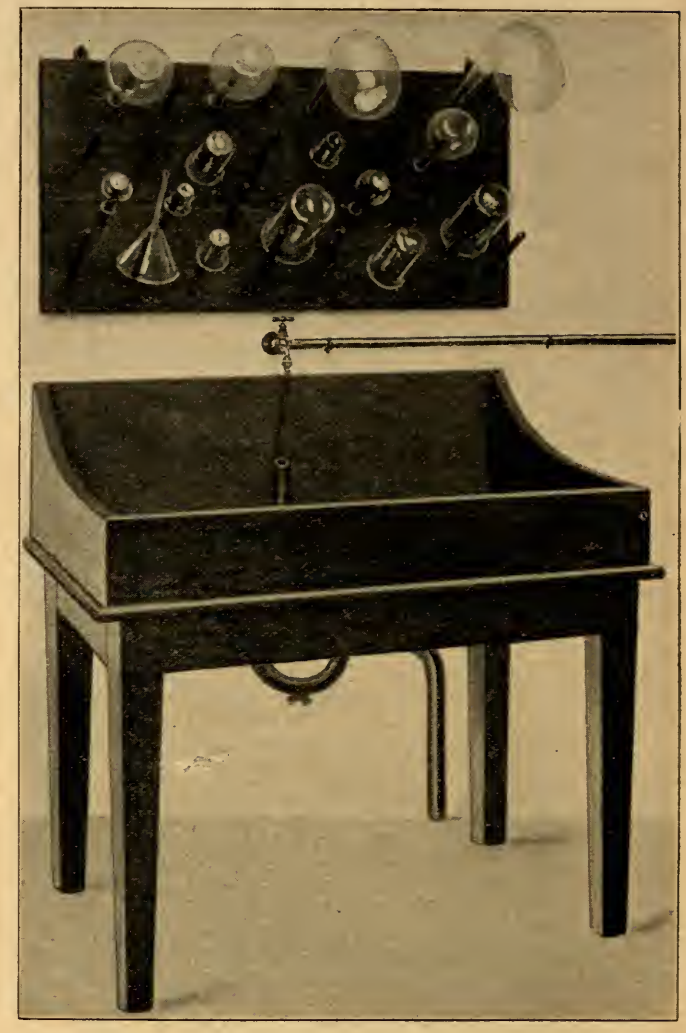
50,322. **Acid-proof Cement** for joining the pipes . . . . . 10 kg 0. 5. 6

50,323. **Chemical Cupboard,** Figures A and B, 1 m long, 2.2 m high, 0.3 m deep, without bottles and chemicals 6. 2. 0

The cupboard is well built of pine, and has double dust-excluding doors with bascule lock (upper part of door glazed). It is stained outside, and painted 3 coats light-blue inside. It contains 5 adjustable shelves (each with 2 stages) on notched mouldings. The base beading is of oak and is rounded at the edges.

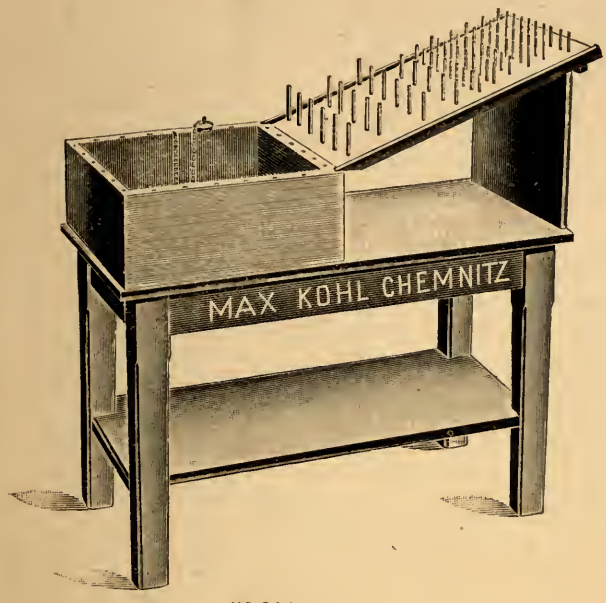
50,324. — The preceding, 1.3 m long, 2.2 m high, 0.3 m deep . . . . . 7. 10.

50 325. 1 : 18.

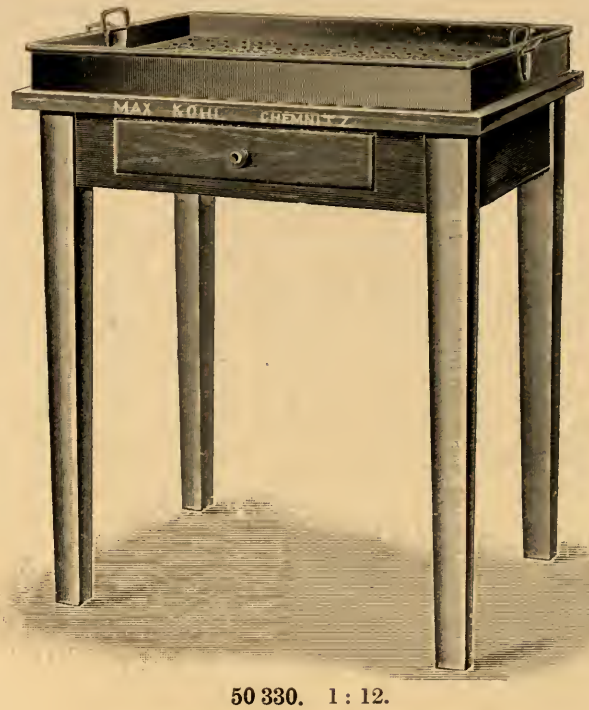


50 328. 1 : 16.

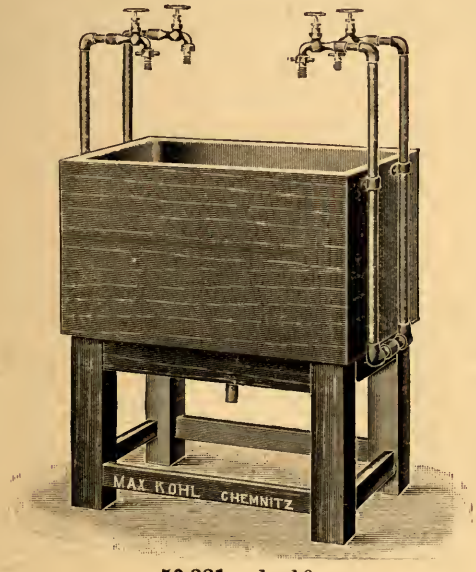
	£ s. d.
50,325. **Chemical Cupboard,** Figure, of pine	8. 5. 0
The cupboard is 1.20 m wide, 2.20 m high; the lower part 0.95 m high, 0.50 m deep, with wood shelves, double doors, and has fillets rounded off at the edges. The upper portion is 1.25 m high, with glazed double door and 5 wood shelves.	
50,326. — The preceding, shelves in the upper portion, being of glass, resting on **T**-iron bearing rails	9. 8. 0
50,327. **Bottles and Chemicals,** Fig. 50,323 B, are supplied at the same time, if desired, at corresponding prices	Prices on application
We would ask that full information be given as to size, number and capacity of the bottles, together with labels required. We also make up suitable collections ourselves and supply estimates of cost of these. The bottles and stoppers have corresponding and consecutive numbers, if required, so that any mistaking of the stoppers is obviated. At a corresponding increase in price, bottles with alkaline liquids have rubber-covered stoppers to prevent the stopper sticking in the neck of the bottle. Bottles of dark-coloured glass can be used for materials which are sensitive to light. The substances in question should be specially indicated when ordering. As regards the shape of the bottles, as a rule the wide shape as shown in Fig. 50,323 B are supplied. If desired, we also supply the narrow Hoffmann shape of bottle, these being specially suitable for frequent use and rapid work in laboratories.	
50,328. **Rincing Table and Drying Board,** Figure	4. 4. 0
The **Rincing Table** is 95 cm long, 50 cm wide and 12 cm deep inside; the back part is raised, and the entire table or sink is lined with sheet lead, the rivets being soldered. It has overflow, lead draining valve, and waste pipe with seal. A water tap is placed above it.	
The **Drying Frame** is a wall board containing a number of wood rods of varying thickness standing out upwards from it for supporting glass measures, retorts, etc.	



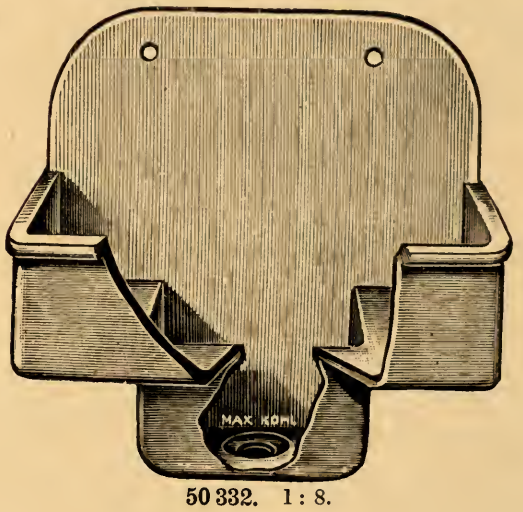
50 329. 1 : 18.



50 330. 1 : 12.

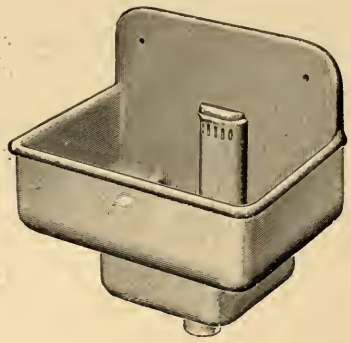


50 331. 1 : 16.

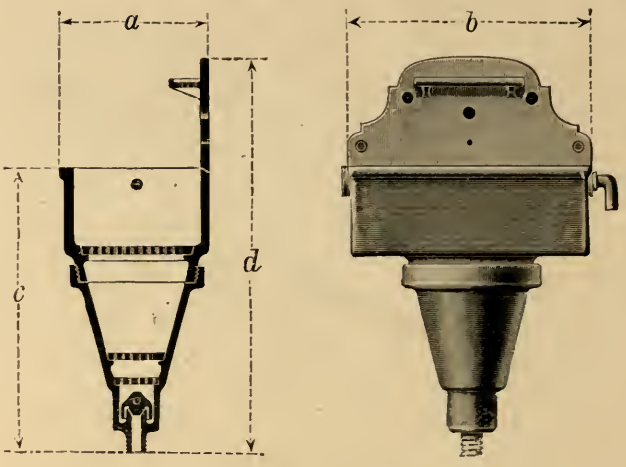


50 332. 1 : 8.

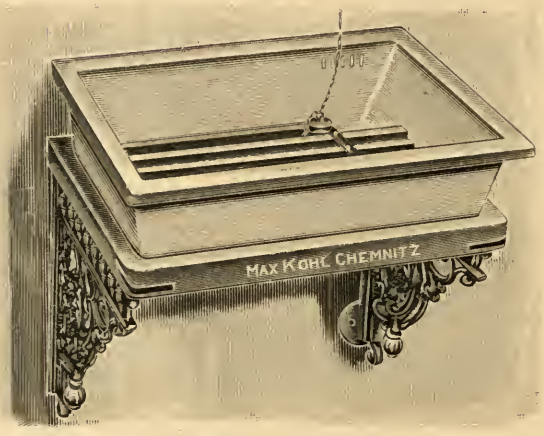
	£ s. d.
50,329. **Rincing Table with Draining Board,** Figure	4. 4. 0
The rincing chamber is 60 cm long, 50 cm wide and 20 cm deep inside; it is lined out with sheet lead, the rivets being soldered. The flushing chamber has overflow, lead draining valve, and waste pipe with seal. The draining board has wood rods, and is placed alongside the trough; the vessels that are dried can be placed underneath.	
50,330. **Table with Zinc Drip Box,** Figure; height of table 90 cm; length of zinc box 80 cm, width 60 cm, depth 8 cm; with strainer at bottom	3. 6. 0
50,331. **Rincing Trough with 4 Water Taps;** trough 70 cm long, 45 cm wide, 40 cm high	6. 2. 0
The frame and trough are of pine, the trough being lined out with lead, with soldered rivets, it has 4 leads of tinned iron piping, 4 screw down taps with hose ends. Waste valve and waste, with seal. Total height 85 cm.	
50,332. **Laboratory Basin,** stoneware, acid-proof glazed, Figure, with raised back, hollowing at the bottom, and stoneware valve, for screwing on to the wall or table. Height 55 cm; width 55 cm; projection 34 cm	2. 5. 0
50,333. — The preceding, height 43 cm; width 60 cm; projection 30 cm	2. 5. 0
50,334. **Rincing Basin,** of brown, acid-proof stoneware. Height 53 cm; width 64 cm; projection 38 cm	1. 15. 0
50,335. — The preceding, smaller: height 53 cm; width 50 cm; projection 38 cm	1. 10. 0



50 336. 1 : 18.

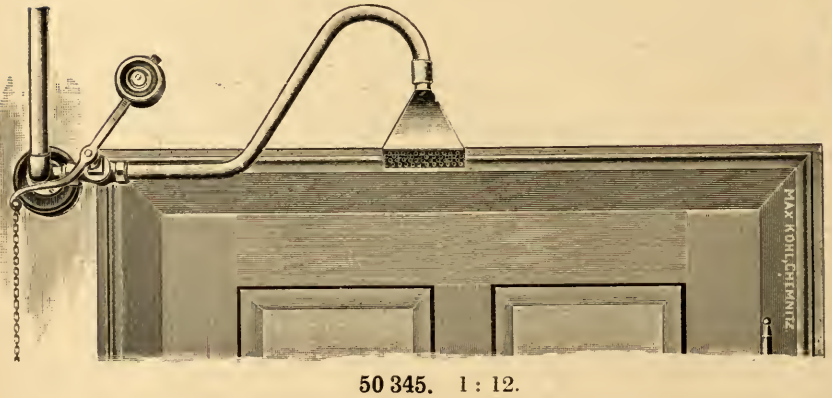


50 337. 1 : 20.



50 340. 1 : 10.

50 344. 1 : 6.



50 345. 1 : 12.

50 343. 1 : 14

50,336. **Laboratory Basin,** earthenware, with Deepening, overflow and sieve, Figure, with raised back wall; basin 50 cm wide, 55 cm high, 35 cm projection, of hard-baked earthenware, with earthenware valve . . . . . £ 2. 5. 0

50,337. **Deep Laboratory Basin,** Figure, of brown earthenware, with 3 strainer plates (removable), with raised back and with overflow 3. 18. 0

This basin is very well suited for rincing and cooling of vessels differing greatly in shape, and especially those which are narrow and tall (to 50 cm). Dimensions: a = 40 cm; b = 67 cm; c = 75 cm; d = 105 cm.

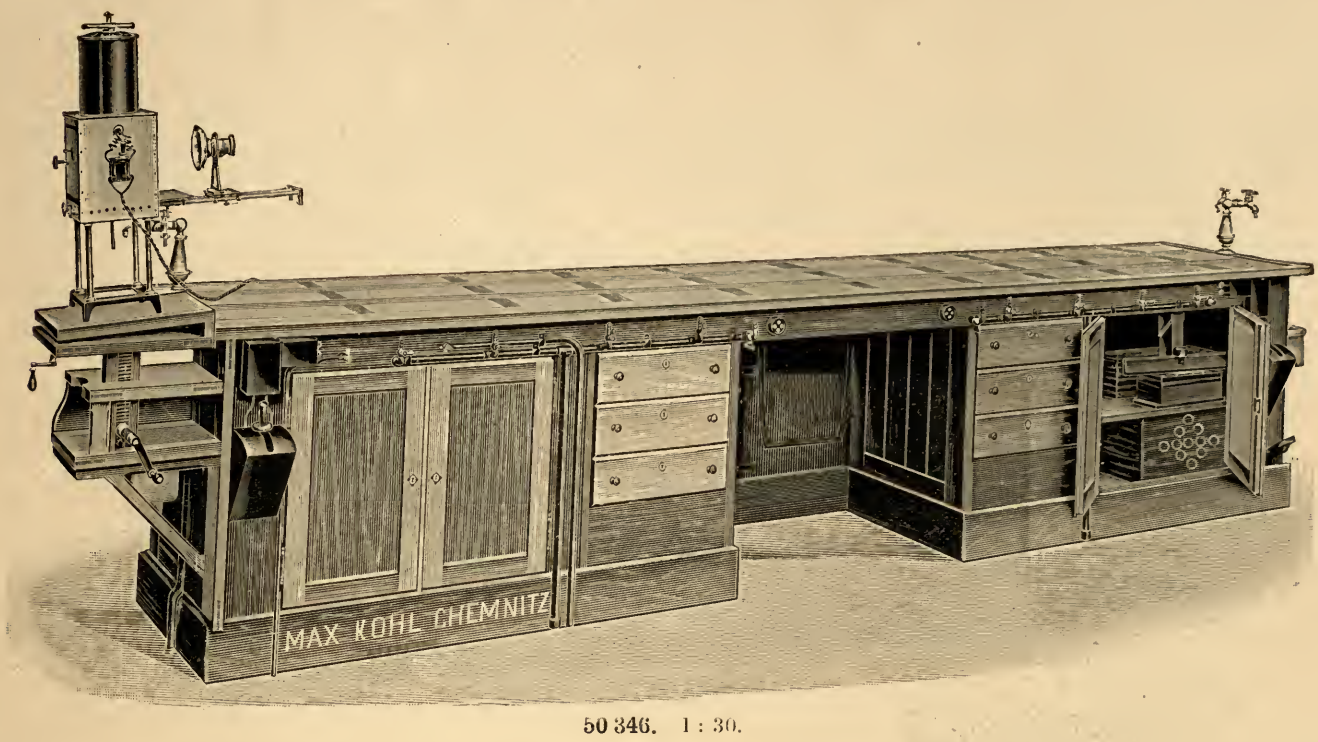
50,338. — The preceding, of white earthenware 6. 0. 0

50,339. We supply light **Wood Lining** for the Laboratory Basins for protecting them in the case of heavy articles falling therein, and for preventing breakage when vessels are handled incautiously. Prices according to size and shape of basin.

50,340. **Sink,** of porcelain, Figure, 53 cm long, 35 cm wide, and 13 cm inside depth, with overflow, draining valve (lead), and oak bars laid across sink inside, on 2 bracket supports with oak frame 2. 10. 0

Very practical for rincing clay pots, etc.
The design of the bracket supports differs from that illustrated.

Cl. 5270, 3905, 3991, 3761, 3214, 29.



50 346. 1 : 30.

50,343. **Large Earthenware Basin,** brown, Figure, 80 cm long, 50 cm broad, 50 cm high inside, with waste supports and earthenware valve ground in . . . . . £ 3. 10. 0

The outside dimensions are 95, 65 and 55 cm.

50,344. **Movable Steel Pipe with Rose** (Figure), of aluminium, very convenient and practical, for filling receptacles which cannot be easily connected up with the water-supply, and for rincing, etc. . . . . £ 1. 10. 0

The steel pipe is connected to the supply by means of an armoured hose and by turning a knob the spray piece or the rose can be connected up, or both can be cut off.

50,345. **Door Rose,** for use in case of fire in the Laboratory (Figure), with wall rose, cock with draw chain and counterpoise . . . . . £ 1. 15. 0

This rose is connected to the water supply. It serves as a protection for the persons concerned in making experiments in which an outbreak of fire may easily occur. In all cases the tendency is to seek an exit, and the rose is fixed over the exit door. A simple pull of the chain sets this rose working, the counterpoise causing the tap to open to its fullest extent.

Equipment of Lecture Rooms and Laboratories of Institutions whose Funds are not restricted.

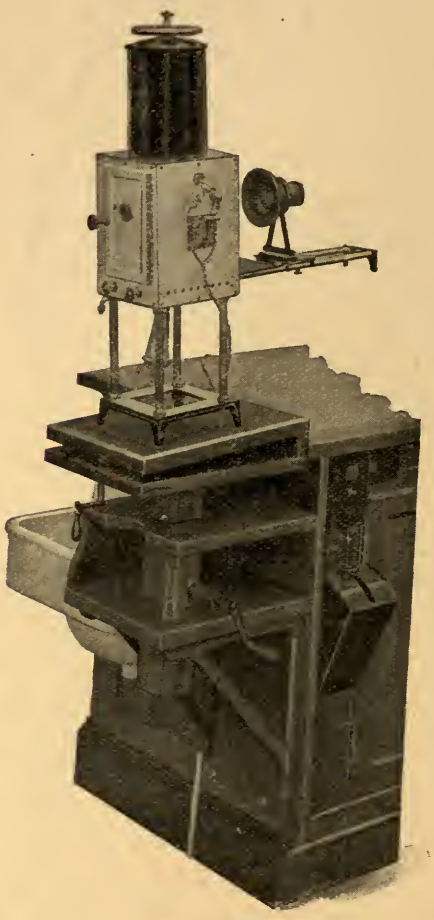
Lecture Tables, etc.

50,346. **Lecture Table,** in the Physical Institute of the Danzig-Langfuhr Technical High School (Prof. Max Wien), Figure . . . . . Price on application

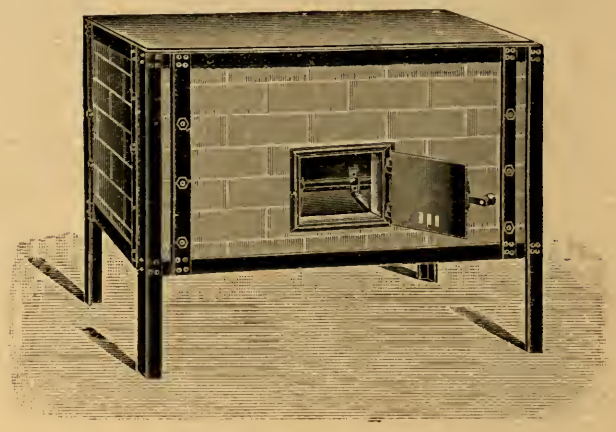
The table is 5.50 m long, 1.20 m high, and 1 m wide. The top is of oak, 40 mm thick, and is composed of frame and pannellings, being coated thrice with hot linseed oil. The side that is viewed (i. e., the side facing the auditorium) has an oak body, the remaining parts being pine. The table has 6 lock-up drawers of various depths and 1 large double-doored cupboard. On the right-hand side is a large bellows fitted for treadling, with wind pressure regulator for working acoustical instruments. The table is fitted with gas, water, aspirated air, and compressed air leads. The gas lead is placed in front under the table top, and has 2 gas taps of 8 mm bore, and 8 taps of usual bore. The water lead is placed on the two narrow sides of the table and terminates in two iron water-standards each having 3 taps. Underneath these water standards are 2 large white laboratory basins with lead waste pipes. The leads for aspirated and compressed air have each 1 conical stop-cock.

In addition, the following are fitted on the table: 2 electric leads, i. e., 1 double lead for current from accumulators (to 60 amps.) and 1 double lead for power supply current to 100 amps. The accumulator lead has 1 double-pole instantaneous switch for 60 amps. with silver fuse-strips, protecting

See also the Lecture Tables at the commencement of this List.



50 346 A. 1 : 20.



50 347 A. 1 : 20.

cover, and with terminals for cable sockets, and distributed over the table are 2 plug boxes for 30 amps. The power supply current lead has 1 double-pole instantaneous switch for 100 amps. silver fuse-strips, protecting cover, and with terminals for cable sockets, and on various parts of the table 3 plug boxes to 30 amps. and 2 plugs each with 3 m double lead; 2 pieces, 1.5 m long, flexible cable lead for 100 amps., with pole shoes, are given in. Two terminals connected with the water lead serve to make a good earth. On the left-hand narrow end a projection table is fastened to the lecture bench (Fig. A). This table is of oak and can be adjusted in an up and down direction by a rack and pinion. The upper table top can be inclined, thus allowing the lantern to be tilted, in order that the image may be projected as high as possible on the screen. The acoustical bellows can be also arranged for electric motor drive.

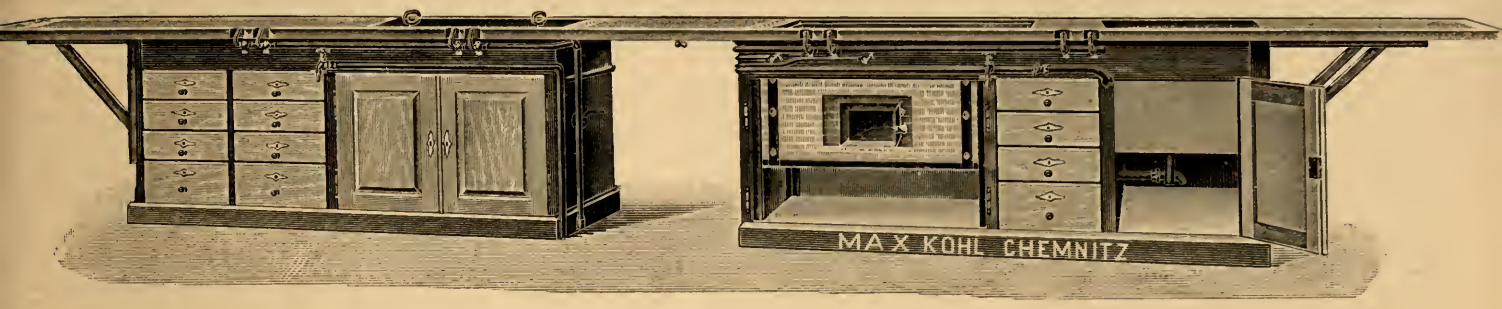
£ s. d.

50,347. **Lecture Table,** in the Physics Department of the Charlottenburg Technical High School, Figure . . . . . Price on application

The table is in 2 portions, having a passage in the centre, with draw flap, and with a leaf 75 cm long at each end supported by folding struts. The table top and leaves are 1 m wide, and consist of 40 mm thick oak, being composed of frame and pannellings. The body is of pitch-pine and has 12 doors and 2 double-door cupboards. A heating device is fixed in each cupboard. These ovens, constructed of fire bricks in an iron housing (Fig. A) are heated with gas and have copper cover plates protected from the direct action of the heat by a stratum of air and by an iron plate. This device keeps electrical apparatus quite dry without their becoming damaged by too great a heat. The heating devices when not in use are covered by slate slabs, which can be drawn out by handles fixed in them. The table has, in addition, a deep pneumatic trough with water tap outside and an arrangement for screwing apparatus on the bottom of the trough. The trough has an overflow, also waste valve. Gas lead with 8 stop-cocks, water lead with 2 taps, and leads for aspirated and compressed air each with 1 stop-cock are laid on down to the floor.

50,348. **Lecture Table for Physics** (Figure), as supplied to the High School of Commerce, Berlin, together with Travelling Table No. 50,349 . . . . . Price on application

This lecture table is 3.60 m long, 80 cm wide and 90 cm high. The top is of oak, is composed of frame and pannellings, and is acid-proof painted. The body is of pitch-pine, it contains 12 drawers and has two large hollow spaces, one being shut off at the students' side by ornamental glass. The base fillets are rounded off at the edges, in order that they may not be disfigured when



50347. 1 : 40.

50348, 50349. 1 : 30.

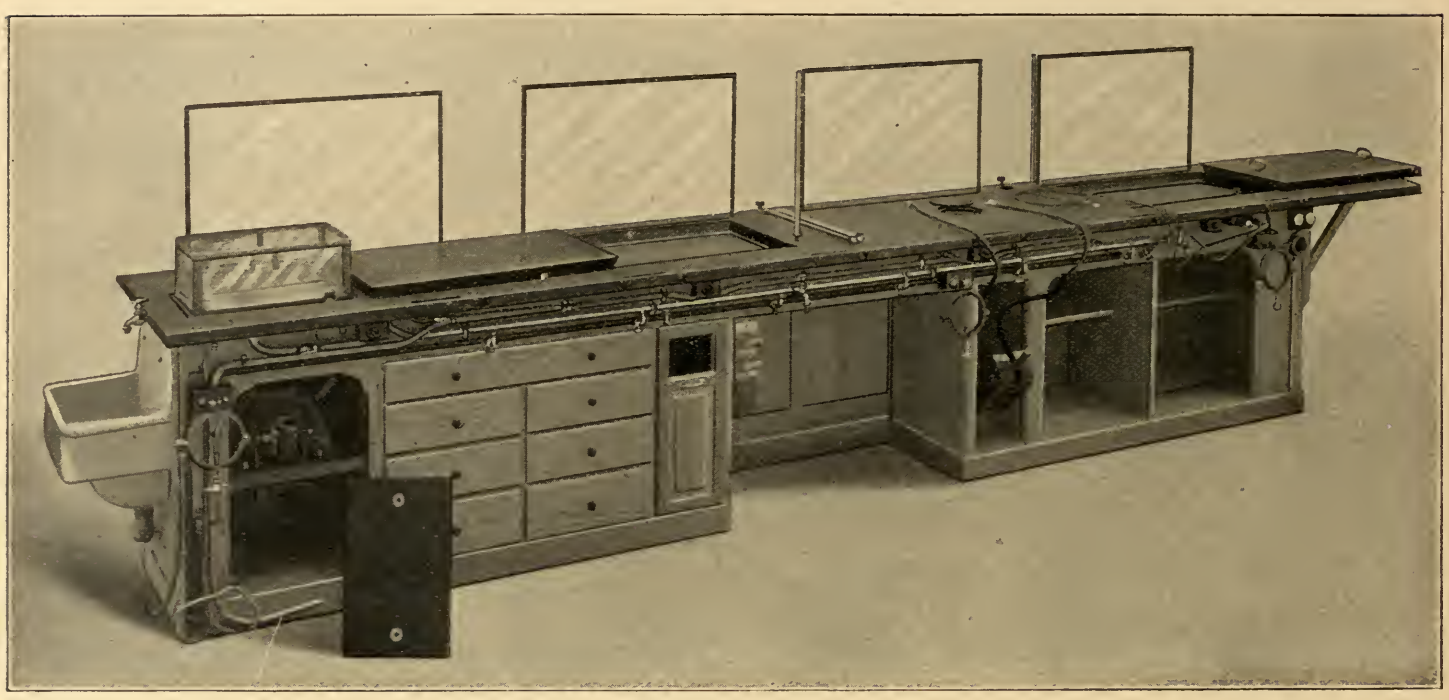
knocked and may be exposed to the minimum of wear. The table has a gas lead with two stopcocks and hose unions turned upwards, on the students' and the lecturer's side. It is possible by using these unions to connect burners and apparatus on the lecture table to the gas lead by hoses without kinking occurring. A hose stopcock is fitted on the left-hand end of the table in order to supply with gas the travelling table (see illustration), which serves to lengthen the lecture table. In addition the table has one lead each for aspirated and compressed air and for water. The water lead serves as inlet to the pneumatic trough and a water waste is also fitted. The pneumatic trough usually has its place inside the table and is then covered over by a slate slab in such wise that the table top is quite plane. After removing the cover plate it can be raised for use by an elevating device until it rests completely above the table. The 4 side walls of the trough are glazed; the side turned towards the audience is arched so that the students sitting sideways may not be deceived as to the position of objects in the trough. The trough is connected direct to the water lead and has an overflow and a waste valve, also a removable bridge. The electric lead of the lecture table terminates at the 4 corners of same in a small marble slab; each slab has a plug box with plug for 30 amps. direct current and alternating current, 2 terminal boxes for accumulator current of 36 amps. and a plug box and plug together with switch for connecting up a table lamp.

£ s. d.

50,349. **Travelling Auxiliary Lecture Table** (see Figure), also serving as **Preparation Table** for containing pieces of apparatus in the preparation room and to lengthen the lecture table . . . . . Price on application

The table, resting on rubber rollers and movable in either direction, is of the same height and width as the preceding lecture table. It is 1.20 m long, 80 cm wide and 90 cm high. In the preparation room are set on the table the apparatus which require a long time to set up or those apparatus which are not used at the commencement of the lecture and which should not attract attention during the lecture. The table is then brought into the lecture room. The construction of the travelling table corresponds to that of the lecture table. It has on each of the narrow sides a lengthening leaf of 50 cm. The table top has a removable portion; this can be substituted by a perforated metal sheet, which covers a glow lamp heating device. The heater serves to heat electrical apparatus. The table has a glas lead with 2 stopcocks and a plug box for connecting the electric heater with the lecture table or with corresponding leads in the preparation room.

See also the Lecture Tables at the commencement of this List.

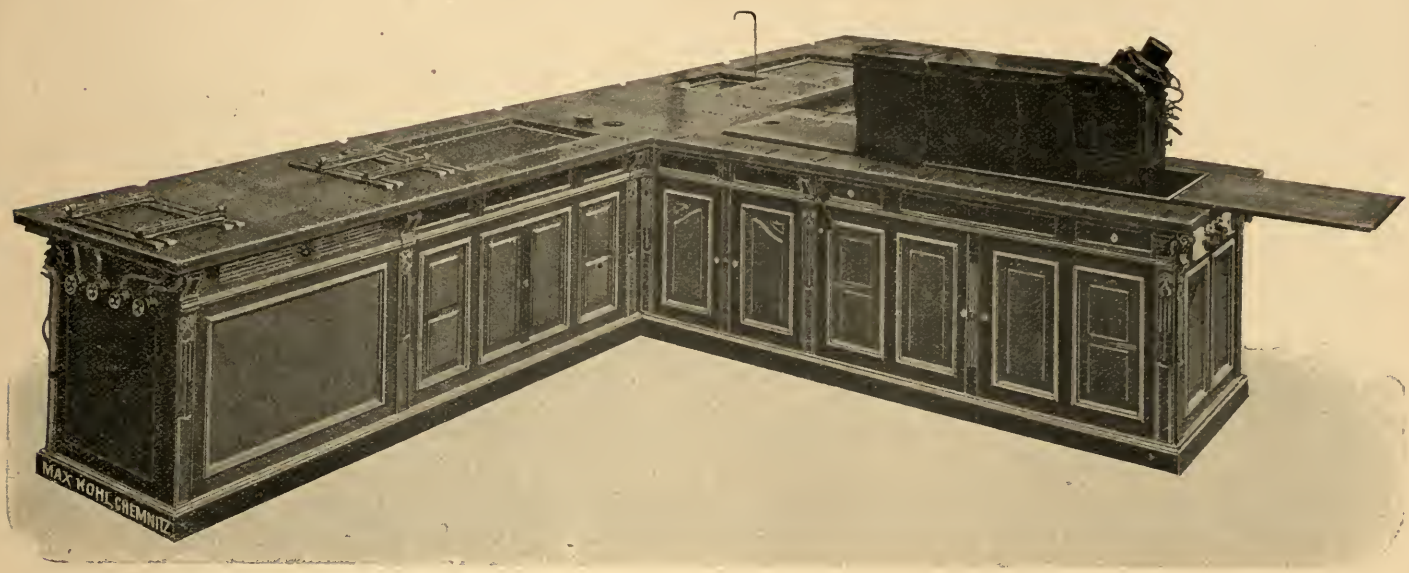


50 350. 1 : 25.

50,350. **Lecture Table** (as suggested by Prof. Otto N. Witt), for Chemistry, Figure, as supplied to the Institute for Chemical Technology of the Royal Technical High School, Berlin (Charlottenburg) . . . . . £ s. d. Price on application

The lecture table is 5 m long, 80 cm wide and 90 cm high. The top is of teak 40 mm thick, being composed of frame and pannellings, and has a 50 cm leaf on the right-hand side. Facing the auditorium are 4 extending boards. The table top is thrice coated with hot linseed oil, and can, if desired, be stained an acid-proof black. The body is constructed of pitch-pine, and has 1 large and 6 small drawers, a box lined with sheet iron for waste paper, etc., and a number of open cavities. The base fillets are of oak, rounded at the edges so as not to be disfigured by knocking and to resist hard wear. The table has a gas lead with 1 hose stopcock for 40, 1 hose stopcock for 10, and 5 hose taps each for 1 burner; water lead with 3 hose taps, leads for aspirated and forced air, each with 1 cock, draught channel 17 × 17 cm inside width with iron cover plate; and an electric lead. The latter consists of two stout brass rails, let into the table, and covered with wood, provided every 40 cm with conical holes for taking 8 plugs; there is also a plug contact for taking 50 amps. All leads are laid ready to the floor. To the left of the table is a large white laboratory basin with earthenware plug and lead waste pipe; a pneumatic trough, which can be lowered under the table top, and constructed of thick sheet copper, 50 × 30 × 20 cm, with 4 crystal glass sheets. In addition there is a knife switch for 150 amps., and 4 crystal glass shielding discs for protecting the audience from spurting liquids. These panes can be lowered under the table top, being raised automatically on to the top by pressing a knob. There are also 2 rising slabs for providing hollows for working with mercury, etc.; one of the cavities has a slate floor. The hose lines laid round the edge of the table are under special hose flaps (of which there are 6), to prevent dragging or squeezing. Three special holders are fitted for holding steel flasks for gases; 5 magnalium rods, serving as stands, can be inserted into any of 10 brass bushes. One lecture desk, of oak, for setting on the lecture table, is given in.

See also the Lecture Tables at the commencement of this List.



50351. 1 : 30.

50,351. **Lecture Table,** in the Physics Lecture Room of the École de mines du Hainaut, Mons, Belgium (Figure) . . . . . Price on application

The table is 6 m long, 1 m wide and 95 cm high. The top is of teak, 40 mm thick, being composed of frame and pannellings. The body is of pitch-pine, the inner side walls and bottoms of red deal; it has 14 lock-up drawers, 1 long drawer for glass tubes, and 2 double door and 1 single door cupboards with shelves.

The table is fitted with the following: 1 gas lead, 1 water lead, 1 pipe line for aspirated air, 1 pipe line for forced air, 2 porcelain sinks with lead waste pipes, 1 draught pipe for gases and noxious vapours, 1 heating device for electrical apparatus, 1 cavity for work involving the use of mercury, 1 lead pneumatic trough with direct water-inlet, overflow, valve waste, and 1 movable tall water discharge for filling vessels, etc.; 4 pairs electric leads in conjunction with 4—30 amp. plug boxes at each end; 1 marble switchboard with fuses, switch plug box with 30 amp. plug for the projector lantern, and 2 pairs slide rails for fixing of small dynamos and motors.

The gas lead has 6 gas stopcocks with hose unions turned upwards, and 2 gas stopcocks turned downwards, for the heating apparatus. The water line has 4 water taps with hose unions, 1 main tap for filling the pneumatic trough, and 1 main tap for the tall water outlet in the trough. The leads for aspirated and forced air each have 2 conical stopcocks with hose unions, the compressed air lead having in addition a large rubber piece for blowing sirens, pipes, etc. At the left-hand side, where the gas channel is placed, a slate slab, 75 × 60 cm, is let into the table top, upon which chemical operations may be carried on. The heating apparatus and the mercury cavity are closed by wood covers when not in use, and form a smooth surface with the rest of the table top. These two wood slabs, and also the cover of the pneumatic trough (of slate) are lifted off by handles, which may be inserted. The covers of the water waste and of the gas draught pipe are of iron, let into iron rings. A terminal connected with the water lead serves to form a good earth.

A second table, 2.5 m long, and 1 m wide, is carried out from the centre of the main table, and at right angles to it, this continuation being made towards the audience. Four pairs of electric conductivy rails are let into the table top, being connected at the head to 4 plug boxes. The table is provided with an arrangement for lowering the projection lantern. The projection lantern is mounted on a wood board 1.35 m long and 52 cm wide with the auxiliary apparatus. The wood board is hung upon 4 Gall's chains. The chains run over 4 sprocket wheels and are fitted at the free ends with counterpoises. Each two such wheels are firmly fixed to an iron shaft, these shafts being set in motion by two worm wheels and worms.

The entire device is placed inside the table, and is not visible from the outside. Only the cranks of the driving shafts are inserted from outside. When the projection lantern is in use, i. e., when the wood board is raised up, the latter rests on two stout wood fillets, thus ensuring a firm support for the lantern. When the lantern is lowered, the opening in the table top is covered by two flaps moving in hinges, the table top then forms a plane, smooth surface.

See also the Lecture Tables at the commencement of this List.

50 352. 1 : 25.

50,352. **Lecture Table,** in the Chemistry Class Room as the „Oberrealschule", Furstenwallstrasse, Dusseldorf (Figure) . . . . . Price on application

The table is 4.5 m long, 90 cm high, 84 cm wide. The top is of 40 mm thick oak, in frames; thick plate glass sheets, ground on the underside, are built into the top. The body, of pitch-pine (the inner floors and side walls of red deal) has two double-door cupboards and 8 drawers.

The gas lead of the table has 4 gas stopcocks with hose unions turned upwards and 1 wide stopcock of 8 mm bore. The water lead has 1 hose stopcock, 1 main stopcock for the pneumatic trough; 1 hose stopcock for the blower and 1 iron water standard with 3 taps. Alongside this tap standard there is a square wood attachment, which serves as a reagent stand. There is also 1 water jet blower with bronzed metal cylinder, gauge glass, screw off pump with stopcock and vacuum gauge, stopcock with movable hose point for the compressed air, and with inlet tap. Below the water standard is a large square porcelain basin with overflow, wood grating let in, lead valve and waste pipe. At the centre of the table is placed a pneumatic trough of sheet zinc, with direct water-delivery, overflow pipe and waste valve built in. The cover of this trough forms a polished slate slab, which can be lifted out by means of a handle which is inserted. To the right of the pneumatic trough there is a porcelain sink with enamelled iron cover. To the right a gas draught pipe is fitted. At this point a rectangular groove is let in the table top and this serves as a mercury gutter, a glass box, with door can be set upon this gutter, and is used as a stink cupboard in conjunction with the draft pipe in the table.

50,353. **Equipment of the Laboratory for Applied Chemistry,** Leipzig (Prof. Beckmann), Figs. A to G . . . . . Price on application

The illustrations show the equipment of the Analytical Room (Fig. A), of the Medical Laboratory (Fig. B), the Mechanical Workshop (Fig. C), and of the Combustion Room (Fig. D).

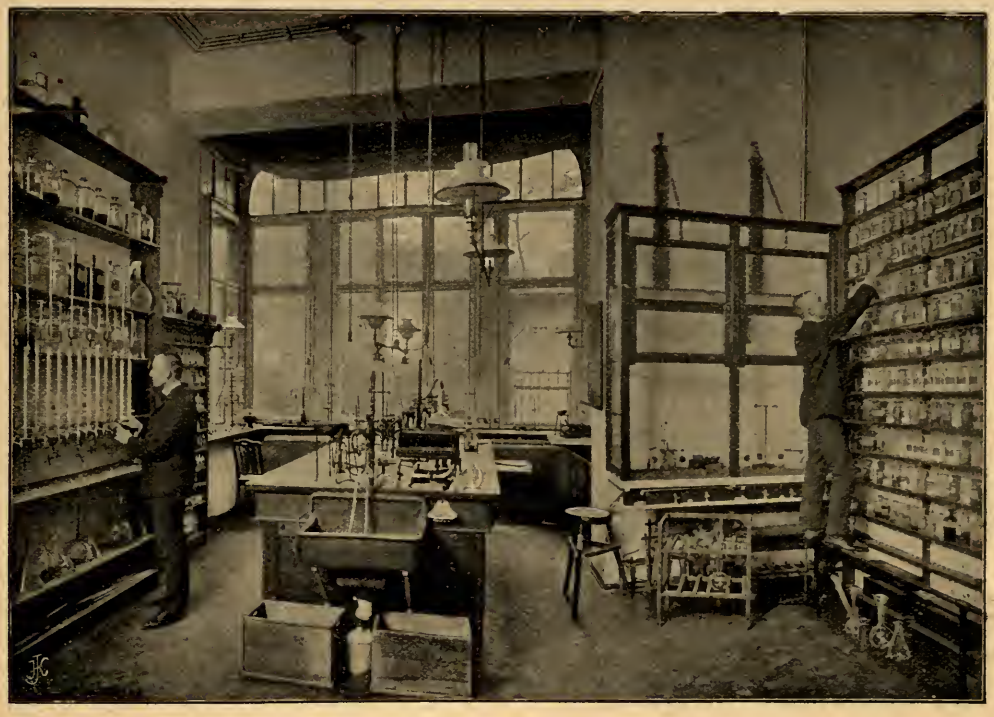
We shall be glad to supply free of cost, **complete estimates** for such installations.

Fig. E shows the **ventilation** in the doors of the Sulphuretted Hydrogen Room, Fig. F the **Sulphuretted Hydrogen Offtake in a Sulphuretted Hydrogen Room,** Fig. G the Sulphuretted Hydrogen Offtake in a **Medical Laboratory.**

Further particulars as to the equipment are contained in the pamphlet „Das Laboratorium für angewandte Chemie der Universität Leipzig in seiner neuen Gestaltung", by Dr. Ernst Beckmann, Leipzig, 1908.

The blocks for these and some other illustrations have very kindly been placed at our disposal by Dr. Beckmann.

See also the Lecture Tables at the commencement of this List.



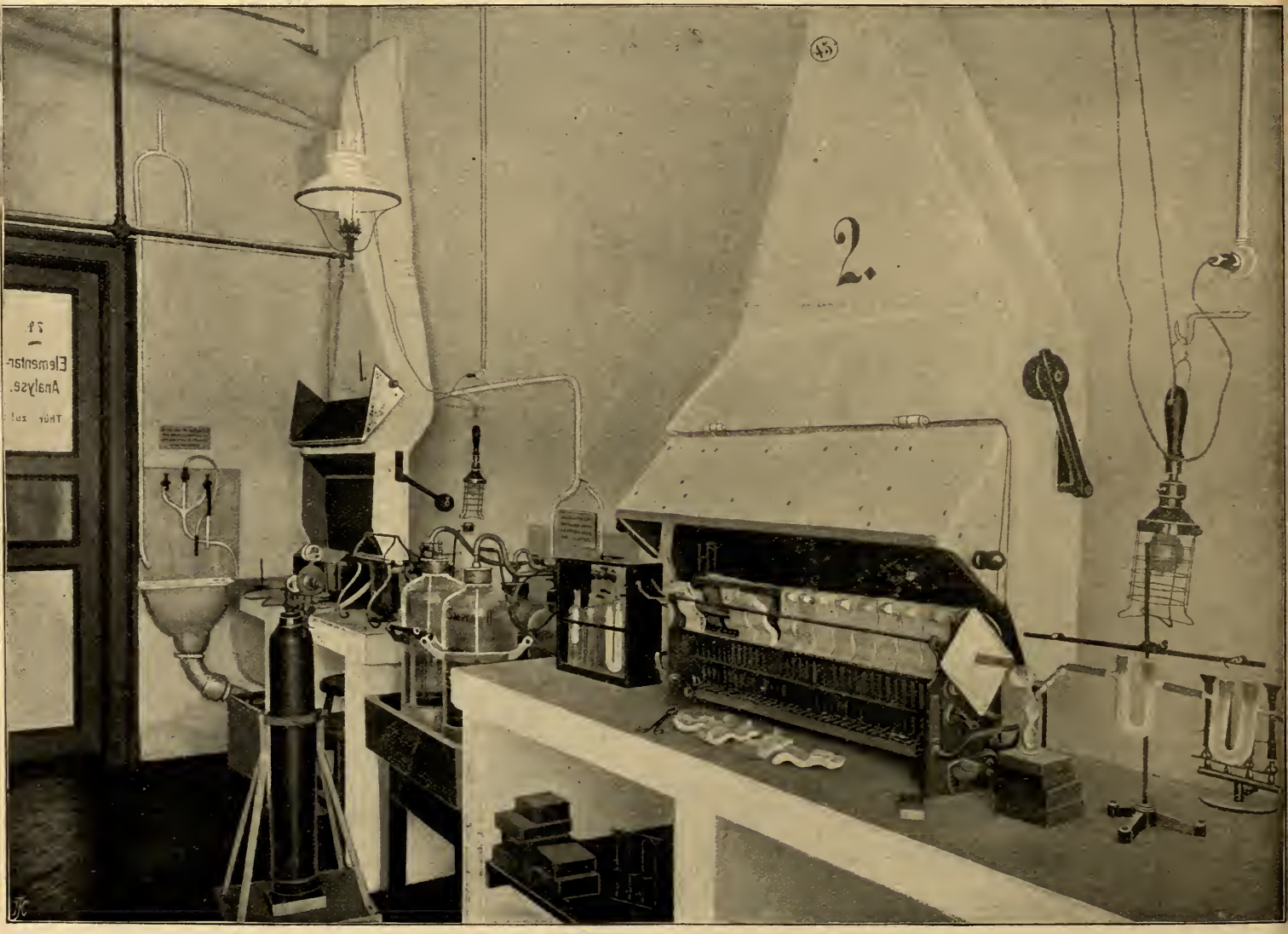
50 353 A.

50 353 B.

See also the Lecture Tables at the commencement of this List. Cl. 5236. 5249.

50 353 C.

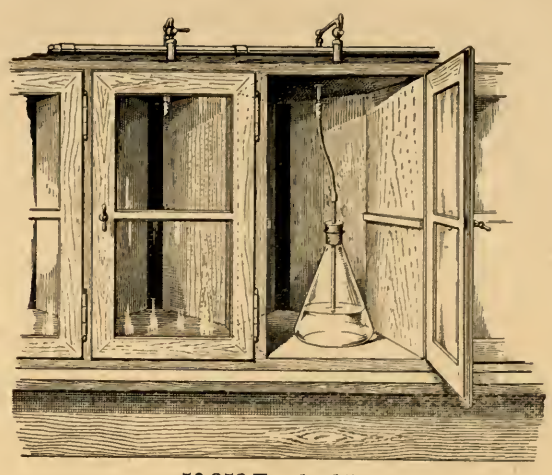
50 353 G. 1 : 15.



50 353 D.

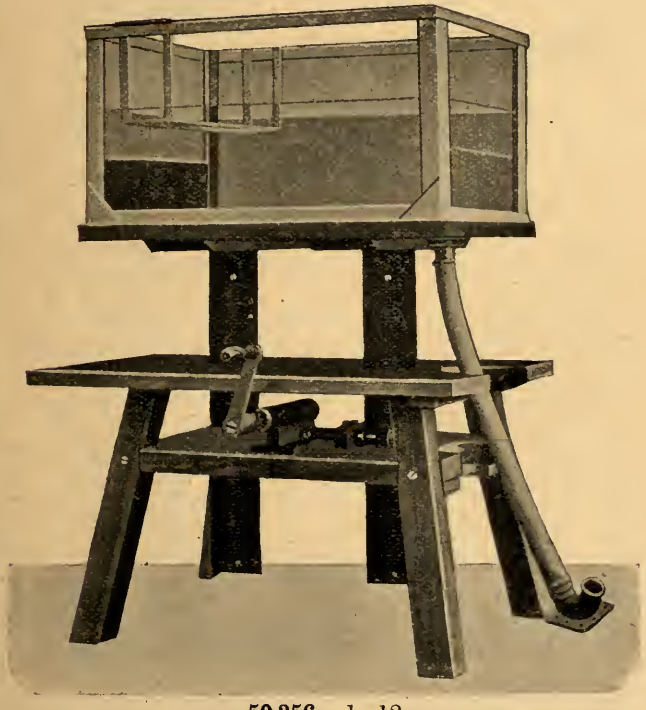
See also the Lecture Tables at the commencement of this List. Cl. 5248, 5244, 5239.

50 353 E. 1 : 20.

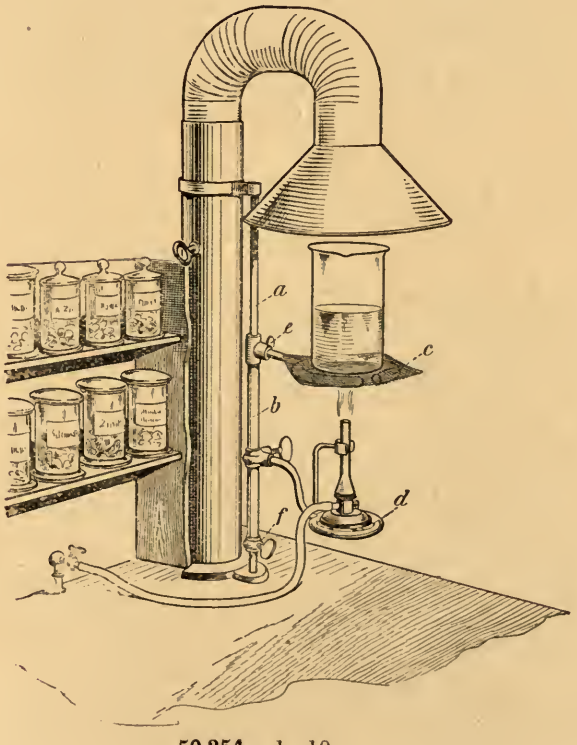


50 353 F. 1 : 15.

50 355. 1 : 10.



50 356. 1 : 12.



50 354. 1 : 10.

£ s. d.

50,354. **Table Draught Pipe with Stand Arrangement** (Figure), in the Laboratory for Applied Chemistry, Leipzig University, Medical Laboratory . . . . . Price on application

50,355. **Contrast Background with Mirror Device** (Figure), for making objects and phenomena plainer, and especially demonstration of reactions in porcelain dishes, crucibles or mortars which can only be viewed from above and not from the auditorium . . 6. 12. 0

This consists of three flap glass plates with black, white and silvered ground. These glass sheets are about 50 cm long and 30 cm high, mounted in metal frame moving in hinges and fitted with device for adjusting. The arrangement is fitted on a wood slab, placed on the table. The whole runs on balls and can be turned about.

50,356. **The Pneumatic Troughs** for the Lecture Table can be supplied in various sizes, of copper, provided on 4 sides with plate glass panes, Figure, with copper bridge, overflow, and water outlet, and with stand for raising and lowering . . . . . Price on application

For special Fittings and Accessories for Lecture Tables see pp. 10—12 and 16—22.

£ s. d.

50,357. **Lecture Table,** in the Laboratory of Applied Chemistry, Leipzig University (Prof. Beckmann), Figs. 50,422 A, B and C, pp. 85—87 . . . . . Price on application

The table is 11.50 m long, 95 cm high and 80 cm wide, being in two parts, and has a flap and door in the centre. **The top** is of 40 mm thick oak in frame and pannellings, is coated thrice with hot linseed oil, and has a water channel running round the under side. The body is of pitch-pine with oak bottom fillets. It has 12 drawers (some with compartments), 1 large double-door, lock-up cupboard with spring lock, space for installing a battery of accumulators, and two large cavities at both ends of the table; the back walls facing the auditorium have fancy glass panels for providing light to the spaces mentioned.

The following are fitted on the table: Gas lead with 12 gas stopcocks for 1 flame each, 2 stopcocks each for 10 jets, and 1 stopcock for 40 jets, also 2 main stopcocks, the outlets terminating at the front of the table above the top. There is also a water lead with 2 water-tap standards on the narrow side of the table, each with 3 taps; 1 tall tap standard with rotatory outlet for filling the gasometer, 8 water taps with hose unions; aspirated air lead with 3 conical stopcocks; compressed air lead with 2 conical stopcocks; 4 leads for oxygen, hydrogen, nitrogen, carbonic acid gas, etc., each with 1 conical stopcock with gauge fitted above; steam lead with steam delivery valve with Jenkins lagging. White laboratory basins are placed on the two narrow sides. The table has in addition:

1 large pneumatic trough (copper) with plate glass slabs;

1 device for raising and lowering mercury troughs;

1 Mercury Board with sloping bottom;

2 large Gas Draught Pipes;

2 Discharge Sinks;

2 Explosion Slabs (which are capable of being lowered);

6 Metal Bushes let into the table top, into which Magnalium Rods may be screwed. These serve as stands. Below these bushes are lead gutters for carrying off escaping liquids.

1 Experimental Switchboard for connecting to a 220 volt supply, for taking a current of from 0.04 to 20 amperes, with a 48 ohm regulating resistance having 30 stages, with large aperiodic precision measuring instruments of 150 mm scale-diameter. These instruments may be rotated so as to be capable of observation from the auditorium.

1 Switchboard for charging and discharging accumulators, and for connecting an arc lamp up with series resistances.

Various parts of the table top are laid with white Mettlacher tiles and red clay tiles, the latter for standing combustion furnaces upon. On the side facing the auditorium, two drop leaves 1.50 m long and 40 cm wide are arranged under the table top, upon which preparations, etc. may be placed.

50,358. **Lecture Table,** in the Chemical Institute, Breslau (Prof. Ladenburg), Figure . . Price on application

The table is 8 m long, 80 cm wide and 90 cm high. The **body,** of pitch-pine, stained and varnished, has 4 double-door cupboards with shelves, and 16 drawers. The **top** is of 40 mm thick oak, laid with white glazed porcelain tiles. The table has gas lead with 12 gas stopcocks with hose unions bent upwards, water lead with 6 taps with screwed hose ends; leads for oxygen, aspirated and compressed air each with 2 conical stopcocks; also steam lead with steam valve. All leads are laid ready to the floor. The following are built into the table: 2 large draught channels for gases; 4 small water funnels with waste pipes from which to suspend water hoses; 1 large pneumatic trough about 70 cm long, with 2 plate glass slabs (the panels of the table being arranged on the front and back walls for removing); also 1 device for raising and lowering mercury troughs by means of crank, rack and pinion.

The covers for the pneumatic trough and of the device for the mercury trough are of oak, and can easily be lifted off by handles (detachable). The covers of the cast iron and asphalted draught offtakes are of enamelled iron set in enamelled iron rings.

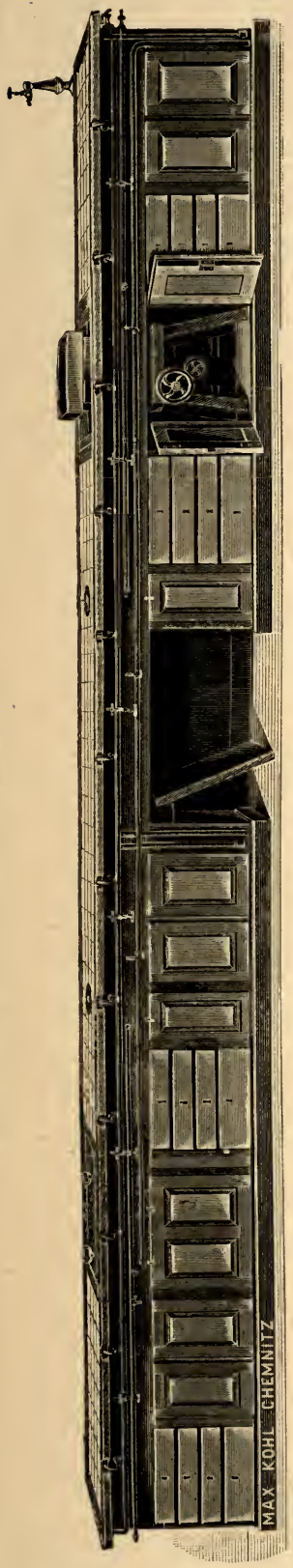
50,359. **Lecture Table,** in the Chemical Institute of the Technical High School, Danzig-Langfuhr (Prof. Ruff), Figure . . . . . Price on application

The table is 8.20 m long, 95 cm high and 80 cm wide. The **top** is of oak, consisting of frame and pannellings, and is coated thrice with hot linseed oil. The **body** is of pitch-pine, the inner side walls and bottoms of red deal, and the beading running round the bottom of oak. The body has 18 drawers, some of them being divided into compartments, and four double-door cupboards with partition. The table is provided with gas, water and steam leads. The gas lead has 3 stopcocks each for 40 jets, 2 each for 10 jets, and 12 each for 1 jet. The water lead has 12 water taps with hose unions (4 of these being arranged for connecting up small water jet pumps), with waste pipes underneath. A main tap is fitted for filling the pneumatic trough, this tap terminating in the trough. The steam lead has two outlets. All leads are laid complete to the floor.

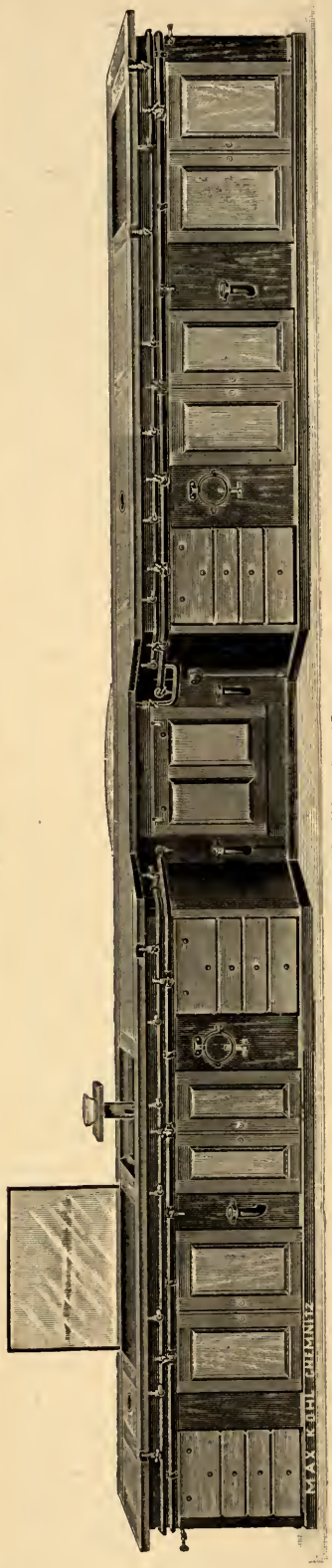
The following are built into the lecture table: 1 large Pneumatic Trough of stout sheet copper, Fig. A (from the auditorium), Fig. B (as seen by the lecturer). The crystal glass sheet turned towards the auditorium is convex, projects over the front of the table, and, when not in use, is protected by a sliding wall. At the lecturer's side there are in front of the trough 2 electric incandescent lamps for lighting the trough. The trough has direct water delivery, overflow pipe, waste valve, and 1 copper bridge for suspending.

1 Explosion Slab, 90 cm long, 60 cm high, of crystal glass mounted in brass. This slab is sunk into the table, balanced by lead weights, and rises automatically on pressing a knob.

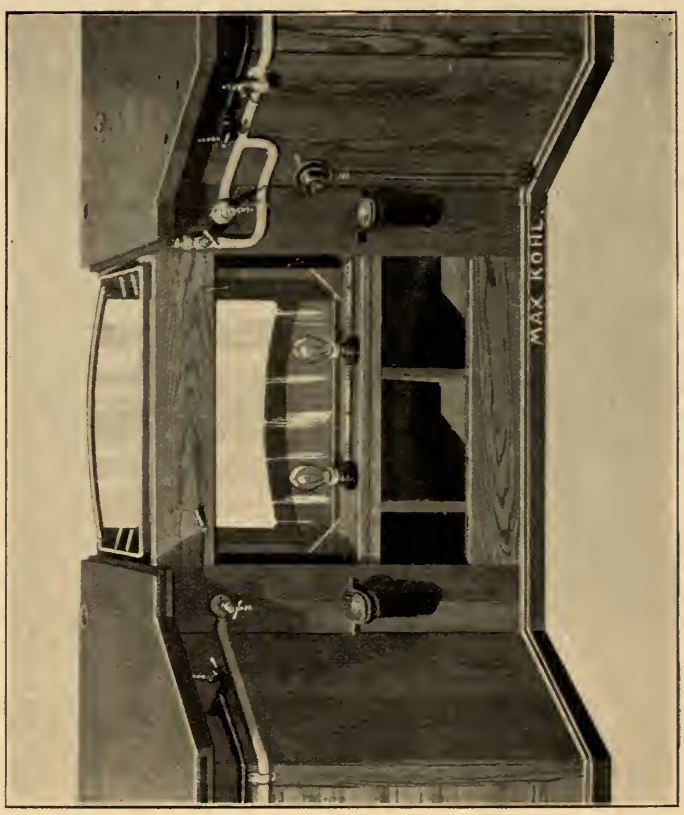
See also the Lecture Tables at the commencement of this List.



50 358. 1 : 40.



50 359. 1 : 42.

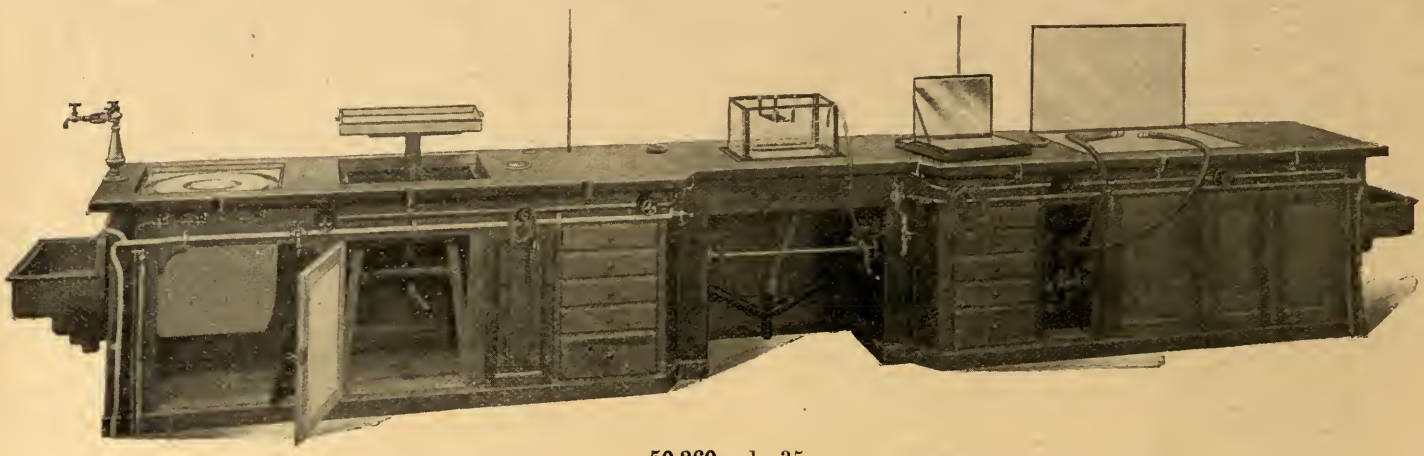


50 359 B. 1 : 18.

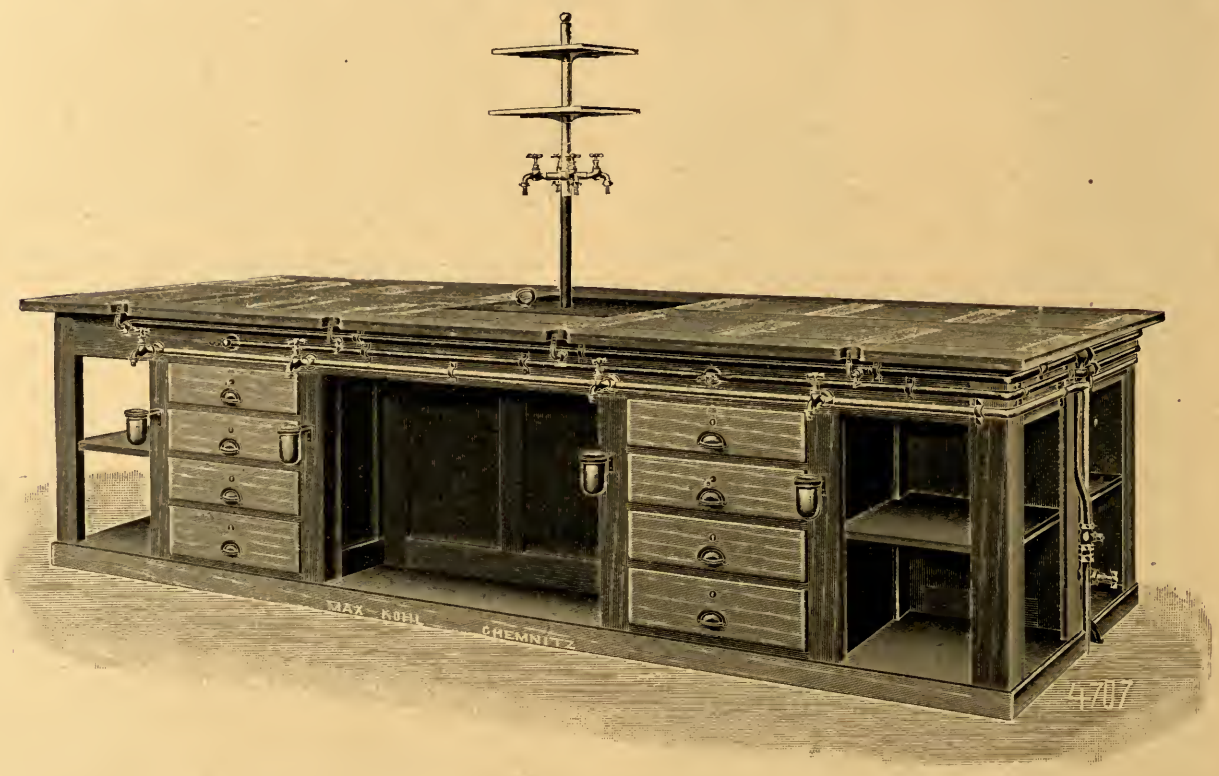
50 359 A. 1 : 18.

	£	s.	d.
1 Sandstone Slab, 90 cm long, on which to set combustion furnaces.			
1 Arrangement for raising and lowering Mercury Troughs, with rack, worm wheel and worm, with tilted bottom of oak and, under the table top, with projecting beading, a guttering for catching liquids from the table.			
1 Porcelain Gas Trough with slate cover.			
3 Draught Channels and 2 smaller draught pipes from which hoses may be suspended.			
8 Water Outlets on the front for suspending water hoses.			
2 Clips for taking steel flasks.			

See also the Lecture Tables at the commencement of this List.



50 360. 1 : 35.



50 361. 1 : 27.

50,360. **Lecture Table,** in the Pharmaceutical Institute of Breslau University (Prof. Gadamer), Figure . . . . . £ s. d. Price on application

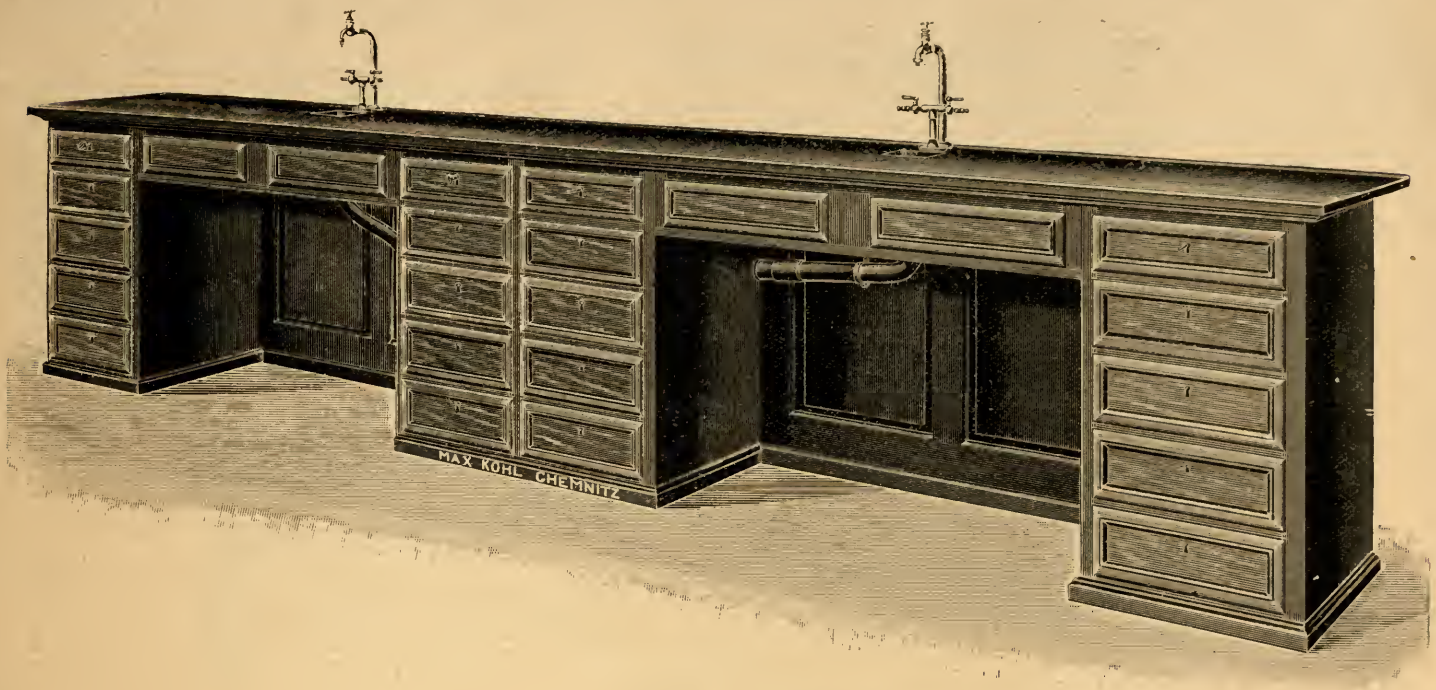
The table is 6 m long, 80 cm wide and 95 cm high. The **top,** of teak, is 40 mm thick, being composed of frame and pannellings and coated thrice with hot linseed oil. The **body,** of pitch-pine, has 10 drawers, 3 cupboards and an open space, provided with fancy glass at the back. The table is also fitted complete with the following — leads for gas, water, aspirated and compressed air, and electric current. The gas lead has a gas stopcock of wide bore and 8 gas stopcocks of ordinary bore. The water lead has a water tap standard with 3 taps, also 4 single taps, and a tap with screwed union for filling the pneumatic trough. The leads for aspirated and compressed air each have a conical stopcock with hose luting. The electric lead is laid in insulating conduits, and has on the table 6 plug contacts for currents to 30 amps. At the two heads of the table there are laboratory basins with deepened bottoms and inlaid with wood grating. The table top is also fitted with 6 flanges into which rods may be screwed to serve as pillars.

The table has, in addition:

1 Pneumatic Trough, of stout sheet copper, provided on 4 sides with stout crystal glass, arranged for raising so that the trough is upon the table when in use.

1 Explosion Slab, consisting of thick crystal glass, 90 cm long, 60 cm high, mounted in brass frame. On the side facing the auditorium this slab is sunk into the table, being held by a catch. By pressing

See also the Lecture Tables at the commencement of this List. Cl. 4645, 4707.



50 362. 1 : 20.

a knob on the lecturer's side, the catch is released and the slab rises automatically and remains firmly in this position. £ s. d.

1 Sandstone Slab on which to set combustion furnaces, etc.

1 Device for Raising and Lowering Mercury Troughs by means of worm wheel and rack.

2 Large Draught Flues, closed by a cover.

2 Large Sinks and two smaller ones for taking water hoses.

1 Device for conducting gases under a large glass bell closed by mercury.

1 Terminal for 300 amps. for the electric melting furnace, with knife switch and 2 connecting cables 1.50 m long.

1 Lecture Desk of teak.

1 Contrast Background and Mirror Device, No. 50,355 (see p. 65).

Laboratory Tables, etc.

50,361. **Students' Work Table for Physics and Chemistry** (as suggested by Prof. Rinkel), Figure, as supplied to the High School of Commerce, Cologne . . . . . Price on application

The table takes the form of a work table, standing alone, for erection in the middle of the work room. It is 3.50 m long, 1.40 m wide and 80 cm high. The **body** is of pitch-pine, having bottom beading of oak, and has on each of the long sides 8 drawers with shell handles; the drawers are arranged in two vertical rows, the upper row of drawers being divided into compartments. The rows are numbered consecutively and lock separately. The **top** is of oak being 30 mm thick and composed of frame and pannellings. In the centre there is a water trough 60 cm long, 50 cm wide and 50 cm deep let into the top. The trough is lined with sheet lead, and has a lead overflow, also waste valve. In the centre of the trough is a tall galvanised iron column, which has 4 water taps with screwed hose ends, and above this are 2 glass slabs with projecting edges, on which to set reagent flasks. The table has a draught lead of acid-proof material for conducting off gases; water lead with 8 taps and, hanging underneath, 8 dropping beakers (copper), removable for emptying; gas lead with 8 stopcocks with hose unions bent upwards; and lead for compressed air, with 4 stopcocks. Two brass bushes, with female threads, are let into the table top, for taking iron columns. When the columns are not used, the screw holes are closed by screw plugs. All leads are laid complete to the floor.

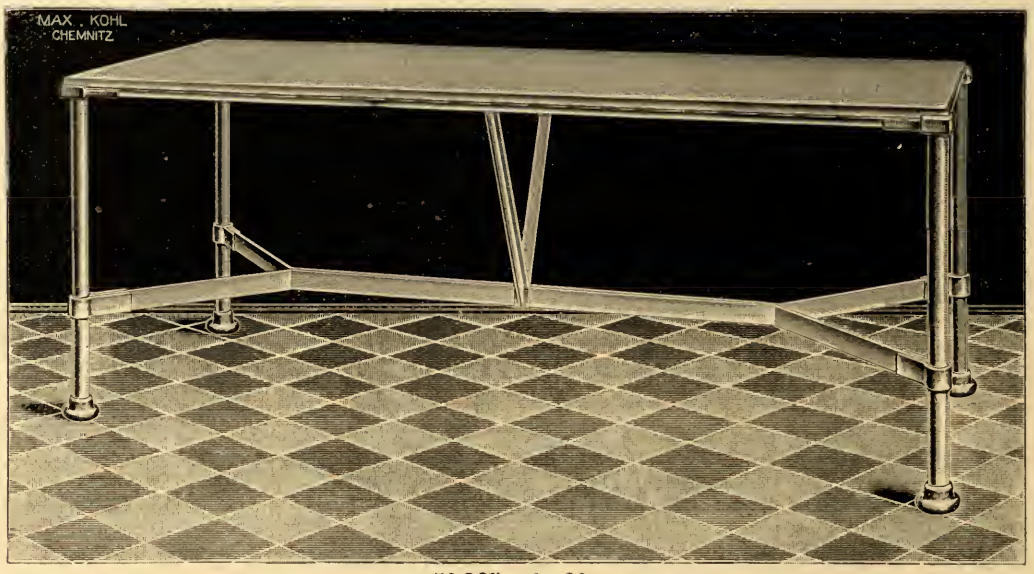
50,362. **Large Microscope Table** (Figure), with 4 places, standing alone, as supplied to the „Kaiserin-Friedrich-Haus" for Medicine, Berlin . . . . . Price on application

The microscope table is 4 m long, 60 cm wide, 85 cm high, and has 4 work places. The **body** is of pitch-pine, is stained and varnished, and has an oak base beading. The top is of 30 mm pine, laid with dark-green linoleum. Each 2 places in general have a water tap on column and 2 hose stopcocks for gas. The taps raise up the water (which is at high pressure) and the water issues in a steady jet without pressure. The gas and water taps, with columns, are nickelled. Under each of the water taps is a square porcelain sink with strainer and rubber plugs. For each working place there is a row of 5 drawers arranged one above the other; the rows of drawers are numbered and are provided with different locks. For each working place are given in with the table a crystal glass slab lacquered half white and half black on the under side, size 20 × 20 cm.

For other Laboratory and Students' Work Tables, see Page 47.

50 363. 1 : 20.

50 365 A.
1 : 8.



50 367. 1 : 20.

50,363. **Microscope Table** (F i g u r e), 1.30 m long, 75 cm wide, 80 cm high, for 1 person . . . . . Price on application

The top is laid with linoleum, and is scalloped out at the centre in front. The body of the table is of pine and has 3 drawers on each side with compartments, and 2 draw-out slabs and 2 lock-up cupboards with sliding shelves. The base beadings are of oak rounded at the edges. Two plate glass preparation slabs, painted white and black on the back, are given in.

50,364. **Simple Microscope Table,** standing alone, for 2 persons . . . . . Price on application

This simple table, with 4 turned legs, has a top laid with linoleum. The frame is of pine and has a drawer for each student; the keys for the drawers are different. Two plate glass slabs for preparations, painted black and white, are supplied along with the table.

50,365. **Microscope Table,** for Courses in Microscopy, intended for setting against the window wall of the Laboratory. This table can be supplied in any desired length, and is 70 cm wide and 80 cm high. A table-length of from 80 cm to 1.30 m is arranged for each student (according to the length of the window wall), in such wise that every two places are separated by one table leg. Prices, according to length of table and number of places . . . . . Price on application

The table top, 30 mm thick, is laid with linoleum. For each working place, a plate glass slab, 20 cm square, for preparations, painted black and white on the back, is given in with the table, and 2 lock-up drawers are provided for each place. Leads for gas and water are laid along the windows, and for every 2 places there is one general water tap with hose union, also 1 gas stopcock to each place. If desired, the water tap is fitted with arrangement for lowering the water pressure. Under the water tap is a square porcelain basin (Pasteur model), F i g. 50,365 a, with a length of side of 15 cm, with perforated plate inserted. On the table there are for every 2 places a deal wall rack with 3 shelves for mordants, reagents, etc.

The gas and water leads are calculated for separately.

50,366. **Microscopy Table,** same construction as No. 50,365, but with racks fitted across the table top, for taking flasks with reagents, mordants, and the like. Height of rack, 85 cm . . . . . Price on application

The racks have each 4 shelves, halved by a moulding running lengthwise, the shelves being placed at unequal distances (25, 20, 15, 10 cm) apart, so as to take both large and small bottles.

50,367. **Iron Microscopy Table with Raw Glass Top** (F i g u r e), 2 m long, 80 cm wide, 80 cm high; the glass top is 15—20 mm thick, painted white on the under surface, the edges being polished. The iron frame is enamelled white . . . . . Price on application

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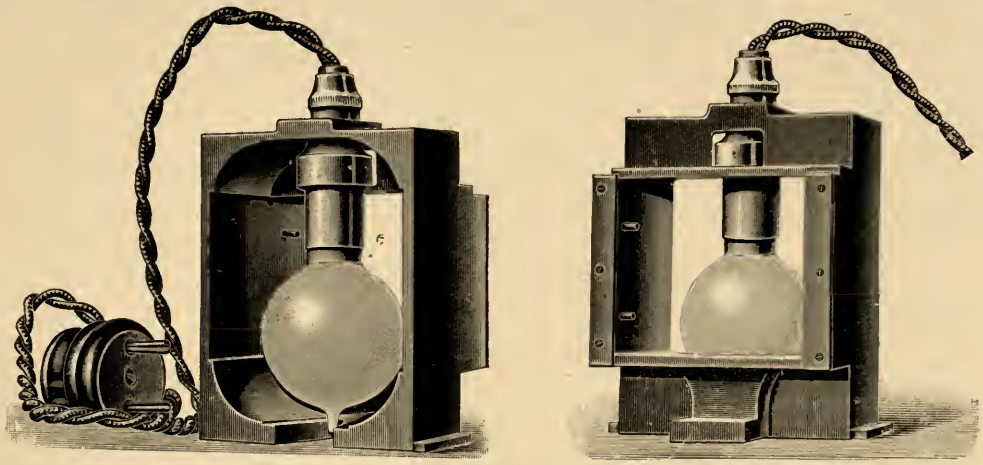
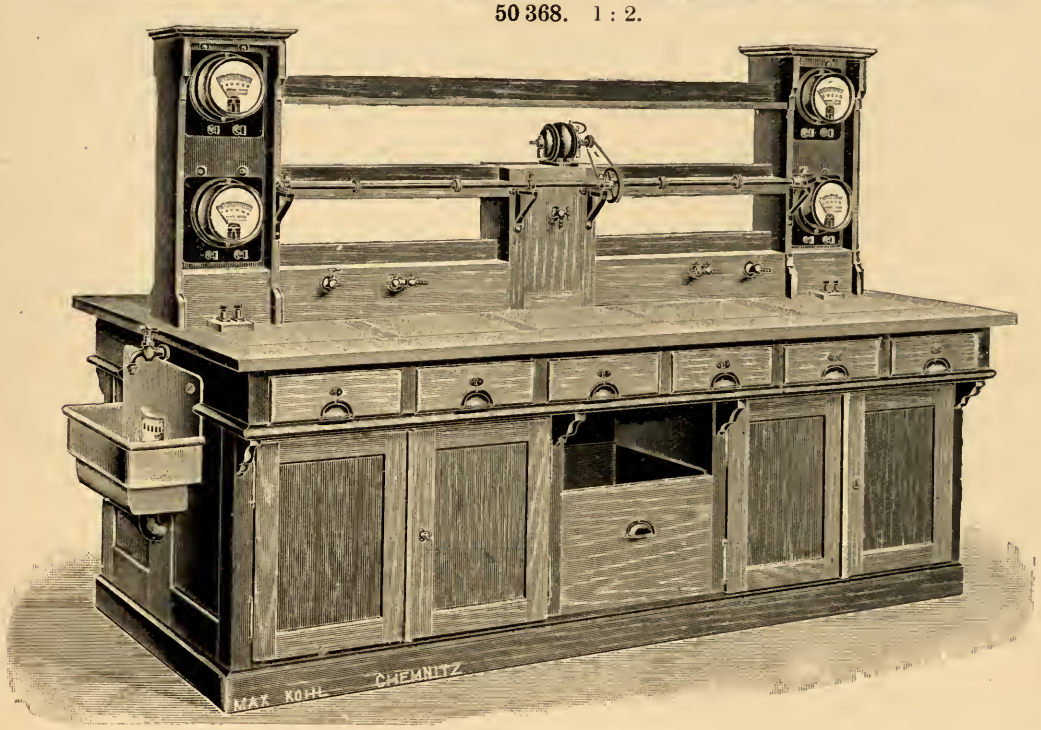


50 368. 1 : 2.



50 369. 1 : 24.

£ s. d.

50,368. **Electric Lamp for Microscopy** (as suggested by Tammes), Figure 0. 15. 0

A glow lamp is contained in an iron housing with a ground glass pane and 4 blue glass panes of various tints, the lamp being provided with plug box, plug and flexible. The frosted pane is turned towards the microscope. The surface of the carbon loop should be vertical to the direction of observation, so as to utilise the maximum of light.

In ordering, please state voltage of lamp. If this is not stated, a 110 volt lamp is supplied.

50,369. **Students' Work Table for Electrochemistry** (Figure), for 4 students . . . . . Price on application

This work table is designed to stand away from any support, is 2.50 m long, 1.60 m wide and 90 cm high. The **top** is of oak, 30 mm thick, being composed of frame and pannellings and impregnated thrice with hot linseed oil. The **body** is of pitch-pine, and contains on each longitudinal side 6 drawers, and underneath these, somewhat set back, 2 double-door cupboards with shelves and a box for waste paper and the like. The table top has a reagent stand, with a housing at the right and left hand sides for containing electrical measuring instruments. The table is provided with gas lead, having 8 stopcocks, water lead with 8 stopcocks, two of these cocks on each long side having hose unions turned outwards and 1 cock with hose union turned upwards; on each of the narrow sides there is 1 large water tap with hose union; 2 white laboratory basins with raised back, deepened bottom, overflow, and earthenware valve, height 50 cm, length 50 cm, projecting 34 cm; 1 transmission shaft on each of the long sides driven by a small $^1/_{16}$ HP. D. C. motor, with 4 bearings, 1 driving pulley, 4 small spindle-rings each having 2 pulleys and 4 adjusting rings; 8 terminals, each 2 being mounted on a marble slab; 4 marble slabs for taking measuring instruments; 2 dead-beat precision ammeters for 1 to 5 amps.; 2 ditto for 1—30 amps.; 2 Voltmeters for 1—70 volts, and 2 Voltmeters for 1 to 10 volts D. C. The following are given in with the table: 4 sliding resistances for low currents; 4 crank resistances for heavy currents and 4 pairs flexibles, 4 sets being provided with the necessary end-connectors: 2 stirrer stands, driven by the shafting, and 1 stirrer with reciprocatory motion.

For further Microscope Lamps, see Page 20.
For further Laboratory Tables and Students' Work Benches, see Page 47.

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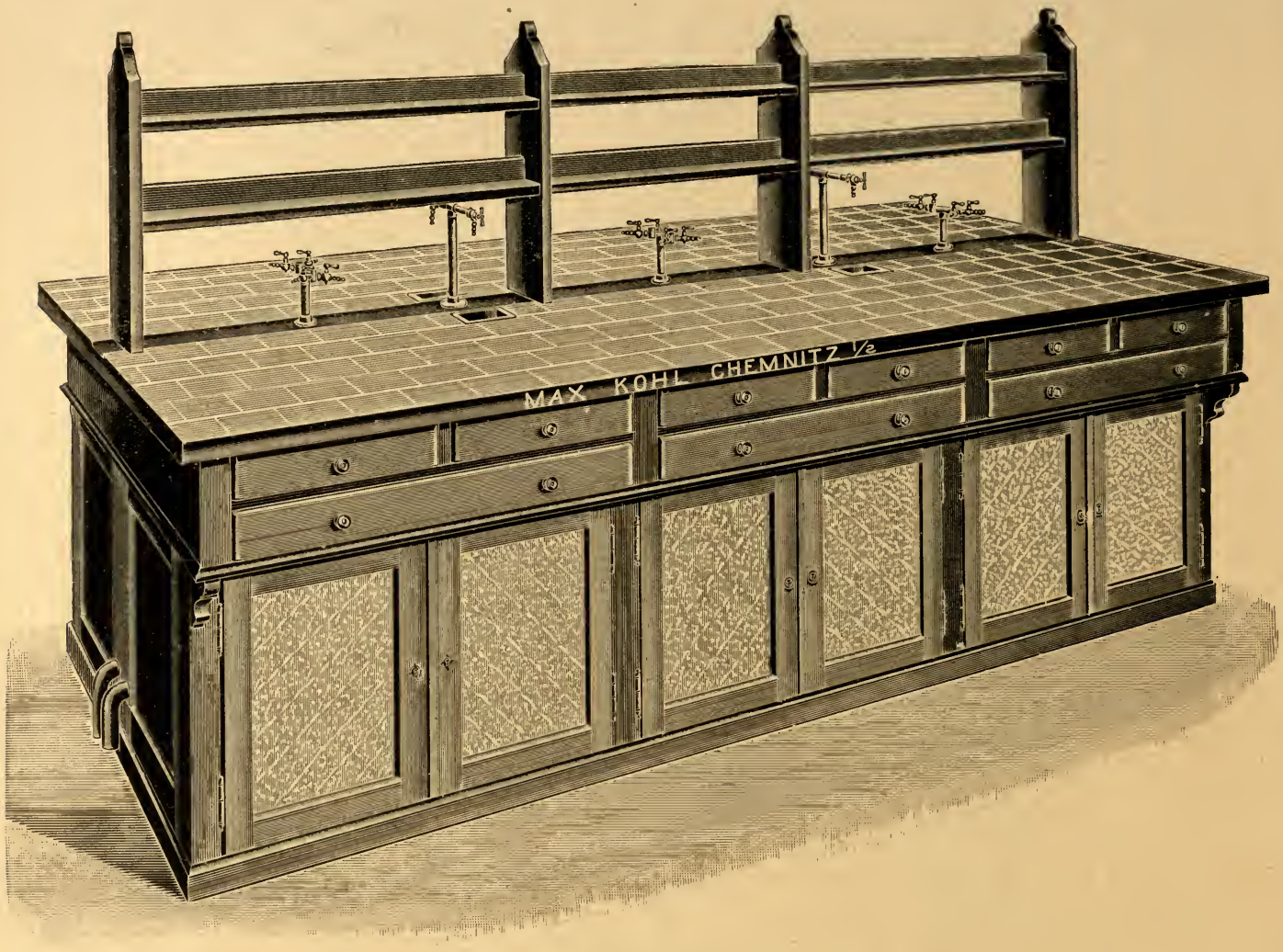


50 370. 1 : 16.

50,370. **Work Table for Chemical and Bacteriological Laboratories** (F i g u r e), with **6** places . . . . . £ s. d. Price on application

The table is designed to stand alone, is 3 m long, 1.60 m wide, 0.95 m high, and has 6 work places. The top consists of an angle iron frame, white glazed tiles being laid upon a suitable base; a narrow strip of teak is inserted in the centre only. On this strip the columns for the gas and water leads are fixed. Above the columns is a bottle rack with 2 shelves, running the entire length of the table.

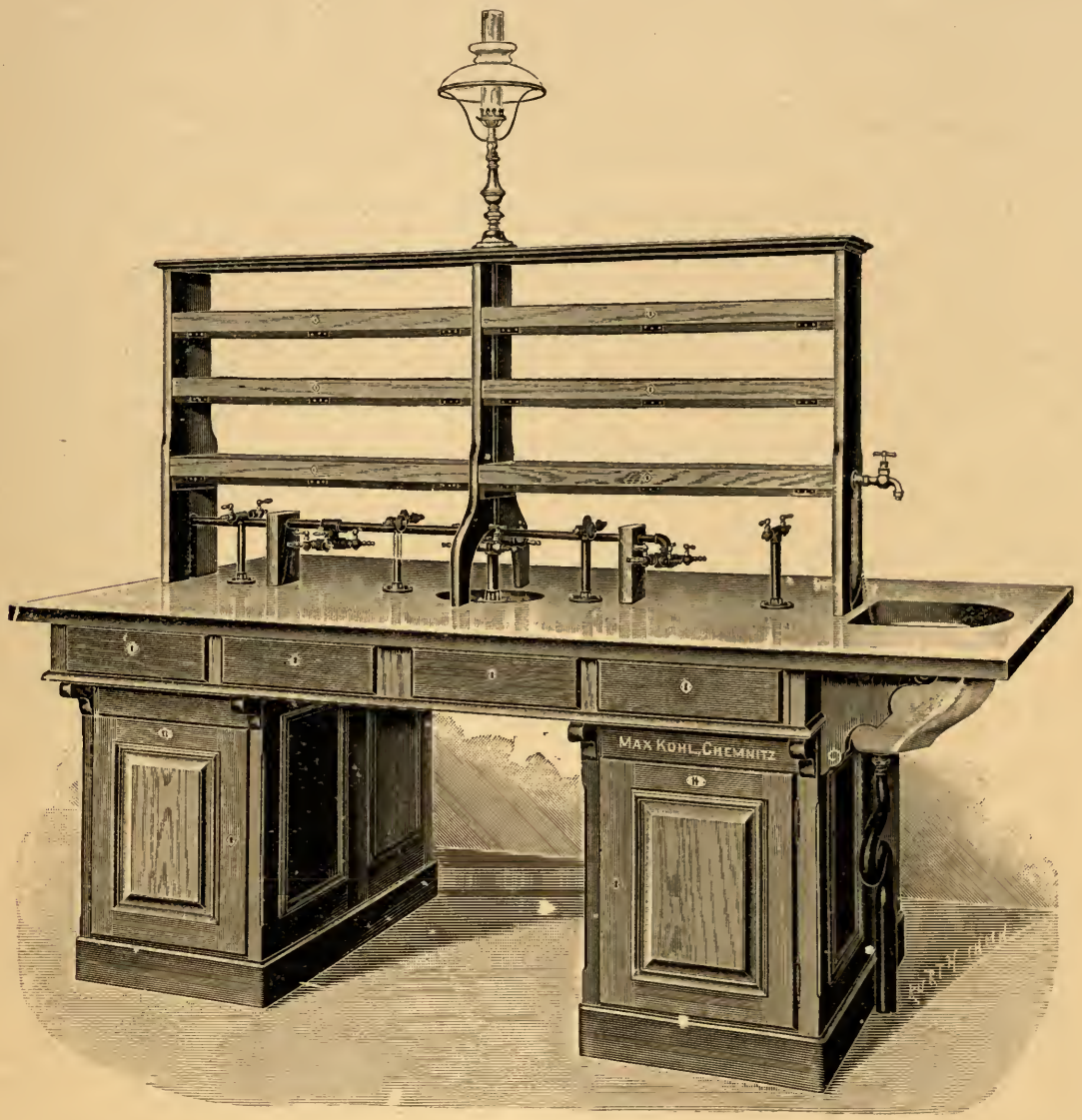
The table top as constructed allows of its being thoroughly washed and disinfected, for which reason this construction is especially preferable for bacteriological work.

The body of the table is of pine, the sides of the drawers and the shelves being of red deal. On each of the long sides there are 3 wide and 6 narrower drawers and underneath these, set back a little, 3 double-door cupboards with shelves. The panels of the doors are of figured glass. The body is carefully stained and varnished and has rounded bottom fillets of oak. The table is fitted with gas and water leads, the gas lead having 6 double hose stopcocks, and the water lead 4 screw down taps with knurled hose pieces. Under these taps there are small square porcelain sinks having a length of side of 15 cm (Pasteur model), inserted in the top of the table, the sinks having strainers (F i g. 50 365 A). These porcelain sinks are connected with the water lead by hard lead pipes. The arrangement of the sinks is well adapted for filtering and distilling purposes as well as for bacteriological work.

All leads are laid ready to the floor.

50,371. **Students' Work Table** (F i g u r e), with **4** working places, as supplied to the École des Mines du Hainaut, Mons (Belgium) . . . . . Price on application

The table is 2.20 m long, 1.20 m wide and 0.90 m high. The top is of pine, 30 mm thick, mortised in frame and pannellings, laid with 2 mm thick rolled lead and surrounded by a troughing

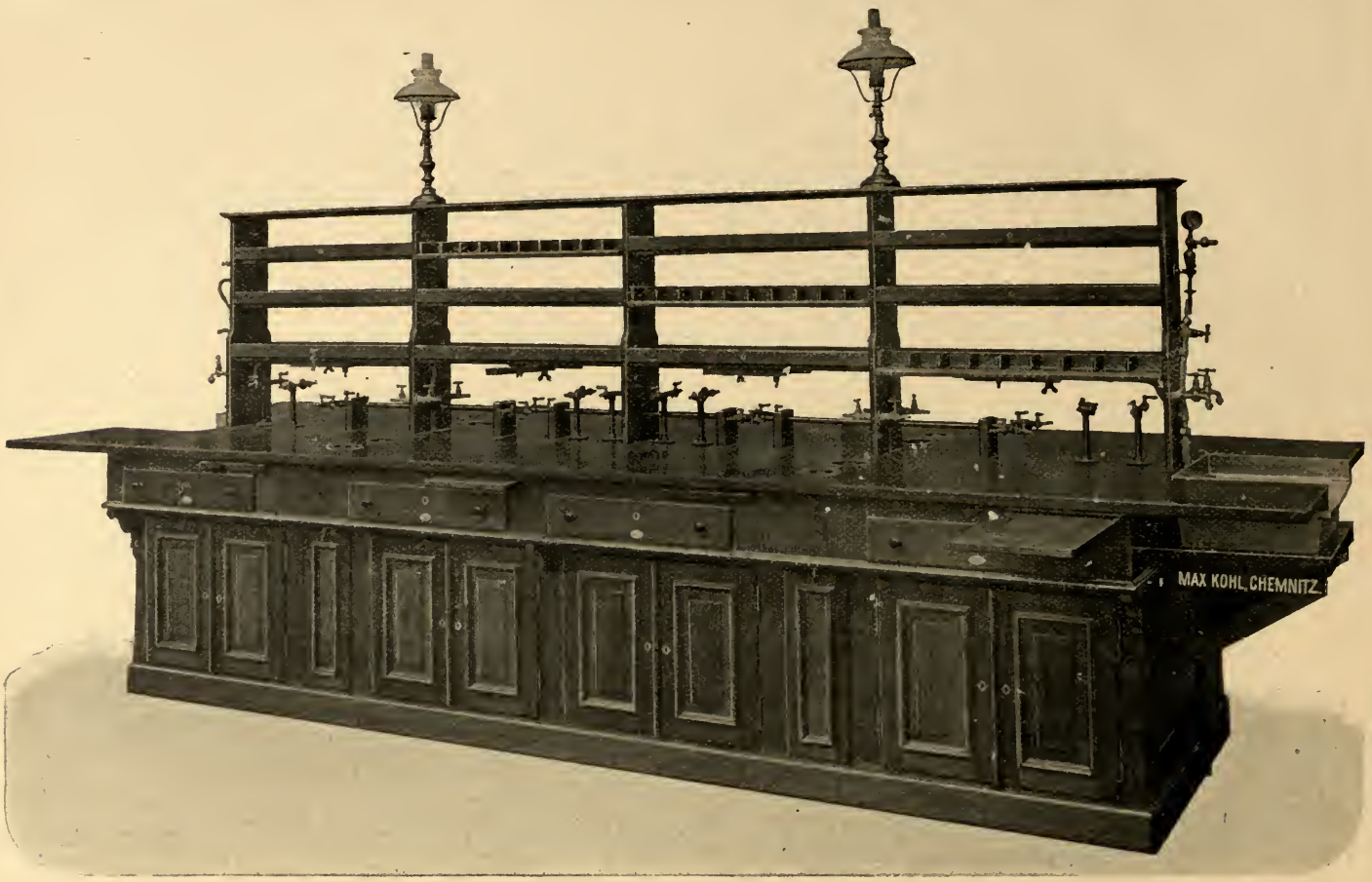


50 371. 1 : 18.

or gutter cut out. The body is of pine, the inner sides and bottoms being of red deal. On each of the long sides the table contains 4 lock-up drawers, and underneath, set back a little, 2 lock-up cupboards with shelves. The bottom fillets are of oak with rounded edges. The lower centre part of the table is free, to take waste paper, etc. baskets. The top is cut out at one side, a half-round porcelain basin with lead valve, and waste pipe of lead being placed underneath. The table is fitted with leads for gas, water, compressed and aspirated air. The gas lead has for each place 2 strong gas taps with long hose grooves. The water lead has in the centre of the table a low, stout galvanised iron column, with 4 water taps with hose ends; in addition there is 1 tap over the porcelain basin with screwed jet-regulator. In the middle of the table top, where the water standard in 4 parts is fixed, there is a round cavity, from which any water that may be spilled is carried to the waste pipe by a pipe soldered on. For each place there is also 1 hose stopcock each for aspirated air and compressed air; 2 taps, both alike, are fixed on a general column, this column being connected with the lead to which it pertains.

On the table is a reagent stand of oak, 1.75 m long, 80 cm high, with 3 stages in 4 sections. The individual stages can be locked and are divided up. In the lower stages 8 bottles of 500 ccm and in the upper 10 bottles each of 250 ccm capacity can be placed in each section. For each place there are therefore 8 bottles of 500 ccm capacity and 20 bottles of 250 ccm capacity. None of the bottles can be removed when the flaps are locked. Above the reagent stand is a bronze gas incandescent lamp with glass shade. Each place of the table is numbered and the locks for the various places are different.

£ s. d.



50 372. 1 : 22.

50,372. **Large Work Table (for Students)**, Figure, with 8 Work Places, as supplied to the École des Mines du Hainaut, Mons (Belgium) . . . . . £ s. d. Priee on application

The table top is 4.40 m long, 1.50 m wide, 0.90 m high, of oak, mortised in frame and pannellings, having a ehannel eut in underneath to allow of the water dropping off outside. The body is of pine, the baek walls and inner side walls being of red deal. The table is 3.55 m long and has on the two long sides 4 wide drawers with compartments, and 4 draw-out wood slabs. Underneath the drawers, slightly set back, are 4 double-door eupboards with shelves. The bottom beadings are of oak, being rounded at the edges. The drawers and cupboards have locks and keys and a number is provided for eaeh plaee. The keys are likewise numbered, and fit only those cupboards and drawers bearing the same number.

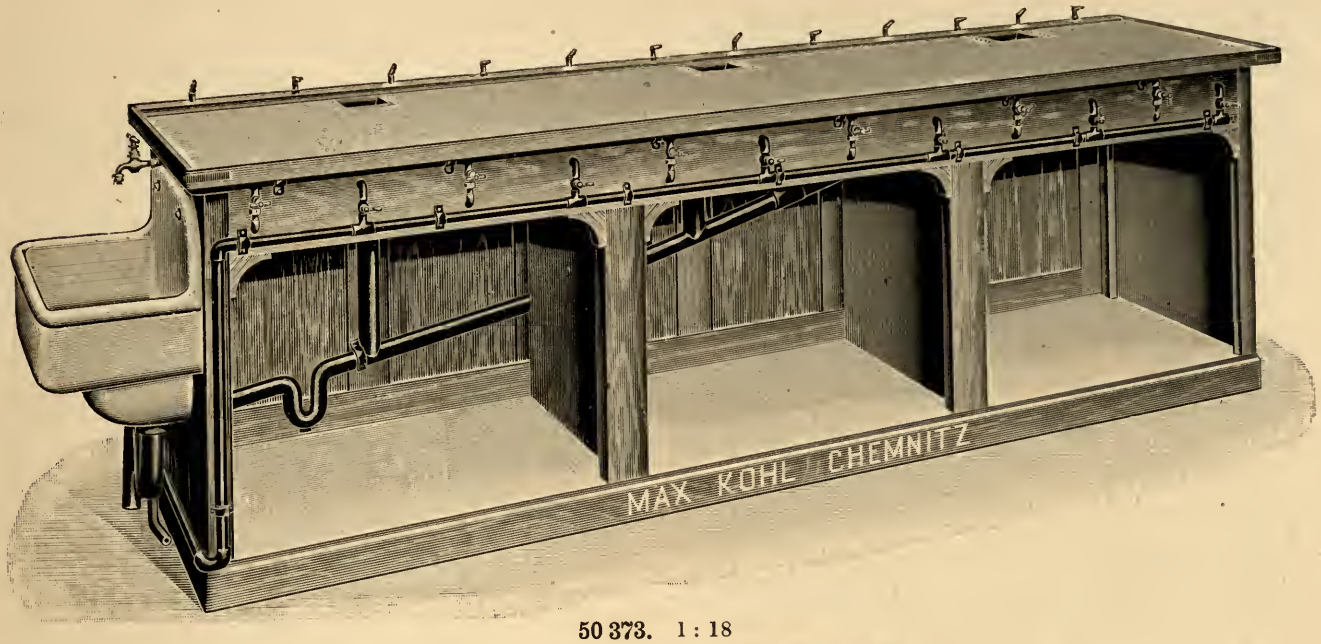
The table is fitted with leads for gas, water, aspirated and eompressed air, also with gas draught pipes and sinks. For eaeh working place there are 2 gas hose stopcocks. 1 water tap with straight hose union, 1 aspirated air stopeock with hose union and 1 compressed air stopcock with hose union. For every two working plaees are fitted 1 gas draught ehannel and 1 sink. The two narrow ends of the table are cut away in the middle, and underneath there is a large square porcelain basin, resting on wood bracket, with overflow, wood grating, lead valve and waste pipe. Over the basins are 2 water taps with serewed jet regulator, and 1 metal aspirator with metal vacuum gauge; these being eonnected up ready for use with the water lead. On the table top a Reagent Stand is fitted. This is of oak, is 3.55 m long, 85 cm high, with 3 stages in 8 seetions. The individual stages can be loeked and are divided up into eompartments. In the lower stages there is room for 9 bottles of 500 ecm capacity and in the upper 10 each of 250 ecm capacity in each section. At each place, therefore, there is room for 9 bottles eaeh of 500 eem and 20 bottles of 250 ccm. None of the flasks can be removed when the flap is loeked. For eaeh place, 1 sliding holder, with perforations for inserting funnels, etc. is fixed to the lower intermediate shelves. Above the reagent stand two gas incandescent lamps, of bronze, are fitted.

50,373. **Distilling Table for Laboratories** (Figure) . . . . . Priee on application

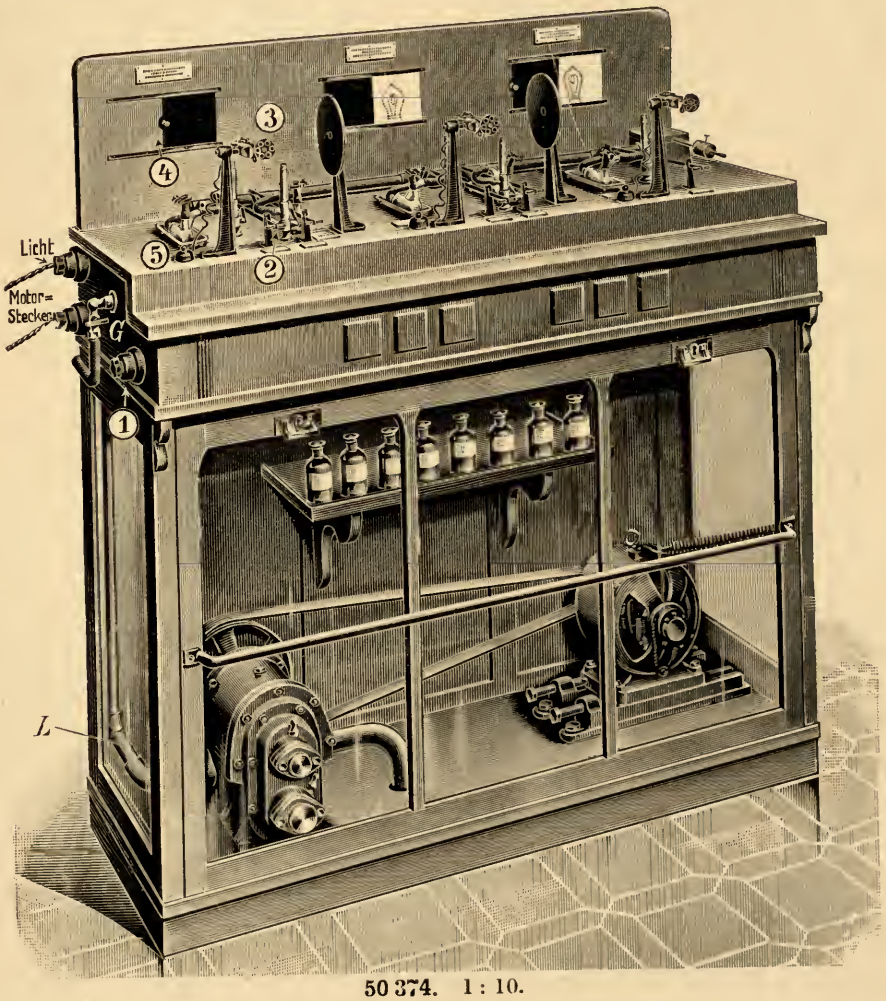
The table is 3 m long, 60 cm wide, 90 cm high, being constructed throughout of pine. The top consists of frame and pannellings, having a round edge running round it. The surface of the table is completely eovered with rolled sheet lead; it slopes down somewhat towards the back, and at that side it has a channel running the entire length for earrying off any liquids spilled; for taking off the water 3 waste funnels are let into the top of the table.

The body has 3 large spaces and has a baek wall; the bottom beadings are of oak and are rounded at the edges. From the gas and water leads eaeh six cocks branch off over the entire length of the table, on the front side, while the delivery pipes are earried under the table top, and terminate in bent hose unions above the table top at the back.

On the narrow side of the table a tap for the water lead is fitted, also a large laboratory basin with deepened bottom and oak grating.



50 373. 1 : 18



50 374. 1 : 10.

50,374. **Spectrum Lamp Demonstration Table,** as suggested by Prof. Beckmann (F i g u r e), (Dr. E. Beckmann: „Das Laboratorium für angewandte Chemie d. Universität Leipzig", 1908, Fig. 19) with all gas and compressed air leads for the 3 spectrum lamps, with electric motor and precision blower, in glazed substructure; and bracket for flasks with 3 small windows in the back wall, of opal glass and black closing disc, the windows being lighted by electricity. Price, inclusive of the 3 Spectrum Apparatus . . . . . £ s. d. 85. 0. 0

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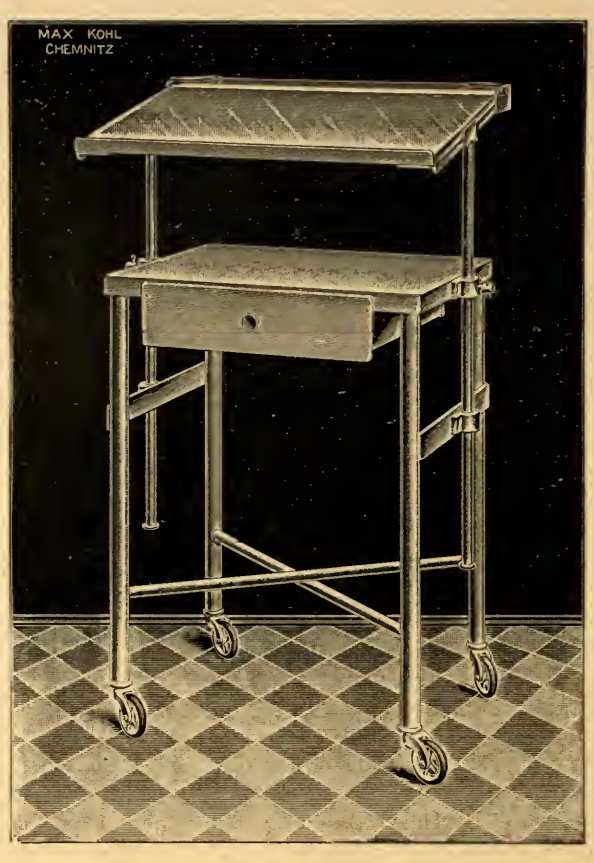
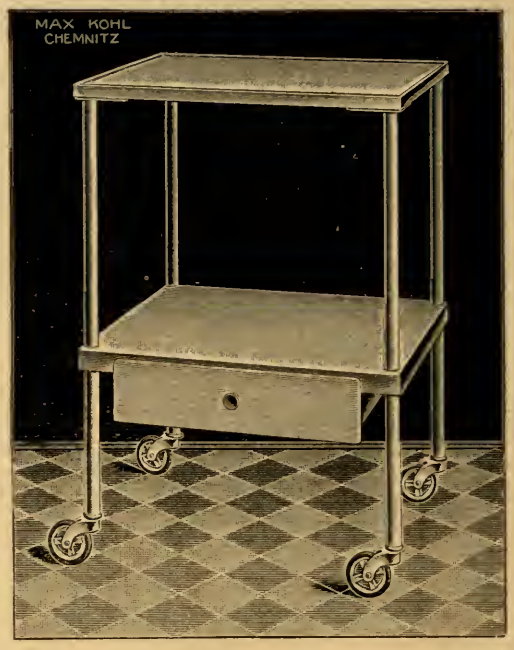
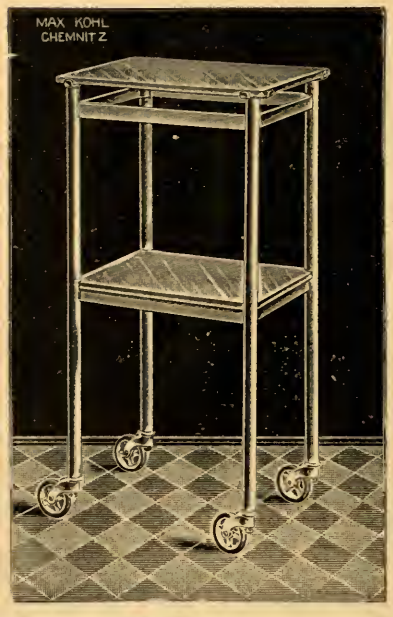


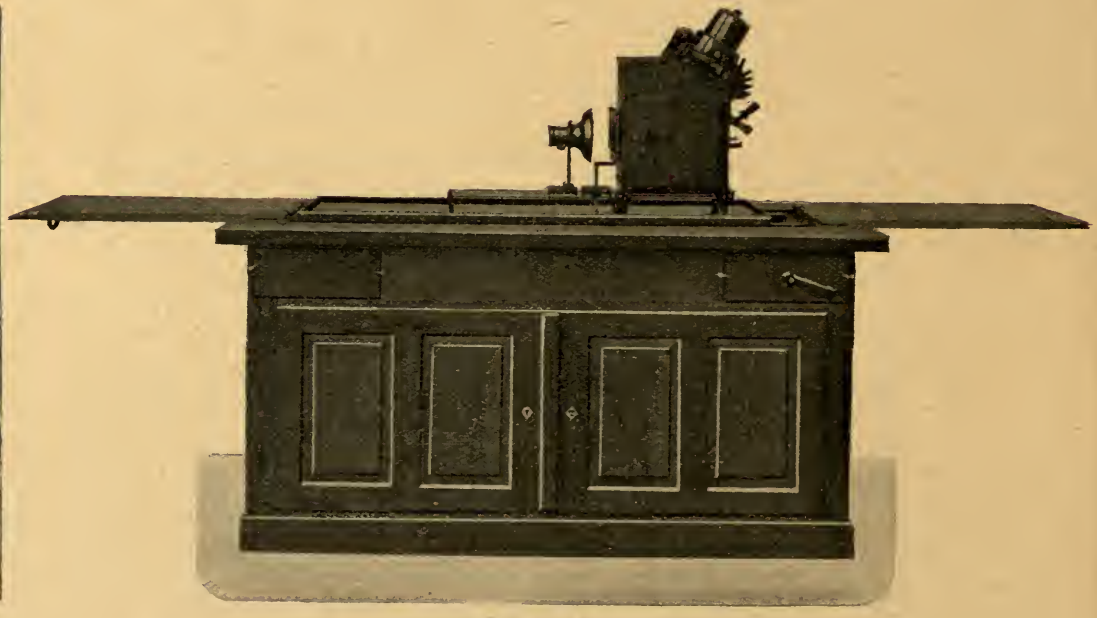
50 375. 1 : 13.



50 376. 1 : 14.

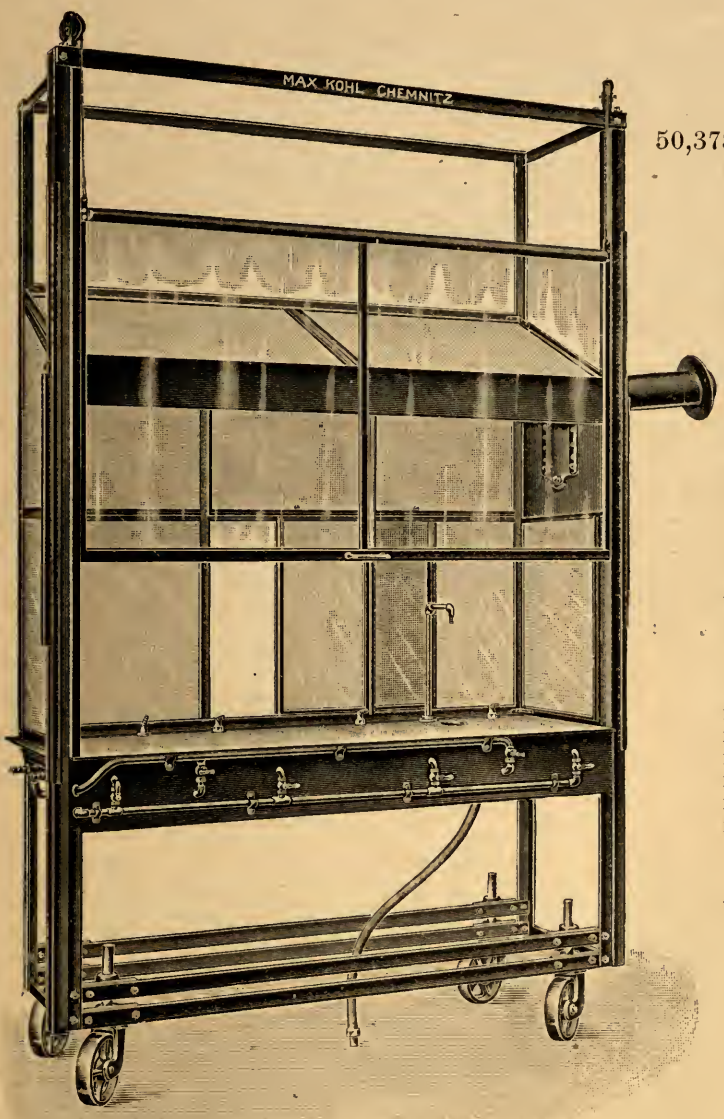


50 377. 1 : 14.



50 379 A. 1 : 21.

	£ s. d.
50,375. **Portable Desk** (F i g u r e), suitable for making reports in the Mechanical or Apparatus Laboratory. The writing surface is of glass, is adjustable as regards height and has metal bow for suspending the ink wells. Length of the writing slab and of the table top 70 cm, width 50 cm, max. height 130 cm. The iron frame is enamelled white and runs on rubber-covered rollers. Price, with drawer	5. 15. 0
50,376. **Portable Iron Apparatus and Instrument Table** (F i g u r e), 60 cm long, 50 cm wide, 90 cm high. The top has a raised edge. At half the height there is a second slab with drawer. Table runs on rubber covered rollers, and the iron frame is enamelled white. Price	2. 15. 0
50,377. **Small Iron Apparatus and Instrument Table,** portable (F i g u r e), with 2 raw glass slabs, 42 cm long, 36 cm wide, 90 cm high, running on rollers with rubber tyres . .	2. 5. 0



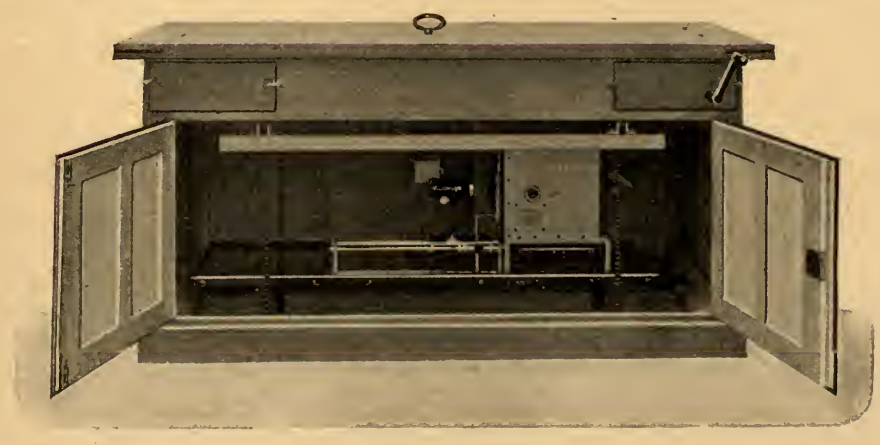
50 378. 1 : 22.

50,378. **Travelling Iron Stink Cupboard,** (F i g u r e), as supplied to the Physical Society, Frankfort-on-the-Main . . .

£ s. d.
Price on application

The stink cupboard is 1.60 m long, about 3 m high, 70 cm deep. The top part is glazed and has a large sliding window in front suspended on thick gut cords, and it can be kept in any desired position by counterpoises. The side and back walls are glazed with wire-covered glass, the back wall having also a sliding window. The roof is likewise glazed, and is sloping. A polished slate slab serves as a table top. The cupboard has a gas lead with 4 stopcocks and water lead with 3 taps. The taps are arranged in front under the table top so as to be easy of access. The outlets of the leads terminate at the back wall inside the cupboard over the table top. The centre water tap ends in a tall bent pipe with a hose union turned upwards. Under this a small lead discharge sink is let into the table top. For taking off gas and water, hose unions are provided on the leads. The gases and vapours are carried off by a sliding tube inserted in the draught flue. The cupboard rests on massive iron rollers and can thus easily be moved about in any direction. This cupboard usually stands in front of the wall of the annexe room, which is cut away; if, however, the projection apparatus installed in the annexe is in use, the cupboard is pushed to one side.

This Stink Cupboard can also be supplied to any other dimensions desired.

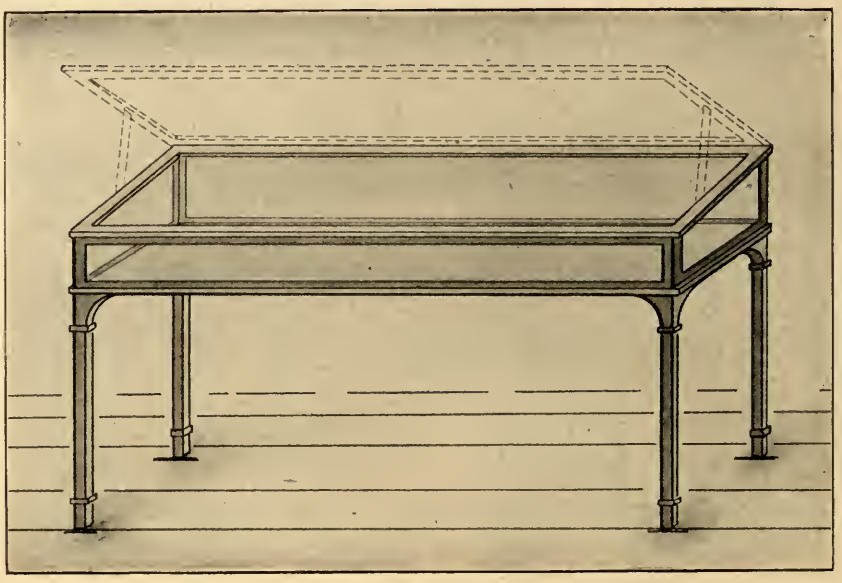


50 379 B. 1 : 21.

50,379. **Travelling Projection Table** (F i g s. A and B) . . . . . Price on application

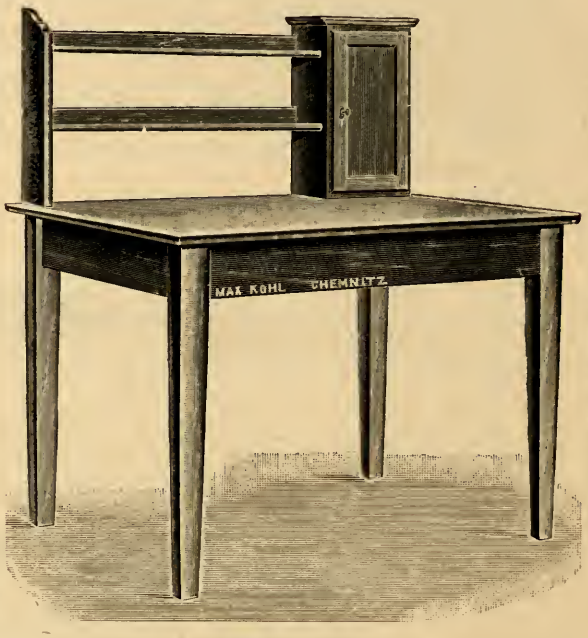
The table, provided with arrangement for lowering and preserving the projection lantern and the auxiliary apparatus, is 1.80 m long, 1 m wide and 90 cm high. The top is of teak 40 mm thick, the body being of pine. The table rests on 4 covered double castors. F i g. 50,379 B shows the table with the projector lowered.

For additional Stink Cupboards, see Pages 48 to 52.



50380. 1 : 20.

50381. 1 : 32.



50383. 1 : 22.

Max Kohl A. G., Chemnitz, Germany.

Show Cases and Mineral Cupboards.

£ s. d.

50,380. **Show Case** (Figure), with iron frame and glazed with plate glass . . . . . Price on application

The show case is 1.60 m long and 60 cm wide, the height (front edge) being 90 cm. It is composed of narrow iron frames and rests on 4 legs, the bottom being of sheet iron. The sides and top are glazed with stout crystal glass. The top rests on the sloping lateral edges in a manner which renders it quite dust proof, and when open it is held up by two supports.

The show cases can be supplied in any desired length, and can be made to suit the conditions of the museum both as regards height and shape of bottom.

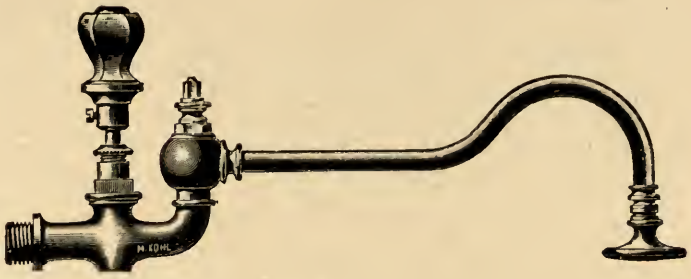
50,381. **Mineral Chest** (Figure), with 4 show cases and 24 drawers, fitted with locks and key 20. 2. 0

The chest is constructed of pine, is 1.30 m high, 3 m long and 80 cm deep; it has 4 lock-up show cases and 24 drawers. Each row of 6 drawers is locked by one fillet (pilaster lock). The show cases are painted a light-blue oil colour inside; the depth inside is 10 cm in front and 30 cm at the back, and have 2 thick glass shelves. The bottom fillets are of oak and are rounded at the edges.

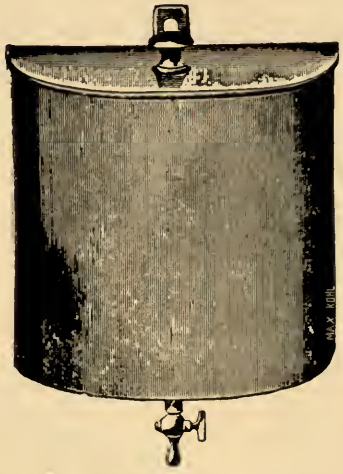
These chests are constructed in such manner that two of them can be set with their backs to each other.

Museum Cupboards, see Pages 43—47.

50384. 1 : 16.



50386. 1 : 2.



50388. 1 : 8.

Equipment of the Dark Room.

50,383. **Table for Photographic Work** (Figure), with rack and small cupboard, 1.25 m long, 1 m wide, table top 0.80 m high; total height 1.30 m . . . . . £ 3. s. 2. d. 0

Rincing Tables, see pp. 54, 55 and 80.

50,384. **Photographic Work Table** (Figure), with water basin, the body being divided up into dockets for containing developer and fixing solution dishes, etc., with rack for chemicals and for the dark room lamp 5. 0. 0

The table is 1 m long, 70 cm wide, and 85 cm high; the table top is of pine and is stained black. The table has a rincing basin at the right hand side, 48 cm long, 30 cm wide and 15 cm deep. The basin is lined with sheet lead, the rivets being soldered; it has an overflow, a lead draining valve, and a waste pipe with shutter. Over the basin a water tap with rose is fitted. The left portion of the body is set back 15 cm from the table top. Total height, 1.40 m.

50,385. **Large Photographic Work Table,** 1.80 m long, with rincing basin, 2 drawers and bottle rack 5. 5. 0

The table rests on massive legs, is constructed of pine, and is 1.80 m long, 70 cm wide, 85 cm high; it has a partition, 2 drawers and 1 rincing basin on the right side. The basin is 50 cm long, 40 cm wide and 18 cm deep, it is lined inside with sheet lead, the rivets being soldered; it contains an overflow, lead draining valve and a waste pipe with shutter. A water tap, with rose, should be fitted above the basin. The table top is stained black, and has a bottle stand 1 m long and 15 cm deep, with 2 shelves. Total height, 1.40 m.

50,386. **Swinging Arm,** Figure, nickelled, with tap for the water lead, and with rose . 0. 8. 0

50,387. — Do., but polished 0. 7. 0

50,388. **Tank,** zinc, with brass tap, capacity about 25 litres 0. 16. 0

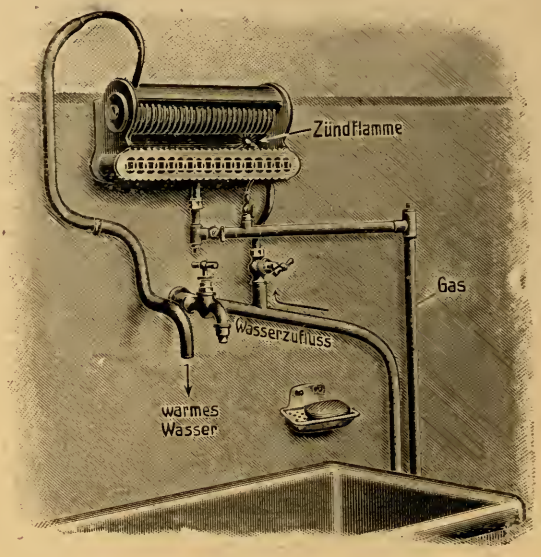
50,389. — The same, capacity 10 litres 0. 12. 0

These tanks are necessary if no water lead is at hand; they are hung on the wall.

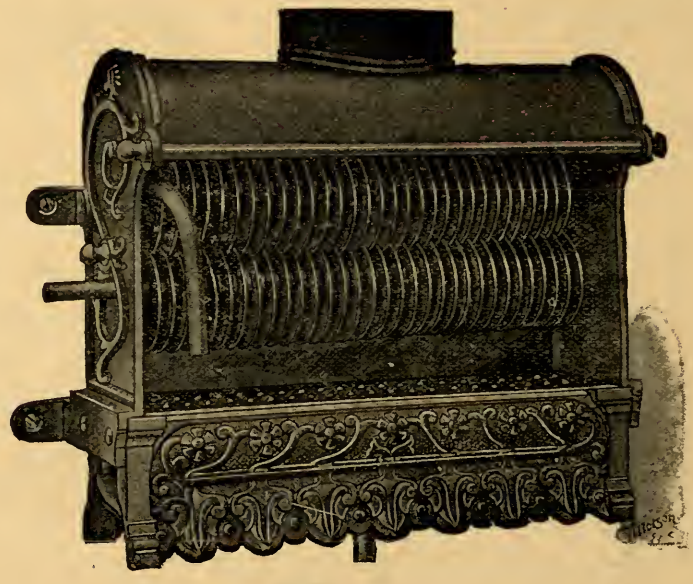
Dark Room Apparatus, see Pages 29—32.

Cl. 1466, 5175, 1467.

50390. 1 : 14.



50394. 1 : 12.

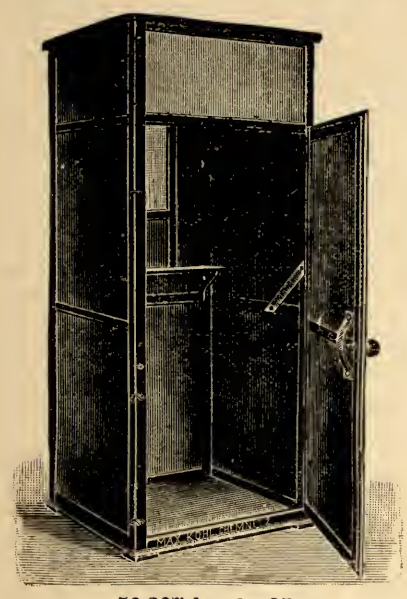


50396. 1 : 5.

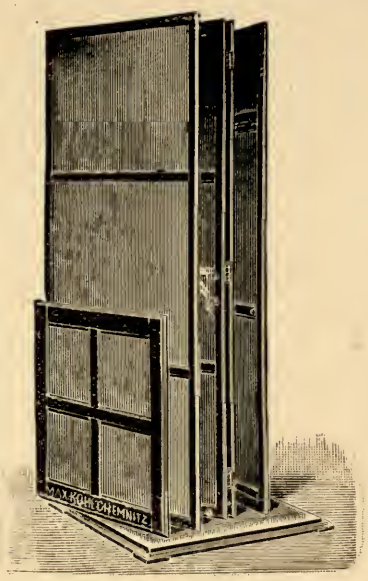
	£ s. d.
50,390. **Flushing Table** (F i g u r e), done out with lead, rivets soldered, with valve, overflow and waste pipe with shutter: 95 cm long, 60 cm wide and 15 cm deep	3. 5. 0
50,391. **Bracket,** of pine, for containing bottles of developer, fixing solution, etc.	0. 8. 0
50,392. **Bottle Stand,** 1 m wide, 20 cm deep and 2 m high, for placing on the wall, with 6 shelves and cornice	1. 8. 0
50,393. **Photometry Board** with bracket supports, 4 m long, 40 cm wide, of black stained oak 30 mm thick	2. 8. 0
50,394. **Geyser,** gas heated (Fletcher, Russell's), F i g u r e. This geyser is connected up to the gas and water supplies and delivers at once hot water to 50 ° C. Price, without leads or taps	11. 5. 0
This apparatus is especially recommended for working in the winter, as all developers have to be at a temperature of at least 15 ° C.	
50,395. — T h e p r e c e d i n g, nickelled	2. 5. 0
50,396. **Geyser,** with double the output of the foregoing	3. 10. 0

For other Rincing Tables, Rincing Troughs and Laboratory Basins, etc. see Pages 54—57.

Cl. 4341, 5247, 151.



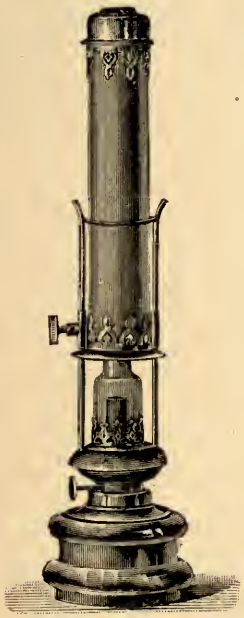
50 397 A. 1 : 27.



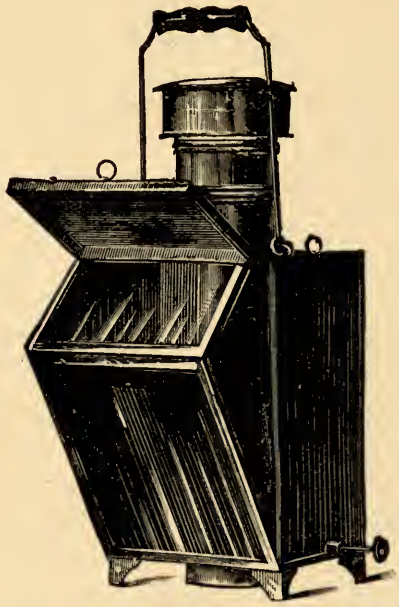
50 397 B. 1 : 27.

50 402. 1 : 4.

50 403. 1 : 6.



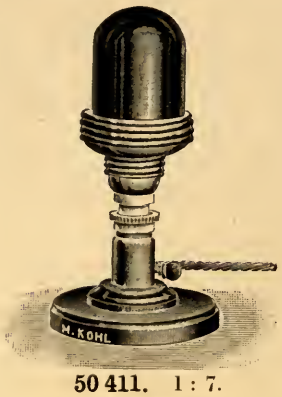
50 404. 1 : 6.



50 405. 1 : 7.

50 407. 1 : 6.

		£ s. d.
50,397.	**Collapsible Dark Room** (Figs. A and B), 1.80 m high, 80 cm wide and deep, absolutely light-tight, with a ruby glass window, for external illumination by weak daylight or an ordinary kitchen lamp	2. 0. 0
	The room allows absolute freedom even for persons of large stature without their suffering inconvenience when a number of vessels and a stool are placed inside.	
50,398.	**Glass Discs** for dark room, **Dark Ruby Glass,** usual outer glass, to 60 × 70 cm, cut if desired. Price per 100 sq. cm	0. 0. 3
50,399.	— The preceding, **Ruby Cobalt Glass.** Per 100 sq. cm	0. 0. 6
50,400.	— The same, **Orange-Yellow Glass.** Per 100 sq. cm	0. 0. 2
50,401.	— The same, **Green Glass** (one side matt). Per 100 sq. cm	0. 0. 3
50,402.	**Candle Lamp** (Figure), brass	0. 1. 0
50,403.	**Dark Room Lamp, burning paraffin** (Figure), with red chimney	0. 2. 0
50,404.	— The same (Figure), with red and yellow chimney for changing the illumination	0. 4. 0
50,405.	**Wall Lantern** (Figure), **for paraffin oil,** with ruby-red and yellow discs underneath, with green disc and closing cap above, with light pane with slide for illuminating bromide prints from the side	0. 11. 0
50,406.	**Dark Room Lamp,** for gas, with red chimney	0. 5. 6
50,407.	**Gas Standing Lamp** (Figure), for red (ruby cobalt), yellow and green light . .	0. 11. 0
50,408.	**Wall Lantern, for gas** (cif. No. 50,405)	0. 11. 0



50 411. 1 : 7.

50 414. 1 : 8.

50 420. 1 : 20.

	£ s. d.
50,409. **Wall Arm for Electric Light,** with outer globe of ruby glass, with switch	0. 10. 0
50,410. — The same, with yellow outer globe	0. 10. 0
50,411. **Electric Dark Room Standing Lamp** (Figure), glow lamp with red outer globe and socket with switch, together with 2 m flexible and screw contact for screwing in Edison lampholders. Price without glow lamp	0. 13. 0
50,412. **Outer Globe** for electric glow lamps, of extra thick ruby glass, with metal cap and holder, without glow lamp (cf. Fig. 50,411)	0. 3. 0
If glow lamps are already installed, it is only necessary to have one of these outer globes.	
50,413. — The same, of yellow glass	0. 3. 0
50,414. **Electric Dark Room Lamp** (Figure), with chimney placed horizontally, adapted for checking purposes when developing plates	1. 4. 0

Equipment of the Biology Class Rooms.

Tables for Biology Class Rooms.

List No.	50,416	50,417	50,418	50,419
Length of Table m.	2,5	3	3,5	4
Price of Table £	**12. 8. 0**	**14. 6. 0**	**17. 1. 0**	**19. 0. 0**

The gross weights are given only approximately and hold for **lath-packing:** about 270 kg for a length of 2.5 m, 310 kg for 3 m, 340 kg for 3.5 m and 375 kg for 4 m.

The top is of 30 mm thick oak, being composed of frame and pannellings and coated thrice with hot linseed oil. The body is of pitch-pine, is carefully stained and varnished, and the inner side walls and bottoms are of red deal. It has 8 drawers and 2 cupboards. The table has gas and water leads and, according to length, 2 to 4 gas taps with hose unions turned upwards; 1 to 2 water taps, and, on one of the narrow sides, a white porcelain basin with draining valve and waste pipe. The gas and water leads are laid complete down to the floor.

50,420. **Box for preserving Plants,** for instruction in Botany (Figure): length 1.50 m, breadth 80 cm, height 60 cm 8. 5. 0

The box is constructed of pitch-pine, rests on 4 legs, and is lined out with sheet zinc. Ten cm above the bottom is a sheet zinc sieve for allowing the water to escape. The water can be carried off by a tap.

For Museum Cupboards, see pp. 43—46, and for Projection Lanterns and Diapositives, see Special Section of this List. Scholars' Work Tables: prices on Application. Cl. 4158, 4154, 3716.

Wainscotting for Lecture Rooms, with Blackboard Stands.

We employ only the best well-seasoned wood for the wainscotting, blackboard stands, etc. constructed in our workshops. As a rule the wainscotting and frames are made of pitch-pine, as this wood is the most suitable for the purpose. The table tops of blackboard stands are of oak, the boards themselves being of poplar inlaid with slate, or they are constructed of red deal covered over with linoleum, red deal being used for the inner walls and bottoms of the cupboards. The bottom fillets of all articles of equipment are of oak, and have the edges rounded off so as to avoid an unsightly appearance should they be knocked.

All pieces of apparatus, etc. to be fixed to the wainscotting, and all gas, water and electric leads are mounted in a thoroughly expert and reliable fashion, special care being taken with the sliding boards, windows and with the projection screens to ensure ease of movement.

As it is of vital importance in these installations to ensure that good and sufficiently dry wood is used, and that a thoroughly reliable joiner, brazier, mechanic and locksmith should be entrusted with the work, it is not advisable that offers of people on the spot be accepted because of a slight difference in cost.

In the case of these objects, it is essentially a question of durability, quality and fitness, and it is not desirable to have them constructed by contract.

We have selected the equipments described in this list from those which we have already supplied, in order to bring before the notice of persons interested the essential facts in regard to the fitting up of lecture rooms, and to show that we are in a position to execute orders of any magnitude both for the simplest and for the most elaborate fittings. We are ready to submit designs and estimates to suit existing conditions.

In general, it is advisable to give preferance to the fittings described in this list, as drawings and patterns of these are already available.

50,421. **Equipment of the large Lecture Room of Chemical Institute I. of Berlin University** (Prof. Fischer), Figure on p. 84 . . . . . Price on application

The lecture table (Figure) is 18 m long, 80 cm wide, 95 cm high, and occupies the entire width of the room. It is distant 1.60 m from the back wall of the lecture room. For traffic there is a passage 88 cm wide on each side 1.15 m from the window; at these places the table top is continued by flaps for an uninterrupted length of 18 m. In the centre of the table the top is cut away for the lecturer for a length of 1.40 m and a depth of 20 cm. The space under the top is provided with cupboards and drawers.

The table contains:

1 **Pneumatic Trough,** 88 cm long, 46 cm wide, 60 cm deep, of stout sheet copper, closed off in front and behind by thick sheets of glass; with inlet, overflow pipe and draining valve. This can be illuminated by electric light.

1 **Mercury Trough,** lined out with waxed cloth and fitted with a waste pipe: 70 cm long, 50 cm wide, 20 cm deep. In the centre is a stand on which to set the porcelain trough, this column being raised by rack and pinion.

1 **Sandstone Slab** let into the oak table-top, 90 cm long, 55 cm wide and 6 cm thick, upon which to set large furnaces.

2 **Plate Glass Slabs** (which can be lowered), mounted, 1 m wide, 75 cm high, for protecting the audience when explosions occur.

2 **Lead Slabs** in front of the explosion slabs, 1.13 m long, 65 cm wide and 3 mm thick.

2 **Clay Pipes,** 15 cm internal width, each being placed 1.70 m from the middle of the table on either side. These are carried under the floor to two flues in the back wall: they are broaden out at the upper part of the table, so that the diameter at the table top is 22 cm. 1 cm below the top is a perforated slate slab upon which vessels may be placed. The apparatus allows of convenient ventilation from the lecture table. When not in use the pipes are closed by wood lids.

6 **Small Lead Pipes,** 3 cm wide, regularly distributed over the table, for the same purpose as the clay pipes and especially for carrying off gases from hose leads.

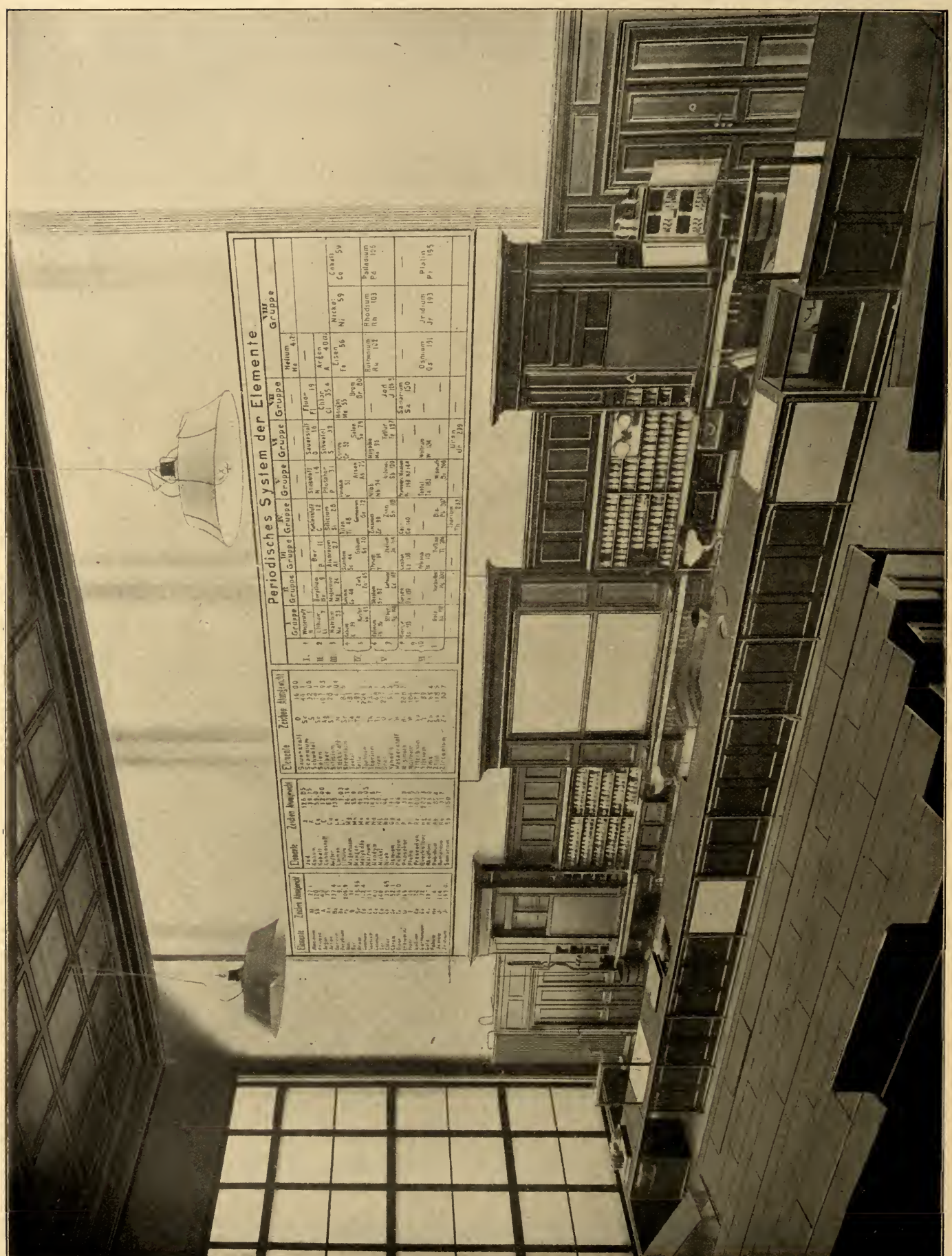
2 **Movable Clips** for supporting compressed gas bombs.

12 **Water Wastes** (of lead piping), which rest on the front wall of the table and terminate in an open channel underneath.

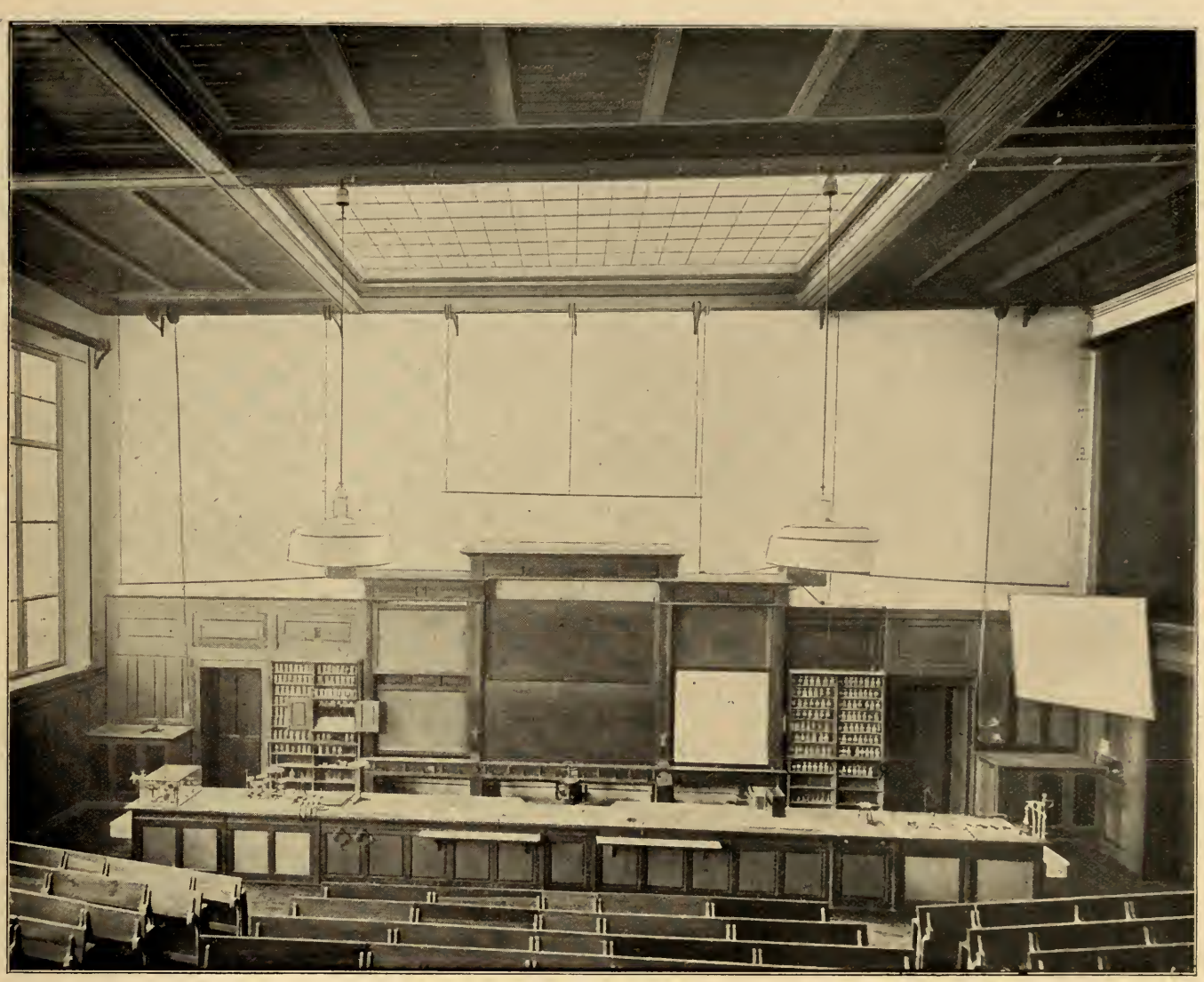
Leads for Water, Gas and Electricity at the back of the table under the top, the latter having holes for the hose leads. Here are equally distributed 24 gas outlets for 1 flame, 2 for 10, and 2 for 40 jets: 14 water outlets; 6 vacuum taps, 4 electric terminals for 20 amps. and 1 for 6 amps.

1 **Aspirator** (water air pump).

1 **Terminal for current of 400 amps.,** together with measuring instruments, for operating electric furnaces, and a terminal for **25 amps.,** together with rheostat, for the projector lamp, at the left-hand end of the table.



50 421. 1 : 70.



50 422 A. 1 : 80.

The Blackboard Wall (Fig. 50,421) contains: £ s. d.

1 Large **Wall Stink Cupboard** in the centre, 2.18 m long, 1.40 m high and 80 cm deep, fitted in front with sliding glass window, and in front of this 2 sliding writing slabs.

2 **Long Racks** for bottles, on both sides.

1 **Transfer Window** on left-hand side, 1 m long, with sliding windows on both sides and with writing slab in the lecture room.

1 **Wall Stink Cupboard** on the right side, of the same length, with sliding window and writing slab.

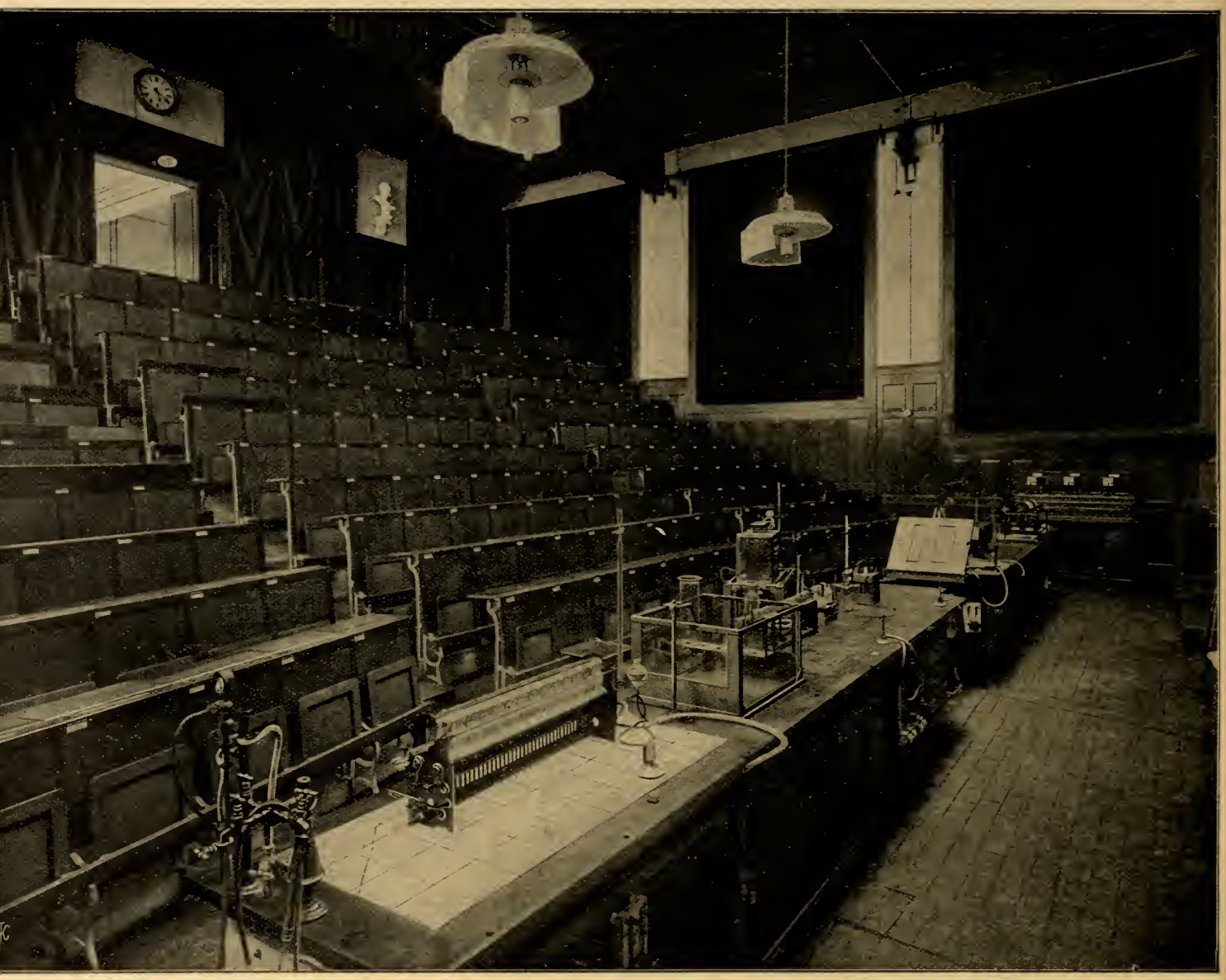
The following is in conjunction with the last item:

1 **Switchboard** with 4 tripole switches for controlling the 4 electric motors which operate the window darkener. The switchboard is built into a lock-up cupboard so as to prevent its being touched by unauthorised persons.

59,422. **Lecture Room in the Laboratory of Applied Chemistry, Leipzig University** (Prof. Beckmann), Figs. A, B and C . . . . . Price on application

The wall behind the lecture table has in the centre a large wall stink cupboard of 6.40 m length. This is formed of three compartments separated from each other by glass partitions. Each compartment has a large sliding window in front, suspended on gut strings and balanced by weights. The table top, the back wall and the sloping roof of the stink cupboard are laid with white porcelain slabs. The right-hand cupboard takes the form of a "through" cupboard, and is closed on the side facing the auditorium by a frosted glass pane 1.40 m square. The plate of glass serves to receive the projection images from the preparation room. The large central compartment of the cupboard and the left compartment are fitted out with gas and water leads and water outlet. The taps for these are placed in front under the table top, while the outlets end inside the cupboards at the back above the table top.

In front of the centre cupboard are placed two blackboards each 2.80 m long and 1.30 m high, of poplar. These boards are covered over with slate, are suspended on gut cords, balanced by iron weights, and can be adjusted up and down. To the left and right of these blackboards two blackboards



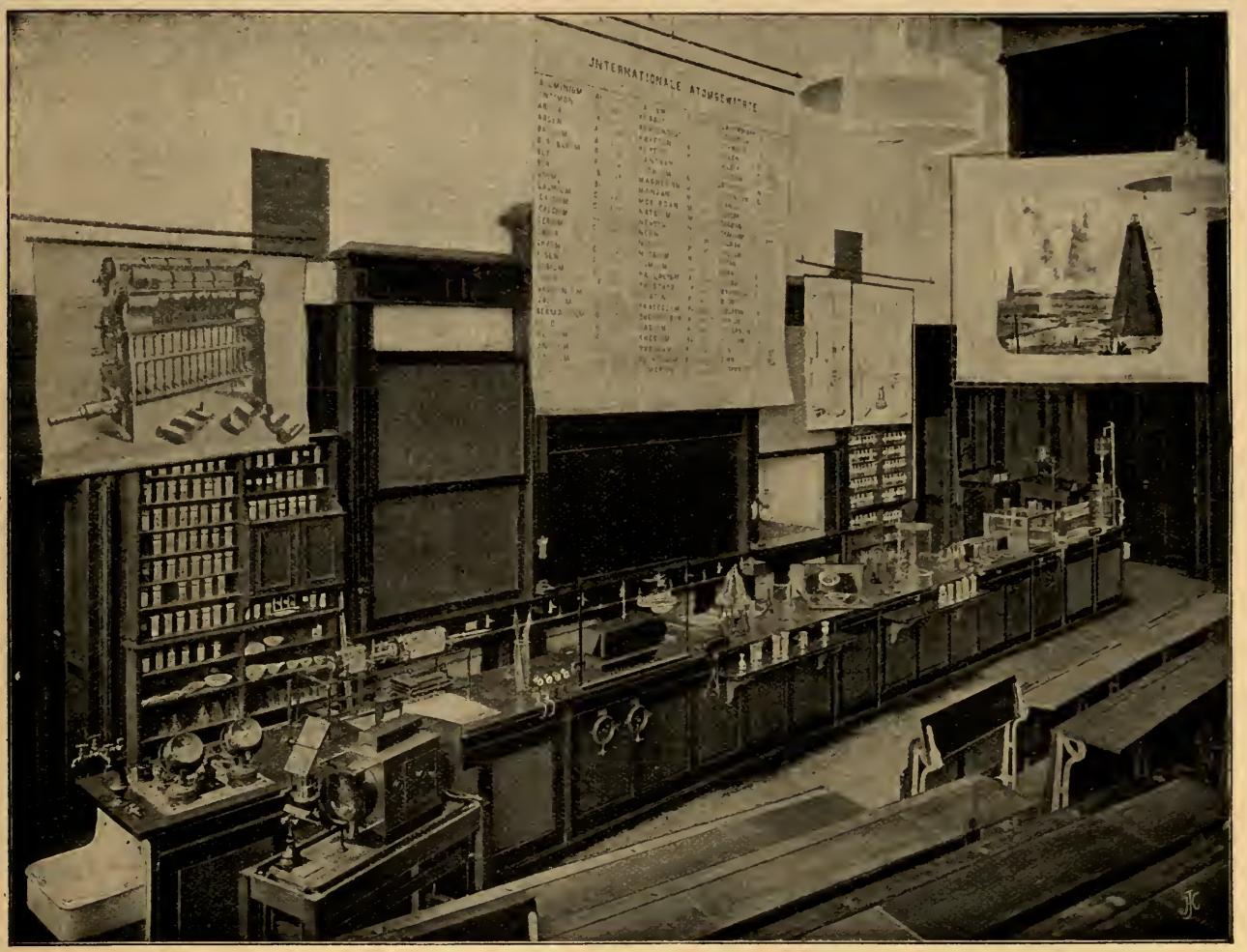
50 422 B.

1.60 m long and 1 m high are arranged in front of the stink cupboards. To the side of these blackboards are Reagent Stands each 1.30 m wide, with 8 horizontal partitions of stout raw glass. A switchboard for the darkener is contained in a cupboard built into the left-hand stand; the darkeners having been supplied for the two window walls and for the fanlight. Above the blackboard wall are 3 suspension devices for plans, maps, tables and the like, one of these being 4 m and two each 3 m long. These devices consist of iron shafts resting in wall bearings. On these shafts are fixed (according to length) 2 or 3 iron rollers, to which hempen cords are attached, the cords winding themselves round grooves in the shape of serew threads. At the free ends of the cords are round oak rods with movable steel hooks on which the tables, plans, etc. are suspended. The upper iron shafts are operated by a hoist consisting of a rope pulley, with steel rope and windlass. £ s. d.

The lecture table illustrated in Figs. 50,422 A, B and C is identical with that described on p. 66 under No. 50,357.

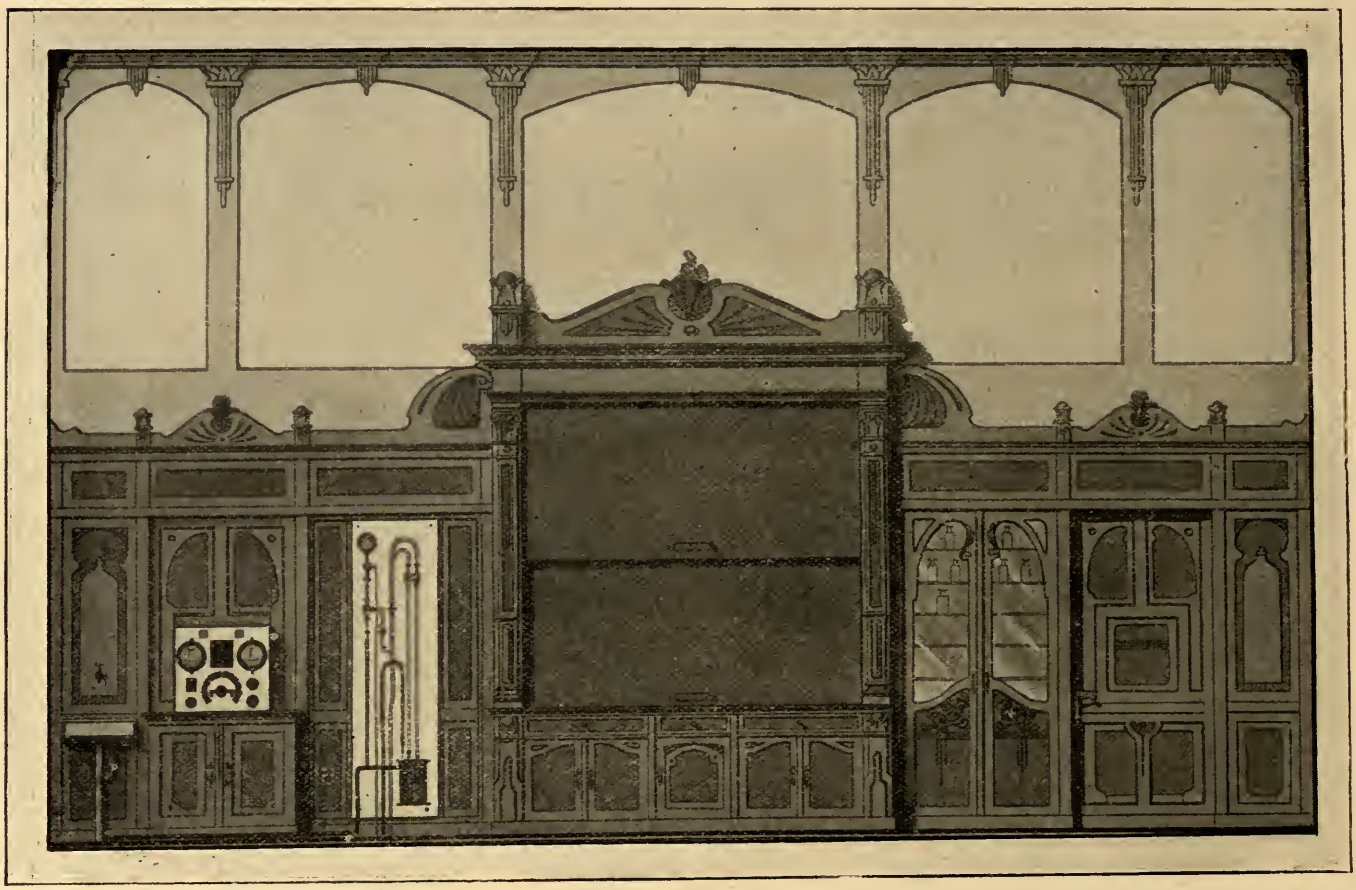
50,423. **Large Wainscot,** oak (Figure), constructed for the École des Mines du Hainaut, Mons (Belgium) . . . . . Price on application

The wainscot is 7.80 m long and 5.40 m high. In the centre there is a wall stink cupboard provided in the lecture and preparation rooms with glazed sliding windows. In the lecture room, in front of the sliding windows are 2 blackboards of poplar, 2 m long and 1.20 high. At both sides of these boards is each 1 writing table standing alone, to the right of this a door to the preparation room, and at the left a Chemical Cupboard which is also accessible from the preparation room. The wall is adorned as far as the ceiling with richly carved pilasters, and the free spaces are laid with marble slabs on which the atomic weights of the elements, the more important chemical formulae, etc. can be painted.



50 422 C. 1 : 40.

50 423. 1 : 60.



50 424. 1 : 50.

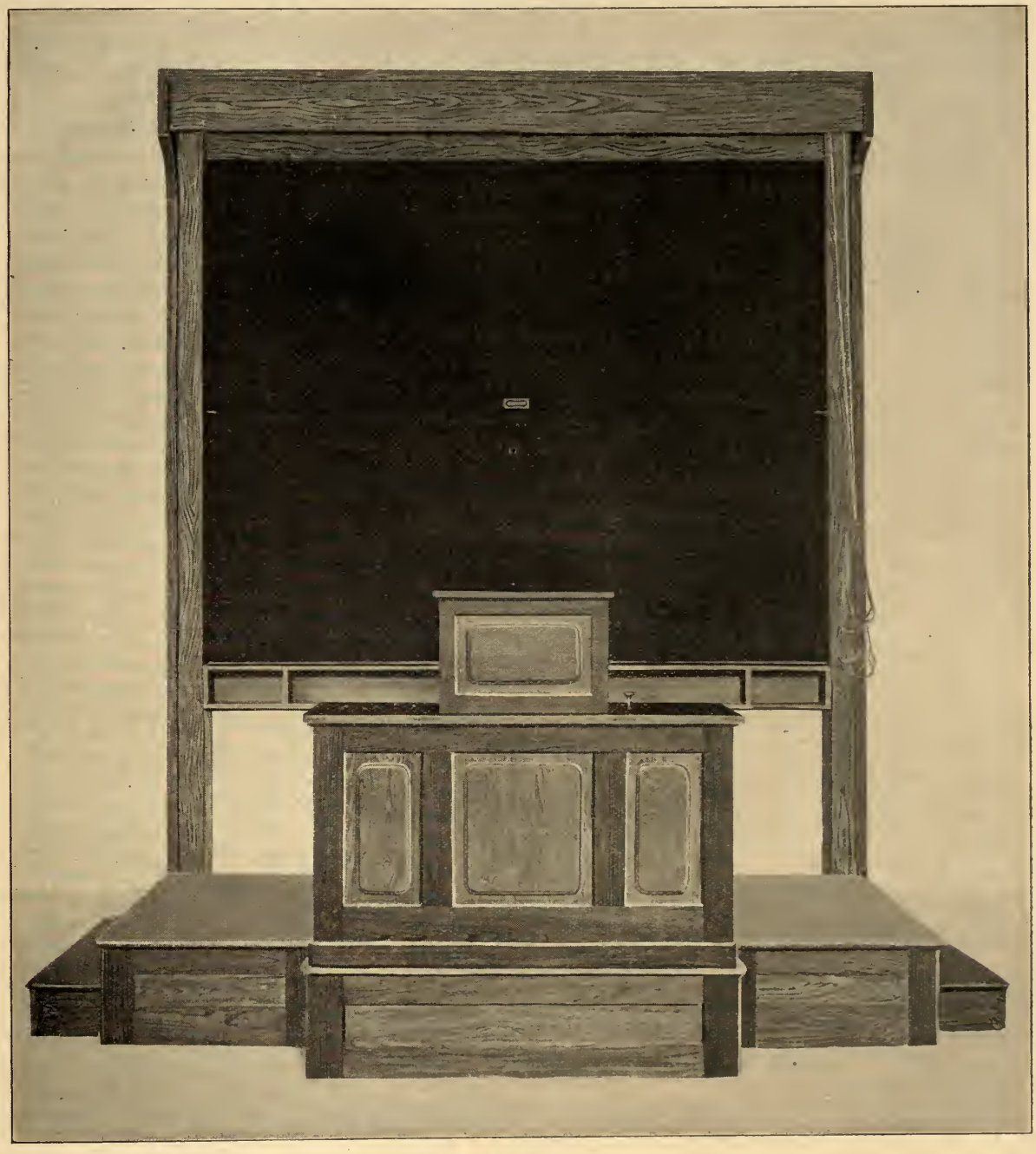
50,424. **Large Wainscot** (Figure), as constructed for the École des Mines du Hainaut, Mons (Belgium) . . . . . Price on application

This is 8.50 m long and 5.40 m high. In the centre are two large blackboards 2.10 m long and 1,10 m high. In the body are 3 drawers and 2 double-door and 1 single-door cupboard. To the right a Cupboard for Chemicals abuts on the blackboard frame, and alongside this cupboard a door leading to the preparation room.

To the left of the blackboards there is an aspirator with force pump (water jet blower), mounted together with all leads on a board, and provided with metal vacuum gauge. The device is connected to the lecture table by 2 leads and is joined up to the water lead and the waste pipe.

Alongside this apparatus, an experimental switchboard is fixed on the back wall over a double-door cupboard; the switchboard consists of an iron framing and marble slab as front wall, for connecting to a working voltage of 110—160 volts, for taking off currents of from 0.03—30 amps. and voltages of from 0.3—110 volts from the network; together with a regulating resistance of 36 ohms resistance in 30 stages and for a max. load of 5—30 amps., with double-contact switch having 30 contacts, 2 lead fuses, 1 main switch, 1 ammeter, 1 voltmeter, 1 voltmeter switch, 1 switch for the shunt, 1 plug box with plug and flexible. Further to the left are 1 water tap and 1 wash basin with overflow and waste pipe.

Please refer to References and Testimonials on pp. 90—98.



50 425. 1 : 22.

50,425. **Blackboard Stand with Projection Screen, Platform and Lecture Desk,** as supplied to the Senckenberg-Museum, Frankfort-on-the-Main (F i g u r e) . . . . . Price on application

The blackboard stand is of pitch-pine, it carries 2 blackboards of 2 m length and 1 m height. The boards are of poplar covered with slate, are suspended on stout gut cords and can easily be moved up and down, one balancing the other. The projection screen is 2 m wide and 2 m high; it is placed under the cornice of the blackboard stand and shielded from dust, being rolled up and down by a cord arrangement. The screen is made for reflected light, of specially prepared fabric with dead white non-reflecting surface, being characterised by its great durability and showing up the image in a beautiful manner. The Lecture Desk is moved from the platform while lantern demonstrations are going on, being mounted on castors to facilitate this. It may also be used when placed alongside the platform, when it faces the audience obliquely to allow of the lecturer observing the image.

For other Blackboard Stands see pp. 27—29, and for further Projection Screens, see List of Projection Apparatus.

References as to Equipments.

We have up to the present supplied complete Equipments and articles of Equipment for Physics Departments, Chemical Laboratories, etc. to the following Institutions and Firms:

Aarau (Switzerland), Chemical Laboratory of the Cantonal School
Agram, Old Gymnasium
New Gymnasium, Real and Commercial School
Aix-la-Chapelle, Realgymnasium
Reiff Museum
Metallurgical Institute of the Technical High School
Allenstein, Municipal Oberrealschule
Municipal Oberrealschule (Repeat order)
Garrison Hospital
Alsfeld, Grand Ducal Realschule
Altenburg (S.-A.), Ducal Seminary
Realgymnasium
Altona, Royal School for Machine Construction
II. Boys' Higher Grade School
III. Boys' Higher Grade School
Municipal Infirmary
IV. Boys' Higher Grade School, Paulstr.
Alzey, Teachers' Seminary
Anklam, Higher Grade Girls' School
Annaberg, Higher Grade School
Realgymnasium
Teachers' Seminary
II. Higher Grade School
Apenrade, Realschule
Arnsberg (Westphalia), Teachers' Seminary
Asch (Bohemia), Academy for the Textile Industry
Aschersleben, Stephanischule
Athens, National University
Auerbach (Saxony), Higher Grade School
Realschule
Augsburg, Royal Gymnasium
School of Crafts
Aurich (Hanover), Royal Gymnasium
Aussig, Communal Obergymnasium
Commercial Academy
Backnang, Seminary
Baden-Baden, Grand Ducal Realschule
Oberrealschule
Municipal Construction Bureau
Bad Salzbrunn, Chemical Laboratory of the Direction of Wells and Baths
Bamberg, New Gymnasium
Royal Lyceum
Barmen, Gymnasium
Realschule
Basle, Werthemann, Botty & Co.
Batoum, Michaels Nicholas Gymnasium
Bautzen, Realschule
Gymnasium
Catholic Training College
Bayreuth, Seminary for School Masters
Belgard, Gymnasium
Belovar, I. kroatische Landesprodukten A. G.
Berditscheff, School of Commerce
Berent, Royal Training College for Teachers
Royal Progymnasium
Berlin, III. Higher Grammar School
V. Higher Grade School
VIII. Higher Grade School
Technical School
Wilhelms-Gymnasium
I. Chemical Institute of the University
Physical Institute of the University
Berlin, Anatomical Institute of the Veterinary High School
Preußisches Kultus-Ministerium for the Lecture Room of the German Educational Exhibit., St. Louis, 1904
Prof. H. du Bois
Medicinal Warehouse
Kgl. Technische Zentralstelle für Textil-Industrie
Kaiserin Friedrich-Haus
Vereinigte Fabriken für Laboratoriumsbedarf m. b. H.
High School of Commerce
Berne, Swiss Agricultural Testing Institution
Bernburg a. S., Ducal Higher Grade School for Girls
Beuthen (O.-S.), Gymnasium
Municipal Realschule
Royal Institute of Hygiene
Bialistock (Russia), School of Commerce
Biebrich, Realprogymnasium
Bielefeld, Gymnasium
Realschule
Endowed Protestant High School for Girls, and Women's Training College
Higher Grade School (Girls)
Realgymnasium
Bielgorod (Russia), Gymnasium
Blagoveschtschensk (Russia), Alexeieff Gymnasium for Girls
Blankenburg (Harz), College
Blankenese, Realschule
Blasewitz, Realgymnasium
Bochum, Gymnasium
General Society of Miners
Borna (Leipzig), Realgymnasium
Bozen, Municipal Office of Public Buildings
Higher Grade School for Girls
Brandenburg, Realgymnasium
Breisach (Baden), Grand Ducal Real School
Bremen, Technical Institute
Seminary in Hamburgstrasse
Gymnasium
Oberrealschule
Realschule
Meteorological Station of First Order
Realgymnasium in Kaiser-Friedrichstrasse
Infirmary
Bremerhaven, Girls' Higher Grade School
Breslau, Chemical Institute of the University
Physical Institute of the University
Hygienic Institute of the University
Pharmaceutical Institute of the University
Pharmacological Institute of the University
"Gerichtsärztliches" Institute of the University
Chemical Institute of the University
Oberrealschule
Wenzel Hancke Infirmary
Katharinenschule
Friedrichs-Gymnasium
Chemical Testing Bureau
I. Kgl. Wilhelms-Gymnasium
Breslau, Catholic Higher Grade School for Boys
Elizabeth-Gymnasium
Kgl. Baugewerkeschule
Royal College of Mechanics
Magdalenengymnasium
Allerheiligen-Hospital
J. H. Büchler
Realgymnasium am Zwinger
Viktoriaschule
Brig (Switzerland), Women's Training College
Bromberg, Gas Works
Realschule
Royal Realgymnasium
Bruchsal (Baden), Higher Grade School for Girls
Brünn (Moravia), Landesoberrealschule
Physical Institute of the Royal German Technical College (repeat order)
Royal German Technical College (Department I of Electrotechnics)
Brussels, Robert Drosten
Military School
Brüx (Bohemia), Royal Staatsgymnasium
Bückeburg, Fürstliches Gymnasium
Burg, near Magdeburg, Kgl. Viktoria-Gymnasium
Burgsteinfurt, Royal Training College for Women
Kgl. Gymnasium Arnoldinum
Butzbach, Grossherzogl. Realschule
Buxtehude, Municipal Realschule
Royal Building School
Calbe (on Saal), Realschule
Cassel, Oberrealschule
Royal Art School
Higher Grade School for Girls in Luisenstr.
Amalienschule
Charlottenburg, Physical Institute of Technical High School
Anorganic Institute of the Technical High School
Institute for Chem. Technology of the Technical High School
Chemical Institute of the Technical High School
Military Technical Academy
Institute for the Metallurgy of Iron at the Royal Tech. High School
Chemnitz, Municipal Oberrealschule
Municipal Oberrealschule (repeat order)
Realgymnasium
Royal Gymnasium
Dr. Bethmann & Co.
Bürgerschule
High School for Girls, Annenstr.
Municipal Institute for the Treatment of Nervous Complaints
Exhibition Room of the Municipal "Vorbildersammlung"
Royal Agricultural College (Landesanstalt)
Pathologico-Hygienic Institute of the Municipal Infirmary
Techn. Staatslehranstalten
Techn. Staatslehranstalten (repeat order)
Training School of the Druggists' Union
Municipal Electricity Works

Chemnitz, Chemical Laboratory in the Municipal Infirmary
Eduard Beyer, Ink Manufacturer
Municipal Meat Inspection Bureau
König-Albert-Museum
Chicago (U. S. A.), St. Ignatius College
Chodau, near Carlsbad, Karl Gasch
Clausthal, Royal Gymnasium
Coblenz, Royal Gymnasium
Realgymnasium
Coeslin, Royal Cadet Corps
Coethen, Higher Technical Institute
Colmar, I. Royal Teachers' Training College
Militärbauamt
Grillenbreitschule
Lyceum
Cottbus, Royal Weaving College
High School for Girls
Crefeld, Municipal Oberrealschule
Municipal Art School
Knoch & Kallmeyer
F. Hillenhagen Nachf.
Crimmitschau, Realschule
Cuxhaven, Higher Elementary School
Realschule
Parish School
Czegléd (Hungary), Staatsobergymnasium
Czernowitz (Bukovina), I. Staatsgymnasium
II. Staatsgymnasium
Griech.-orient. Oberrealschule
Danzig, Petri-Realschule
Municipal Gymnasium
Johannisschule
Oberrealschule
Danzig-Langfuhr, Physical Institute of the Technical High School
Chem. Institute of the Tech. High School
Conradstiftung
Darmstadt, Technische Hochschule
Technische Hochschule, Additional Buildings
Viktoria-Schule
Mittelschule, Hermannstrasse
Ehrhardt & Metzger Nachf.
J. Jakobi, Schützenstraße
Delmenhorst, Municipal Realschule
Dessau, Ducal Antoinetten-Schule
Science and Art School
Municipal Handels-Realschule
Detmold, Fürstl. Gymnasium
Deuben, near Dresden, Direction of Schools
Deutsch-Wilmersdorf, near Berlin, Bismarck-Gymnasium
Dieburg (Hesse), Higher Grade School
Diedenhofen (Lorraine), Gymnasium
Imperial School of Mines
Dillenburg, Gymnasium
Dillingen, Realgymnasium
Dirschau, Royal Realprogymnasium
Döbeln, Realgymnasium
Doberan, Higher Grade School
Donaueschingen, Progymnasium
Dornbirn, k. k. Staats-Oberrealschule
Dortmund, Kgl. Werkmeister-Schule
Realgymnasium
Realgymnasium (repeat order)
Realschule
Gymnasium
Catholic High School for Girls
Savings Bank and Municipal Library
Dresden, Wettiner Gymnasium
Dreikönigschule
Realschule in der Johannvorstadt
Annenrealschule
Training College for Governesses
Freemasonry Institute
Science and Art School
Dresden, Kreuzschule (Gymnasium)
Veterinary High School
Municipal Art School
A. Müller, Fröbelhaus
F. B. Lehmann
Royal Hospital for Women
II. High School for Girls
Royal Technical High School
Vitzthumsches Gymnasium
K. Sächs. Hausmarschallamt (for the dark room in the residential storey)
C. F. Thiers
Royal Technical School with Museum
König Georg-Gymnasium
I. Realschule Johannstadt
Dt. Krone, Teachers' Training College
Duderstadt, Kgl. Gymnasium
Ursulinenkloster
Duisburg, Municipal Realgymnasium
Municipal High School for Girls
Duisburg-Ruhrort, Higher Grade School for Girls
Duppau (Bohemia), Gymnasium
Düren, Gymnasium
Felix Peltzer & Co.
Düsseldorf, Realgymnasium
General Municipal Hospital, Zwischenbau XVI, Prof. Hoffmann
,, XVIII, Prof. Schlossmann
Ströhlein & Co.
II. Realschule in Prinz Georgstr.
Realschule in Rethelstrasse
Oberrealschule in Fürstenwallstr.
Luisenschule in Bastions- und Kasernenstrasse
Boys' Intermediate School, Louisenstrasse
Eberswalde (Brdbg.), Wilhelmsgymnasium
Ebingen (Würtbg.), Realschule
Eckernförde, Realschule
Eger, Realschule
Kommunal-Oberrealschule
Eilbeck, Realschule
Eilenburg, Realgymnasium
Einbeck, Realprogymnasium
Neues Realgymnasium
Eisleben, Gymnasium
School of Mines
Oberrealschule
Oberrealschule (repeat order)
Ekaterinoslav (Russia), High School of Mining
School of Commerce
Elberfeld, Gymnasium
Royal School of Mechanics
Chemical Testing Bureau
Elbing, Oberrealschule
Elmshorn, Realschule
Elsfleth, School of Navigation
Erfurt, Royal School of Science and Art
Mechanics and Art School
Rich. Hegelmann
Erlangen, Realschule
d'Esch-sur-Alzette, Administration communale
Eschwege, Friedrich-Wilhelms-School
Essen (Ruhr), Oberrealschule
Realgymnasium
Realschule, Margaretenstrasse
Mining School
Friedr. Krupp A.-G., Cast Steel Works
Ettenheim, Realgymnasium
Ettlingen, Grand ducal Realschule and Realprogymnasium
Exin, Royal College for Training Teachers
Finsterwalde, Realschule
Flensburg, Gymnasium
Oberrealschule
Frankenberg (Hesse), Seminary
Frankenberg (Saxony), Realschule
Training College for Masters
Frankfort-on-Main, Goethe-Gymnasium
Akademie für Sozial- und Handelswissenschaft
Electrotechnical School
Jügelhaus
Physical Institute
Musterschule
Ersatzmusterschule
City Continuation School
Sachsenhäuser Realschule
Lessing-Gymnasium
Commercial Academy
Viktoriaschule
Senckenberg-Museum
Lecture Room of the Senckenberg Anatomical Inst.
Lecture Room of the Children's Hospital for Internal Diseases at the Infirmary
Lecture Room of Hospital for Women
Schillerschule
Continuation School on the Deutschherrnkai
Training College for Governesses
Frankfort a. d. O., Royal Science and Art School
Fraustadt, Kgl. Gymnasium
Training College for Teachers
Freiburg (Switz), Physical Institute of the University
Freiburg (Breisgau), Chem. Lab. of the University
Oberrealschule
Friedrichs-Gymnasium
Training College for Teachers
Freiburg (Silesia), Municipal Oberrealschule
Freising, Lyceum
Friedberg (Hesse), Training College
Friedrichsthal (Saar), Realschule
Fulda, Realschule (Oberrealschule)
Gablonz a. N., Municipal Commercial School
Realgymnasium
K. K. Fachschule
Galkhausen (Rhein. Prov.), Heil- und Pflegeanstalt
Geisenheim, H. N., Royal College for Viticulture, Fruiticulture and Gardening
Ghent, Bacteriological Inst. of University
Gera (Reuss), High School a. d. Ziegelberge
I. Boys' High School
Zabelschule
Gevelsberg, Municipal Realschule
Giessen, University
Glatz, Kgl. Gymnasium
Glauchau, Pestalozzi-Schule
Gleiwitz, Kgl. Gymnasium
Glogau, Kgl. evangel. Gymnasium
Realschule
Glückstadt, Gymnasium
Godesberg, Evangel. Pädagogium
Rheinische Obst- und Gartenbauschule für Frauen
Geh. Rat Prof. Dr. L. Claisen
Goldap, Reform-Realprogymnasium
Görlitz, Gymnasium
Göttingen, Higher Grade Girls' School
Natural History Museum
Kaiser Wilh. II. Oberrealschule
Institute for Applied Electricity
Graudenz, Oberrealschule
School of Machinery
Greifswald, Chem. Inst. of the University
Hermann Wittig
Greiz i. V., Dr. G. Wichmann

Grimma, Realschule
Seminary
Gross-Bothen, Prof. W. Ostwald
Grossenhain, Realschule
Gross-Lichterfelde (Berlin), Gymnasium
Grunewald (near Berlin), High School for Girls
Gumbinnen, Kgl. Gymnasium
Gummersbach, Teachers' Training College
Güstrow, Realgymnasium
Hadersleben, Teachers' Training College
Kgl. Gymnasium
Hagen (Westphalia), Technical School
Gymnasium
Hague, The, Gemeentewerken
Halberstadt, Kgl. Domgymnasium
Realgymnasium
Halle a. S., School for Girls, Steinstr.
School of Crafts
High School, Klosterstrasse
High School, Friedenstrasse
University Clinic of Medicine
High School, Torstrasse
Gymnasium
High School for Girls, Weidenplan und Unterberg
Oberrealschule
Dr. Gocht & Dr. Ehebald
Hamburg, Realschule Weidenstieg, Eimsbüttel
Realschule a. d. Seilerstr. in St. Pauli
Teachers' Training College, Grindelhof
Catholic High School for Boys
Gewerbeschule v. d. Steinthor
Wilhelmgymnasium
Wilhelmgymnasium (repeat order)
Hugo Ahlers-Hestermann
Vasogenfabrik Pearson & Co.
Eduard Niemeyer
Geb. Oetling
A. Krüss
Hirschmann & Co.
Hamburg Electricity Co., Ltd.
Hameln, Gymnasium
Hamm (Westphalia), Municipal Higher Grade School for Girls
Hanau, Stadtbauamt
Hann. Münden, Higher School for Girls
Hanover, Veterinary College
Girls' High School I, Langensalzastr.
New Buildings of Chem. Inst., Techn. High School
Hattingen (Ruhr), Progymnasium
Haubinda, Deutsches Landeserziehungsheim
Haynau (Silesia), Realschule i. E.
Heide, Realschule
Oberrealschule
Heidelberg, Academical Infirmary, Surgical Section
Teachers' Training College
Heiligenstadt, Gymnasium
Helmstadt, Gymnasium
Helsingfors (Finland), Alexander Gymnasium
Hemelingen (Bremen), Athenstaedt & Redeker, Chemical Factory
Herford (Westphalia), Teachers' Training College
Herne (Westphalia), Higher Grade School for Girls
Hersfeld, H. N., Kgl. Gymnasium
Hilchenbach, Royal Seminary
Hildburghausen, Ducal Training College for Teachers
Gymnasium
Hildesheim, Royal Art School
Hitzkirch (Switz), Seminary
Höchst a. M., Gymnasium
Hof, Realschule
Hohenstadt (Moravia), German Polytechnic
Holzminden, Municipal Art School
Husum, Royal Gymnasium
Inowrazlaw, Royal Gymnasium
Innsbruck, Commercial Academy
Higher Grade School for Girls
Interburg, Royal Gymnasium
Intermediate School for Boys
Iserlohn, Realgymnasium
Kgl. preuss. Fachschule
Itzehoe, Higher Grade Girls' School
Realschule
Jena, Mineralog. Inst. of the University
Lecture Room for Archeology
New University Buildings
Jever, Gymnasium
Jüterbog, Realschule
Kalk a. Rh., Municipal Secondary School for Boys
Kalocsa (Hungary), New Gymnasium of the Jesuit Fathers
Mutternhaus der Schulschwestern Notre Dame
Kamen (Westphalia), Realprogymnasium
Karlsbad, Städtisches Kaiser Franz Josefs-Realgymnasium
Karlsruhe, Chem. Lab. F. Scelig & C. Müller
Mittelschule an der Gartenstrasse
Kattowitz, Gymnasium
Technical School
C. Ed. Schulz
Kharkoff (Russia), University, Chem. Lab. of Technolog. Inst.
Kieff, School of Commerce
I. Gymnasium
Polytech. Institut des Kaisers Alexander II
Karl Zivotsky
Kiel, Phys. Inst. of University
Extension of College Buildings of the University
Surgical Hospital of University
Mineral. Inst. of University
Hygienic Inst. of University
Patholog. Inst. of University
Chem. Inst. of University (large lecture room)
Royal Marine School
Johannssen & Schmiclau
Oberrealschule mit Reformgymnasium
Prof. G. Martius
Marine-Sanitäts-Depot
2. Girls' High School
3. Boys' High School, Königsweg
Municipal Technical School
Doppelmittelschule am Ravensberg
Kleinzschocher, School
Klinza (Russia), Mittl. 7 klass. techn. Schule
Köln (Rhine), Intermediate School for Girls
Kgl. Maschinenbauschule
High School of Commerce (Physical Section)
Königsberg i. Pr., Kgl. Friedrichs-Kolleg
Agricult. Inst. of University
Städtisches Realgymnasium
Kgl. Realgymnasium a. d. Burg
II. Municipal Intermediate School
Municipal High School for Girls
Kneiphöfisches Gymnasium
Technical School
Municipal Realschule
Royal Oberrealschule a. d. Burg
Surgical Pavilion of the Municipal Infirmary
Löbenichtsche Oberrealschule
Königshütte, Gymnasium
Konitz, Gymnasium
Konstanz, Oberrealschule
Kortau (near Allenstein), Operationshaus
Kronstadt (Russia), Artillerie-Schule für Marine-Offiziere
Kaiserl. Marine-Ingenieur-Schule
Krotoschin, Gymnasium
Landau i. B., Realschule
Landsberg a. W., Kgl. Gymnasium mit Realschule
Landshut i. B., Kgl. Gymnasium
Realschule
Langensalza, Realgymnasium
Lankwitz (Berlin), Realgymnasium (chem. Laboratory)
La Plata (Argentine), Physical Inst. of the University
Lauingen, Schullehrerseminar
Lausanne, Botanical Lab. of the University
Lehe, Oberrealschule
Leipzig, Schimmel & Co. (6th lecture table)
Lab. for Applied Chem. of the University
Physical Inst. of University
Patholog. Inst. of University
Anatom. Inst. of University
Hygien. Inst. of University
Municipal Technical School
Dr. Albert Gebhardt
Teachers' Seminary
Universitäts-Frauenklinik
Chemical Lab., Liebigstr.
Oberrealschule, Nordstrasse
Lemberg (Gal.), F. M. Zlotnicki
Lengenfeld (Voigtl.), Secondary School
Leobschütz (Schl.), Kgl. Gymnasium
— do. — (repeat order)
Teachers' Seminary
Liegnitz, Kgl. Gymnasium
Johanneum
Lima (Peru), Escuela de Artes y Oficio
Linden vor Hanover, Realschule (Humboldt Schule)
Municipal Secondary School, Bergstrasse
Löbau i. S., Seminary
Lörrach, Gymnasium
Löwenberg i. Schl., Real-Reform-Gymnasium
Lübeck, Seminary
Secondary School, St. Lorenz
Reformrealgymnasium
Ernestinenschule
Lucerne, Cantonal School
High School for Girls
Lüdenscheid, Realgymnasium and Realschule
Ludwigshaven (Rhein), Realschule
Lab. of Municipal Infirmary
Ludwigslust i. M., Grand Ducal Realgymnasium
Lund (Sweden), Fisika Institutionen
Lüneburg, Johanneum
Johanneum (repeat order)
High School for Girls
Luxemburg, New School of Commerce and Industry
Madrid, Viuda de Aramburo
Magdeburg, Kgl. Wilhelms-Gymnasium
Royal Art School
Royal Machinery School
Siemens & Halske A. G.
Mährisch-Ostrau, Landesoberrealschule
Kaiser Franz Josef-Komm.-Gymnasium
New School for Girls
Manchester, Municipal Technical School
Mannheim, Realschule
Realgymnasium
Neues Realgymnasium
Gymnasium

Mannheim, High School for Girls
Oberrealschule, Tullastr.
Gewerbeschule
Kurfürst Friedrich-Schule
Marienburg (Wpr.), Kgl. Gymnasium
Royal Seminary
Marienwerder, Magistrate
Kgl. Gymnasium
Mayence, Oberrealschule
High School for Girls
Meerane i. S., Realschule
Meiderich, Municipal Realgymnasium in conjunction with Realschule
Meiningen, Realgymnasium
Meissen a. E., Munic. Realschule mit Progymnasium
Messkirch (Baden), Realschule
Metz, Lyceum
Mewe, Kgl. Realschule
Milwaukee (U. S. A), German. American Teachers' Seminary and German-English Academy
Mittweida, Secondary School
Realschule
Mons (Belgium), École des Mines du Hainaut
Inst. commercial des Industrielles du Hainaut
Moscow, Ferdinand Scheer
E. S. Tryndins Söhne
Chem. Central Lab. of Ministry of Finance
Higher Grade School for Girls
Mülhausen i. E., Kasernement des Reginents Jäger zu Pferde
Munich, Deutsches Museum von Meisterwerken der Naturwissenschaft und Technik
M.-Gladbach, Gymnasium
Higher Grade School
Oberrealschule
Münster, Paulinisches Gymnasium
Münsterberg, Teachers' Seminary
Myslowitz, Gymnasium
Nauheim, Higher Grade School
Neisse, Kgl. Gymnasium
Dr. Jantzen
Neumark (W. Pr.), Kgl. Progymnasium
Neumünster, Boys' Secondary School
Neu-Ruppin, Gymnasium
Neu-Schleussig, School
Neustadt a. H., Realschule
Neustadt i. O.-S., Gymnasium
Neuzelle, Seminary
New York, Eimer & Amend
Nienburg a. d. W., Kgl. Progymnasium
Royal Technical School
Northeim i. H., Gymnasium
Royal Seminary
Nossen, Seminary
Novo Alexandria, Agricultural and Forestry Institute
Ober-Glogau, Seminary
Oberhausen, Realgymnasium
Odessa (Russia), Gymnasium A. P. Rownjakow
Oels, Royal Gymnasium
Oelsnitz i. Vgtl., Realschule
Secondary School
Offenbach a. M., Heinrich Credé Gymnasium
Offenburg, Gymnasium
Oldesloe (Schl.-H.), Realschule
Olmütz, Commercial Academy
Schul- und Pensionsgebäude
K. K. böhm. Staatsgymnasium
Oppeln, Royal Gymnasium
Oschatz, Übungsschule des Seminars
Osnabrück, L. Häberlein
Catholic High School for Girls
Higher Grade School for Girls
Ratsgymnasium
Secondary School, Hakenstr.
Osterode (O.-P.), Gymnasium
Otterndorf (Unterelbe), Royal Realschule
Pabionice, School of Commerce
Paderborn, Royal Gymnasium
Palermo, Physics Lab. of the Royal University
Pankow-Berlin, Laboratory of the Infirmary
Patschkau, Royal Gymnasium
Peine, A.-G. Peiner Walzwerk
Perleberg, Royal Realgymnasium
Higher Grade School for Girls
Pfarrkirchen, Royal School of Agriculture
Pforzheim, Oberrealschule
Gymnasium
Higher Grade School for Girls
Pillau, Realschule
Pirmasens, Realschule
Pirna, Realschule
Plauen i. Vgtl., Realschule
Royal Seminary
Gymnasium
Technical School
I. Intermediate School
XII. Intermediate School
Plauen b. Dresden, Seminary
Ploen, Gymnasium
Intermediate School, Barthstrasse
Royal Higher School of Machinery
Posen-Jersitz, Gymnasium
Prague, k. k. Staatsgewerbeschule
Physical Inst. of Royal Bohemian University
Pr. Friedland, Protestant Teachers' Seminary
Proskuroff, Alexeieff-Realschule
Prossnitz, k. k. Staatsgymnasium
Putbus (Rügen), Kgl. Pädagogium
Quedlinburg, Realschule
Kgl. Gymnasium
Radebeul i. S., Realschule
Rappoldsweiler, Realschule
Ratibor, Kgl. Gymnasium
Ratingen, Progymnasium
Ratzeburg, Teachers' Seminary
Ravensburg (Württbg.), Realanstalt
Rawitsch, Royal Seminary for School Masters
Recklinghausen, Oberrealschule
Regensburg, Kgl. Lyceum
von Müller's Girls School
Reichenbach i. Vgtl., Realschule
Reichenbach i. Schl., Realgymnasium
Reichenberg (Bohemia), k. k. Staatsgewerbeschule
Remscheid, Higher Grade School for Girls
Rheydt, Oberrealschule
Städt. Gymnasium
High School for Girls
Riesa i. Sa., Realprogymnasium
Riga (Russia), School of Commerce
Rixdorf (near Berlin), Realschule in Emserstrasse
Rochlitz i. S., Seminary
Realschule
Rogasen, Teachers' Seminary
Rorschach (Switzerland), Teachers' Seminary
Rössel, Kgl. Gymnasium
Rossleben, Klosterschule
Rothenditmold, Gewerbl. Fortbildungsschule
Rotterdam, Elementary School
Höhere Realschule
Neue Höhere Realschule
Gemeentewerken
Gymnasium
Rufach (Alsace), Imperial School of Agriculture
Saalfeld (Saale), Realschule
Saarbrücken, Kgl. Gymnasium
High School for Girls and Governesses' Training College
Saarburg i. Lothr., Gymnasium
Saarlouis, Gymnasium
Saaz (Bohemia), k. k. Staats-Ober-Gymnasium
Sagan, Katholisches Gymnasium
Saraievo (Bosnia), Obergymnasium
St. Gallen, Verkehrsschule
Talhof-Schulhaus
Municipal Commercial Academy
do. (repeat order)
Knabenrealschule
St. Gilles (Belgium), École moyenne
St. Johann-Saarbrücken, Royal Mining School
St. Paul (Austria), Ober-Gymnasium
St. Petersburg, Reformierte Kirchenschule
Petrischule
Schaffhausen(Switz.), Neues Gymnasium
Schleswig, Kgl. Domschule
Higher Grade School for Girls
Schleusingen, Kgl. Gymnasium
Schmölln, Herzogl. Realschule
Schneeberg, Seminary
Schneidemühl, Gymnasium
Royal Seminary
Schönberg (Mecklenburg), Grossh. Realschule
Schöneberg (near Berlin), Reform-Gymnasium
Schopfheim, Realschule
Schwerin a. W., Städtische Realschule
Schwetz a. W., Gymnasium
Schwyz (Switz.), Lehranstalt "Maria Hilf"
Sebnitz i. S., Neues Schulhaus
Sensburg, Infirmary
Siegburg, Kgl. Gymnasium
Siegen, Realgymnasium
School of Mining
Eisenfachschule
Sinsheim a. E., Grossh. Realschule
Solingen, Reformgymnasium
Higher Grade School for Girls
Fachschule für die Solinger Industrie
Sonneberg, Realschule
Sopron (Hungary), Higher Training College for Governesses
Sorau (N. L.). Preuss. höhere Fachschule für Textilindustrie
Spremberg, Neue Mädchenschule
Stade, Gymnasium
Starobielsk (Russia), Gymnasium for Women
Steglitz, Realschule
Steinau a. O., Royal Seminary
Sterkrade, Realprogymnasium
Stettin, Higher Grade School for Girls
Arndtschule, Barnimstrasse
Ottoschule
Royal Technical School
Royal Higher School of Machine Construction
Friedrich Wilhelms-Realgymnasium
Schiller-Realgymnasium
I. Girls' Intermediate School
Stadtgymnasium
Stollberg i. S., Seminary
Stolp i. P., Realschule
Stralsund, Realgymnasium
Strasburg (Westpr)., Gymnasium
Strassburg (Alsace), Imperial Teachers' Seminary
Technical School
F. Majer
Higher Grade School for Girls
Chemical Lab. of the Customs, Technical Testing Bureau

Strassburg, Bischöfl. Gymnasium
(Kleines Seminar) am St.Stephan
Lyceum
Thomasschule
Straubing (Lower Bavaria),
Royal Teachers' Seminary
Strehlen i. Schl., Kgl. Kaiser-Wilhelms-Gymnasium
Striegau, Realgymnasium
Stuttgart, Paul Spindler
Swinemünde, Realprogymnasium
Tarnowitz, Kgl. Realgymnasium
Tatischevo (Russia), Mariinkoje Agricultural School
Tauberbischofsheim, Gymnasium
Thorn, Continuation School
Kgl. Gymnasium und Realgymnasium
Tiegenhof (West Prussia), Realschule
Tilsit, Gymnasium
Toledo (Ohio), St. John's College
Tomsk, Geological Section of the Technical Institute
Physics Lab. of the Technol. Institute
Tondern, Seminar-Lehrgebäude
Treptow, Observatory
Trier, Gymnasium
Troppau, k. k. Staatsoberrealschule
Boys' Intermediate School
Tsingtau (China), New School Buildings
Tübingen, Zoologico-Mineralogical Inst. of the University
Chemical Inst. of University
Eye Hospital
Ufa (Russia), Realschule
Uhlenhorst (Hamburg), Realschule
Unter-Barmen, High Grade School for Girls
Utrecht, Physical Inst. of the University
Valkenburg, near Maastricht (Holland), Ignatius College
Valladolid (Spain), Carlo de la Cuesta
Varel (Oldbg.), Realschule
Vechta, Grossherzogl. Gymnasium
Vegesack-Bremen, Realgymnasium
Viborg (Finland), Russian Realschule
Vienna I., Mädchen-Gymnasium
XVIII., Austrian Experimental Station and Brewery Academy
VII., k. k. Staatsrealschule
XIX., Lehrmittelbureau am k. k. österr. Museum
Villingen (Bad), Realgymnasium und Realschule
Wanne-Eikel, Realprogymnasium
Waren i. Meckl., Gymnasium
Warnsdorf (Bohemia), k. k. Staatsrealschule
k. k. Staatsrealschule, Chem. Department
Warsaw, 7th Class Commercial School
Wehlau (Ostpr.), Kgl. Realschule
Weihenstephan (near Freising), Kgl. Saatzuchtanstalt
Weimar, Grand Ducal Seminary
Weinheim, Gymnasium
Weissenfels, Secondary School
Royal Teachers' Seminary
Weisswasser (Bohemia), Höh. Forstlehranstalt
Wels (Upper Austria), Stadtgemeinde
Werdau, Realschule
Wertheim a. M., Gymnasium
Wesel, Gymnasium
Municipal Infirmary
Municipal High School for Girls
Wetzlar, Gymnasium
Wiesbaden, Kgl. Realgymnasium
Oberrealschule
Reform-Realgymnasium
Girls' Higher Grade School
Mortuary of Municipal Infirmary
Oberrealschule am Zietenring
Wiesbaden, Intermediate School, Riederbergstrasse
Girls' Higher Grade School II., Dotzheimerstr.
Wilhelmsburg a. E., Realschule
Wilhelmshaven, Gymnasium
Deck Officers' School
Oberrealschule
Realschule
Wilmersdorf (Berlin), Goetheschule
Wismar, Girls' Higher Grade School
Wittenberg, Melanchthon-Gymnasium
Wolfenbüttel, Gymnasium
Realschule
Wollstern, Kgl. Realschule
Wongrowitz, Kgl. Gymnasium
Worms, Grand Ducal Gymnasium and Grand Ducal Realschule
Gymnasium
Würzburg, Royal Schoolmasters' Seminary
Realgymnasium
Pathological Inst. of the University
Chemical Inst. of the University
Physical Inst. of the University
Zabrze, Progymnasium
Gymnasium
Girls' Higher Grade School
Zagreb-Agram (Croatia), Jacob Rosskam
Zehlendorf (Teltow), Gymnasium
Zeitz, Realschule
Oberrealschule
Zillisheim (Alsace), Bischöfl. Progymnasium
Zittau, Realgymnasium
Zschopau, Royal Teachers' Seminary
Züllichau, Kgl. Pädagogium
Zürich, Riedtlischule
Institut Minerva
Zwickau i. S., Realgymnasium
Realgymnasium (repeat order)
Gymnasium

Testimonials as to Apparatus, and Fittings Supplied (Translations).

Schopfheim, Grossh. Baden, 9th November 1908.

The fittings supplied have given entire satisfaction, and have been erected in such a practical manner that only a few alterations have been necessary.

Prof. **F. Bissig,** Realschule.

Eisleben, 21st December 1908.
Hessestr. 21.

In conclusion, I must express to you my greatest satisfaction with the equipment of the Physics Room.

Fr. Willers, Head Teacher.

Innsbruck, 19th December 1908.

We are glad to state that we are perfectly satisfied with your mirror-screen- and curtain-devices.

Dr. **Greil,** Royal Imperial Anatomical Inst.

Eisleben, 10th December 1908.

I beg to state that your fitter is now busy on the equipment of the Physics Rooms, and as far as I can see everything is faultless.

Franz Willers, Head Teacher.

Duisburg, 30th September 1908.

The fittings supplied by you have arrived in good condition and are to our satisfaction.

Rektor **Nieland,** Städt. Mädchen-Mittelschule.

Einbeck, 1st May 1908.

The darkening arrangement supplied by you for the new building of the Realgymnasium here is now fixed and works well.

Stadtbauamt.

Osnabruck, 5th May 1908.

I am glad to say that the equipment of the Physics Room, which you took in hand is now complete. The fittings have won universal approval.

W. Pleister,
Teacher of Physics and Natural Philosophy, Intermediate School.

Charlottenburg, 16th March 1908.

Messrs. Max Kohl have carried out, according to my instructions and original drawings, the whole of the carpentry work including lead covering and flagging, for the new building of the Institute for Inorganic Chemistry of the Royal Technical High School, Berlin: this work being done in 1907. The work in question had reference to 80 running metres of work places with accessories: rincing troughs, flues for the places, general flues and ventilated cupboards. This work has all been carried out to my satisfaction.

Prof. Dr. **Erdmann,** Director of the Institute.

Borna, near Leipzig, 24th January 1908.

We are satisfied with the fittings supplied by you.

Rector Dr. **Fritzsche,** Realgymnasium.

Blankenese, 5th December 1907.

The darkening device, also blackboard and stink cupboard supplied by you have now been erected in the new Physics Room and are working excellently.

Prof. Dr. **Penseler,** Realschule.

Göttingen, 26th November 1907.

The arrangement for obscuring the fanlight, fitted by you in our Lecture Room, is working to our entire satisfaction, after we have made some slight alterations. The blind works with very little noise and excludes the light absolutely. Up to the present no hitch in the working has occurred.

Prof. Dr. **Herm. Th. Simon,**
Institute for Applied Electricity.

Czernowitz, 6th November 1907.

I am perfectly satisfied with the equipment (which is now completed), and beg to tender you my best thanks for same.

W. Kropatschek,
Curator of the Chemistry Section of the Realschule.

Vienna XIX/1, 7th October 1907.

I was greatly pleased with the fittings supplied (the following were supplied: Lecture Table, travelling Table, Stink Cupboard, etc.; also Chemical Utensils).

Prof. Dr. **Beutel,**
K. K. Lehrmittelbureau für gewerbl. Unterrichtsanstalten, Chemico-Technical Section.

St. Gallen, 6th October 1907.

The Lecture Table for Chemistry and Physics ordered from you arrived yesterday. I am very pleased with it. The table is quite an ornament to the lecture room.

H. Schmidt, Knabenrealschule.

Strassburg, 26th September 1907.

I beg to inform you that the darkening device fitted by you in the Physics Class Room has met with our fullest satisfaction both as regards material and the exclusion of light.

Schatzmeister **Julius Gava,** Bischöfl. Gymnasium.

Sinsheim, 22nd August 1907.

The fittings (experimental table, stink cupboard, aspirator and force pump) have now been put into use. We cannot refrain from expressing our satisfaction. The practical construction and neat workmanship have met with general approval.

Prof. **Kistner,** Grossh. badische Realschule.

Hilchenbach, 16th Juni 1907.

The table has arrived safely, and is satisfactory.

Oberlehrer **Mevius,** Seminary.

Dresden, 18th May 1907.

I am in receipt of the wall cupboard invoiced by you on the 3rd inst., also the apparatus debited to me on the 7th inst., and I am glad to state that the goods are as I wished, and from the short experience I have had of your apparatus, they work quite satisfactorily.

F. B. Lehmann.

Cottbus, 16th May 1907.

It is a particular pleasure to add that I have nothing but favourable opinions of the apparatus and fittings delivered by you.

Dr. **Buchhoft,** Städt. Realschule.

Duisburg-Meiderich, 10th March 1907. (Lower Rhine).

I beg to state that the efficiency of the Megadiascope is to our entire satisfaction. It has been of great service to us in a number of lantern lectures.

Prof. **Hermanni,** Realgymnasium.

Duderstadt, 12th October 1906.

Since Easter 1904, I have obtained for the Royal Gymnasium here 3 cupboards as catalogued by you, with which I am perfectly satisfied.

Prof. **Borgas.**

Innsbruck, 17th September 1906.

You have been of considerable service to the institute by complying with the wishes of the professors and sending plans and descriptions to the building authorities while the buildings were in the skeleton stage, and thus giving them valuable help. The interior fittings which you supplied later are excellent. The work tables, wall cupboards, collection boxes, Arendt lecture table with switchboard and rectifier, also the wall stink cupboards, blackboard stand and microscope table, etc. are all well constructed and work in the best possible manner.

Our school is being continually visited by German and foreign professional men, and great wonderment has been expressed at the way in which they work.

Ernst Pechlaner,
Professor of Chemistry at the Commercial Academy.

Königsberg, 10th August 1906.

We thank you for the precise manner in which you have supplied the articles and fittings for the Chemical Laboratory of the Kgl. Oberrealschule auf der Burg. All the things — the students' work tables, digestor, water jet blower, etc. — have met with universal approval.

Prof. Dr. **Mischpeter.**

Liegnitz, 10th August 1906.

The lecture table and other apparatus have arrived here safely, and I find them good.

Prof. **Paul Röhrich,** Kgl. Gymnasium, Johanneum.

Cleveland, Ohio, May 31, 1906.

The second consignment of apparatus was duly received in perfect order, and all is very satisfactory. The oil air pump and the Megadiascope are pleasing in the highest degree.

Dayton C. Miller,
Case School of Applied Science, Department of Physics.

St. Gallen, 5th June 1906.

I have tested the apparatus, and am, as in previous cases, quite pleased with the faultless construction thereof.

Dr. **H. Renfer,** Commercial Academy.

Chemnitz, 27th April 1906.

In reply to yours of the 23rd April, I am able to state that the exhibition cupboard supplied by your firm has by reason of its simple, practical, and entirely excellent construction, met with our fullest satisfaction. Articles of the most varied nature, which have been contained therein, were shown off to the best possible advantage. Also as regards dust-proof qualities the cupboard leaves nothing to be desired.

Kunstgewerbe-Verein.

Zeitz, 21st April 1906.

Many thanks for the excellent and well constructed equipment supplied for the physics classroom of the Realschule here and for the educational apparatus supplied.

Oberlehrer **Alwin Fischer,** Realschule.

Northeim, 16th March 1906.

I must express my satisfaction with all fittings supplied for the physics and chemistry class-rooms of the new Gymnasium here. The gas engine and dynamo work very well. The switchboard has found a good place in the physics class-room, thus enabling me to charge the accumulators (which are set up under the lecture table) conveniently on the spot; and I am able to feed the arc lamp direct from the machine.

Prof. Dr. **Fest.**

Kalocsa, 27th November 1905.

Before all I must express my best thanks for the lamp recently delivered. It entirely satisfies my demands. As to the equipment of the Physics Lecture Room, professional men and laymen alike are loud in their praise of the precise, practical and beautiful manner in which the work has been carried out.

Alex. Riegl, Curator of the Physics Department, Obergymnasium.

Strassburg (Alsace), 10th November 1905.

As the lecture table, blackboard stand, aspirator and force pump have come to hand, I am able to state to my great satisfaction that everything is working without a hitch, a proof of the fact (which we gladly recognise) that everything has been constructed with the greatest care and precision.

I would remark by the way that the neat and pleasing construction of the fittings has earned the entire approval both of the master and myself.

Julius Gava,
Treasurer and Director of the Bischofl. Gymnasium.

Kalocsa, 18th August 1905.

The transfer took place yesterday in the presence of the school officials. The Commission expressed its praise with the fittings delivered and with the excellent way in which things were erected.

Julius Hörl, Director of Obergymnasium.

Dresden, 4th August 1905.

. . . I have already fixed up the darkener and have put it to a thorough test. It fulfils its purpose without a fault and I must thank you.

Victor Graf v. Rex, Canalettostr. 8
(Dark Room of His Majesty King Frederick August of Saxony).

Milwaukee, 22nd May 1905.

The lecture table is now erected and is already in use. I hope that the table, which is excellent in its design, may continue for many years to render good service.

Max Griebsch, Teacher in Natural Philosophy, National German-American Teachers Seminary and German-English Academy.

Dornbirn, 20th May 1905.

As the fittings supplied by you for the Staats-Oberrealschule here have been in use for more than $1^1/_2$ years, I feel it my duty to express to you my most perfect satisfaction therewith.

The three large glass cupboards supplied by you for preserving physical apparatus are faultless; they shut well and are quite dust-proof. No hitch has occurred in connection with the Weinhold lecture table, even though it consists of a number of sections. The darkening arrangement for the 4 windows of the physics class-room, the aspirator, and the force pump, the blackboard stand with the two blackboards, etc. all work thoroughly well in spite of the great demands made upon them. The three phase-direct current plant together with switchboard, fitted by you, satisfies me in every respect; and also the numerous pieces of physical apparatus such as the large induction coil with X-ray outfit, the equipment for the Tesla high-tension experiments, for wireless telegraphy, and the Deprez d'Arsonval galvanometer, the quadrant electrometer, large electro-magnet and the auxiliary apparatus — all supplied from your works — make the work of teaching both to the scholar and teacher a genuine pleasure. We have especially been able to get beautiful radiographs and make good penetrations (some of them difficult ones) with the X-ray apparatus.

Dr. **Hans Zuchristian,** k. k. Professor.

St. Gallen, 3rd May 1905.

While thanking you for the careful manner in which the lecture table has been constructed . . .

Dr. **Renfer.**

Posen W. 3, 20th March 1905.

The lecture table has been received and erected. It has met with my entire satisfaction, and I willingly testify in this sense. My thanks for prompt delivery and good construction.

J. Czachowski, Mittelschullehrer.

Bozen, 16th January 1905.

In conclusion I would state that the physics lecture table which the town has purchased for our school is to my perfect satisfaction and excites the wonderment of all.

Dr. **Karl Krüse,** Professor at the Staatsoberrealschule.

Danzig-Langfuhr, 21st January 1905.

In response to your query, I am glad to say that the apparatus and fittings supplied by you have met with my satisfaction; this is especially so in regard to the wood-work (lecture table) and acoustical apparatus.

Prof. **M. Wien,**
Physical Institute of the Technical High School.

Altona, 18th January 1905.

The laboratory equipment handed over to me to-day by your engineer is satisfactory and in accordance with my wishes.

Prof. Dr. **Umber,**
Chief Physician of the Inside Department of the Municipal Infirmary.

Riga, 4th October 1904.

The Board cannot refrain from expressing to their warmest appreciation and best thanks for the fitting of apparatus for the Physics and Chemistry Departments which has been done, and which is excellent in every respect.

Governors of the Riga Commercial School.

Toledo, 13th September 1904.

I was glad to see your beautiful apparatus at the St. Louis Exhibition, and also thank you for having exhibited the pendulum apparatus. The Americans have nothing but praise for the magnificent German exhibit of scientific apparatus. It surpasses everything else in this respect which is exhibited. I can only congratulate you heartily. — (The equipment of a Physics Lecture Room was exhibited to the order of the Reichskommissar, this exhibit being included in the Special Exhibit of the Royal Prussian Ministry of Education.)

Prof. **Fred. J. Hillig,** St. John's College.

Iglau, 26th May 1904.

I wish first of all to state that the wall heliostat is working to my entire satisfaction. You may rest assured that I will certainly consider your firm in any future orders, and all the more so since the complete remodelling of my physics department will necessitate a great deal of new equipment.

Prof. Dr. **Lauter,** k. k. Staats-Gymnasium.

Hitzkirch, 1st May 1904.

Your consignment of the lecture table and stink cupboard has arrived in good condition; I am perfectly satisfied in every respect with the articles named.

Prof. **J. Brun,** Seminarlehrer.

Duisburg, 28th April 1904.

The lecture table has arrived safely, and as the fitting has not been carried out, I beg to thank you for the substantial manner in which it has been constructed and for the way in which you have correctly anticipated my wishes.

Oberlehrer Dr. **Koch,** Städt. Realgymnasium.

Sorau, N.-L., 21st April 1904.

I am well satisfied with the lecture table and with the three work tables (each having 4 places) supplied by you.

Dr. **Buntrock,**
Head of the Department of Dyeing, Printing, Bleaching and Finishing of the Prussian Higher School for the Textile Industry.

Přibram, 11th February 1904.

I feel it a duty to express to you my especial thanks for the plant supplied to me last autumn, consisting of a Deutz gas engine, and Schumann dynamo purchased from you $1^1/_2$ years ago.

The plant works excellently and especially so in connection with the 40 hour initial charge of a battery of accumulators recently installed; it works without any hitch. Again let me thank you for the consignment.

Prof. Dr. **Jos. Theurer,** k. k. Bergakademie.

Kandy, Ceylon, 29th October 1903.

The heliostat is now in good condition and I have every reason to be satisfied with it.

Jean Dohet, Papal Seminary.

Leipzig, 4th November 1903.

I hereby state that Messrs. Max Kohl A. G. of Chemnitz have supplied the following for the new Lecture Room of the Laboratory for Applied Chemistry, Leipzig University:

1. A modern lecture table with electrical switchboard, battery of accumulators, pneumatic water and mercury troughs, leads for compressed air and gases, with gas draught pipes working from underneath; explosion slabs; gas and water installation, etc.
2. The back wall of lecture room with stink cupboards, blackboard and glass slab fittings, suspension device for tables, projection table, reagent stand, etc.
3. Three darkening devices, for the fanlight and the two rows of windows of different sizes on the side walls of the lecture room.
4. An electrically driven blower.

All these fittings have been constructed in a reliable and substantial manner with due regard to the wishes expressed in regard to them, and with entire satisfaction.

Die Direktion des Laboratoriums für angewandte Chemie der Universität Leipzig.

Prof. Dr. **E. Beckmann,** Direktor.

Mons, 16th September 1903.

I am glad to say that the didactic furniture which you have supplied, to the value of 90,000 francs, gives us entire satisfaction. It comprises the entire equipment of the chemical laboratories and of the large Chemistry, Electricity and Physics Lecture Rooms, consisting of lecture and work tables, large and small stink cupboards, wainscots and large panels. The whole is supplied with leads for water, gas, compressed and rarified air, and of high and low tension continuous and triphase currents.

It is also a pleasure to me to mention the care you have taken and the courtesy with which you fulfilled all our wishes and furnished us with all information desired.

Lastly, I am not less satisfied with your various physical and electrical apparatus, especially your induction coil of 500 mm spark-length and the apparatus for the Hertz, Tesla and Roentgen experiments.

Le Directeur de l'École des mines du Hainaut,
Professeur de Physique industrielle et d'Électricité
A. Macquet.

St. Gallen, 9th May 1905.

The lecture table is exactly in conformity with my wishes and is well constructed. The table form experimental switchboard for 30 amps. and 120 volts D. C., with precision instruments, works faultlessly. The other apparatus are also satisfactory, and I can thus express to you our fullest satisfaction again this time for the instruments and fittings supplied. We shall not fail to bear you in mind in our future requirements.

Prof. Dr. **H. Renfer,** Commercial Academy.

References as to Darkening Devices with Electric Motor Drive.

Aix-la-Chapelle, Reiff-Museum

Berlin, Ist Chemical Institute of the University
Physical Institute of the University
Anatomical Institute of the Veterinary High School
Preuss. Kultusministerium für den Hörsaal der Deutsch. Unterr.-Ausstellung, St. Louis, 1904
Kaiserin-Friedrich-Haus
Commercial High School

Brünn (Moravia), Physical Inst. of the Royal Imperial German Technical High School
Electrotechnical Institute

Charlottenburg, Institute for Chemical Technology of the Royal Technical High School
Chemical Institute of the Royal Technical High School

Chemnitz, Pathological Hygienic Institute of the Municipal Infirmary (also fanlight)
König-Albert-Museum (also fanlight)
Kgl. Techn. Staats-Lehranstalten

Darmstadt, Technical High School (also fanlight)
Technical High School extensions (3 fanlights)

Dresden, Kgl. Frauenklinik (also fanlight)
Royal Technical High School

Frankfort-on-the-Main, Akademie für Sozial- und Handelswissenschaften
Physical Institute (also fanlight)

Geneva, Bacteriological Inst. of the University

Göttingen, Institute for Applied Electricity (also fanlight)

Innsbruck, Commercial Academy

Jena, Mineralogical Inst. of the University

Kiel, Chemical Institute of the University (large lecture hall)

La Plata (Argentine), Physical Institute of the University

Leipzig, Lab. for Applied Chemistry, University (also fanlight)
Physical Inst. of the University (also fanlight)
Pathological Inst. of the University (also fanlight)
Hygienic Inst. of the University (also fanlight)
Universitäts-Frauenklinik (also fanlight)
Chemical Laboratory, Liebigstrasse (also fanlight)

Magdeburg, Kgl. Maschinenbauschule

Mons (Belgium), École des mines du Hainaut

Prague, Physiological Inst. of the Royal Imperial Bohemian University

Tomsk, Physics Lab. of the Technological Institute

Tübingen, Chemical Institute of the University

Wilmersdorf (Berlin), Goetheschule

Würzburg, Pathological Inst. of the University

Göttingen, 26th November 1907.

The fanlight darkening arrangement for our lecture room, fitted by you, works to our entire satisfaction after we have made a few slight alterations. The blind works with very little noise and sufficiently rapidly, and completely excludes light. Up to the present no hitch in the working has been observed.

Prof. Dr. **Herm. Th. Simon,**
Institute for Applied Electricity.

Estimates of Cost of Fittings

for the Physics and Chemistry Class Rooms and the Preparation Rooms, Museum, and Students' Work Rooms.

In the following numbers 1—3 it is understood that quite separate rooms are available for Physics and Chemistry; while in Nos. 4—6 it is assumed that Physics and Chemistry are taught in one general room. Moreover, in the collections of estimates drawn up, consideration has been given to the extent of means available for equipment purposes.

Proportionate increases are made in the prices in the case of the window darkeners when the number and size of the windows differ from those given in the lists. This increase also takes place in connection with the experimental switchboards when a different voltage and different kind of current are available from those shown in the estimates, or when another type is desired.

With Separate Rooms for Physics and Chemistry.

Collection 1. Elaborate Equipment.

A) Physics Class Room.

	£ s. d.
50,003. 1 Weinhold Lecture Table, 4 m long, with oak top	27. 0. 0
50,012. 1 Extension Leaf, 80 em long	1. 8. 0
50,083. 1 Travelling Table for supplementing the lecture table, on movable double castors, 1 m long	5. 5. 0
50,090. 1 Oak Stink Cupboard for placing on the gas draught pipe of the lecture table, with door	1. 7. 0
50,095. 1 Draught Pipe for placing over the flue of lecture table	0. 17. 0
50,109. 1 Electrie Soffit Curtain for lighting the lecture table and blackboard, 4 m long, with 8 glow lamp holders	7. 0. 0
In the case of lighting by gas the following is used instead of the soffit curtain:	
50,104. 1 Gas Distributor £ 1. 10. 0	
50,103. 4 Burners with large shade at £ 0 11. 0 eaeh ,, 2. 4. 0	
£ 3. 14. 0	
50,115. 1 I-beam with traveller	1. 12. 0
50,116. 1 Screw Pulley to earry 100 kg	2. 5. 0
50,118. 1 Bracket for mirror galvanometer	0. 8. 0
50,124. 1 Transparent Galvanometer Scale of frosted glass, 2 m long	0. 17. 0
50,127. 1 Aspirator (Arzberger and Zulkowsky's) and 1 Foree Pump, with all leads, mounted on a board	6. 0. 0
50,167. 1 Blaekboard stand with cupboard substrueture, with 2 blaekboards, each board 1.8 m long and 1 m high, each movable	13. 10. 0
50,181. 1 Wall Stink Cupboard lined with slate slabs, with 1 burner for the draught flame, without gas lead	12. 0. 0
50,182. 1 Window Darkener for 3 windows, size of windows 1.8×3 m; for 1 window £ 7. 5. 0	21. 15. 0
50,185. 1 Rope Pulley	0. 13. 6
50,187. 1 Winder with auto eateh, large	0. 19. 0
50,189. 10 m wire rope, 1 m 0. 0. 9	0. 7. 6
Carried forward £	103. 4. 0

	£ s. d.
Brought forward	103. 4. 0
50,202. 1 Small Cupboard for Chemicals	2. 8. 0
50,228. 1 Hoist for plans, drawings, etc., 2 m long	1. 0. 0
50,332. 1 Laboratory Basin	2. 5. 0
Total £	108. 17. 0
Additional to above:	£ s. d.
50,209. 1 Wall Heliostat, wall thickness taken as up to 66 cm	7. 5. 0
— 1 Experimental Switchboard Type B_1 (220 volts), as blackboard, with dead-beat preeision measuring instruments	24. 5. 0

For Estimates as to Projector Equipments, see Special Section of this List.

B) Preparation Room for Physics.

(For the Teacher.)	£ s. d.
50,240. 1 Work Table, 3 m long	10. 0. 0
50,241. 1 Work Table	2. 10. 0
50,242. 1 Parallel Vice, rotary and detachable	1. 7. 0
50,243. 1 small Anvil	0. 18. 0
50,245. 1 Cupboard with 6 drawers, for wires, terminals, hose, corks, etc.	3. 10. 0
50,246. 1 Tool Cupboard with mechanics' tools and turning tools	8. 12. 0
50,247. 1 Tool Cupboard with Joiners' Tools	4. 10. 0
50,256. 1 grindstone	2. 0. 0
50,257. 1 Slide Rest Lathe, for Treadling	19. 0. 0
— 1 Planing Bench, 1.80 m long, with front and back press	3. 12. 0
50,267. 1 Bracket for taking the balance	0. 18. 0
50,323. 1 Cupboard for Chemicals, 1 m long	6. 2. 0
50,332. 1 Porcelain Laboratory Basin	2. 5. 0
50,182. 1 Window Darkener for 1 window, size 1.8×3 m	7. 5. 0
50,184. 1 Rope Pulley, small	0. 9. 6
50,186. 1 Winder, with auto-catch, small	0. 13. 6
50,188. 10 m Wire Rope, 1 m = £ 0. 0. 5	0. 4. 2
Total £	73. 16. 2

C) Physics Museum.

	£ s. d.
50,280. 1 Glass Cupboard (standing alone), 3 m long, 2.3 m high and 0.85 m deep inside	23. 15. 0
50,282. 2 Wall Cupboards, 3 m long, 2.3 m high, 0.6 m deep inside: 1 cupboard = £ 17. 10. 0	35. 0. 0
Total £	58. 15. 0

D) Physics Students' Room.

	£ s. d.
— 2 Work Tables (standing alone), 3 m long, 1.40 m wide, 0.90 m high, with 30 mm thick mortised oak top and 8 lock-up drawers: one table = £ 11. 10. 0	23. 0. 0
— 1 Wall Work Table, 3 m long, 0.70 m wide, 0.90 m high, with 30 mm mortised oak top and 4 lock-up drawers	6. 15. 0
— 4 Work Tables, 1.50 m long, 0.70 m wide, 0.90 m high, with oak top 25 mm thick: one table = £ 2. 2. 0	8. 8. 0
50,118. 2 Wall Brackets for galvanometers, at £ 0. 8. 0	0. 16. 0
50,244. 1 Wall Rack for glass tubes and rods	2. 15. 0
50,267. 2 Wall Brackets for taking the balances at £ 0. 18. 0	1. 16. 0
50,271. 1 Blast Table for glass blowing, with cylindrical bellows, glass cutting knife, glass tools and burner	4. 15. 0
50,282. 1 Wall Cupboard, 3 m long, for preserving apparatus	17. 10. 0
Total £	65. 15. 0

E) Chemistry Class Room.

	£ s. d.
50,052. 1 Chemistry Lecture Table, 4 m long	31. 13. 0
50,011. 1 Extension Leaf, 50 cm long	1. 1. 0
50,083. 1 Travelling Table on movable double castors, 1 m long	5. 5. 0
— Staining the top of travelling table, black	0. 3. 6
50,090. 1 Draught Box for setting on the flue in the lecture table, with door	1. 7. 0
50,095. 1 Draught Pipe for placing over the flue in lecture table	0. 17. 0
50,109. 1 Electric Soffit Curtain for lighting the lecture table and blackboard, 4 m long, with 8 glow lamp sockets	7. 0. 0
In the case of gas lighting, the following should be chosen instead of the soffit curtain:	
50,104. 1 Gas Distributor £ 1. 10. 0	
50,103. 4 Light Burners with large shade, at £ 0. 11. 0 £ 2. 4. 0	
£ 3. 14. 0	
50,127. 1 Aspirator (Arzberger and Zulkowsky's) with 1 force pump, mounted, with all leads, on a board	6. 0. 0
50,167. 1 Blackboard Stand with cupboard substructure, with 2 blackboards, each board 1.8 m long, 1 m high, each movable	13. 10. 0
Carried forward £	66. 16. 0

	£ s. d.
Brought forward	66. 16. 0
50,181. 1 Wall stink Cupboard, lined with slate tiles and with burner for the draught flame, without gas lead	12. 0. 0
50,182. 1 Window Darkener, for 3 windows, size of window taken as 1.8 m × 3 m. For 1 window = £ 7. 5. 0	21. 15. 0
50,185. 1 Rope Pulley, large	0. 13. 6
50,187. 1 Winder with auto-catch	0. 19. 0
50,189. 10 m Wire Rope, at £ 0. 0. 9	0. 7. 6
50,228. 1 Hoist for tables, plans and drawings, etc., 2 m long	1. 0. 0
50,323. 1 Cupboard for Chemicals, 1 m long	6. 2. 0
50,332. 1 Porcelain Laboratory Basin	2. 5. 0
Total £	111. 18. 0

Additional to above:

	£ s. d.
— 1 Experimental Switchboard Type B1 (220 volts), as blackboard, with dead-beat precision instruments	24. 5. 0

For Estimates as to Projector Outfits, see Special Section of this List.

F) Chemistry Preparation Room.

(For the Teacher.)

	£ s. d.
50,240. 1 Work Table, 3 m long	10. 0. 0
For above:	
— Gas Lead, Water Lead, Porcelain Basin with waste, and a bottle rack on the work table	3. 18. 0
50,244. 1 Wall Rack for glass tubes and glass rods	2. 15. 0
50,255. 1 Tool Board with 2 drawers, including tools	3. 5. 0
50,267. 1 Bracket for holding balance	0. 18. 0
50,271. 1 Blast Table, with cylindrical bellows, glass cutting knife, 5 glass blowers' tools and burners	4. 15. 0
50,297. 1 Stink Cupboard, with cupboard substructure, 1.15 m long, 2.3 m high and 0.7 m deep, with gas and water leads	12. 10. 0
50,314. 1 Iron Table with hood: table 1.50 m long, 60 cm wide and 90 cm high, laid with red tiles	7. 5. 0
— 1 Chemical Cupboard, 1.5 m long, 2.2 m high; body 50 cm deep, top portion 30 cm deep	9. 2. 0
50,328. 1 Flushing Table and drying board	4. 4. 0
50,182. 1 Window Darkener; size of window taken as 1.8 m×3 m	7. 5. 0
50,184. 1 Rope Pulley, small	0. 9. 6
50,186. 1 Winder with auto-catch, small	0. 13. 6
50,188. 10 m Wire Rope, at 5 d.	0. 4. 2
Total £	67. 4. 2

G) Collection Room for Chemical Apparatus and Utensils.

	£ s. d.
50,280. 1 Free-standing Glass Cupboard, 3 m long, 2.3 m high, 0.85 m deep inside	23. 15. 0
50,282. 2 Wall Cupboards, 3 m long, 2.3 m high, 0.6 m deep inside, at £ 17. 10. 0	35. 0. 0
50,381. 1 Mineral Cupboard with 4 show cases and 24 drawers, 3 m long	20. 2. 0
Total £	78. 17. 0

H) Students' Work Room for Chemistry.

	£ s. d.
50,291. 3 Students' Work Tables each seating 8 scholars: 3 m long, 1.40 m wide, 0.90 m high, at £ 38. 10. 0	115. 10. 0
50,302. 1 Stink Cupboard (with 4 compartments), 4 m long, 2.3 m high, 0.7 m deep inside, with gas and water leads	39. 15. 0
50,324. 1 Chemical Cupboard, 1.30 m long, 2.20 m high, 0.30 m deep inside	7. 10. 0
50,325. 1 Chemical Cupboard, 1.20 m long, 2.20 m high, with projecting lower portion	8. 5. 0
50,328. 1 Flushing Table and drying board	4. 4. 0
50,244. 1 Wall Rack for glass tubes and rods	2. 15. 0
50,267. 2 Wall brackets for containing balances, at £ 0. 18. 0 each	1. 16. 0
50,271. 1 Blast Table with cylindrical bellows, glass cutting knives, glass tools, and burners	4. 15. 0
50,282. 1 Wall Cupboard for the Chemical Apparatus, 3 m long	17. 10. 0
50,314. 1 Iron Table with hood: table 1.50 m long, laid with red tiles, 60 cm wide, 90 cm high	7. 5. 0
— 1 Tank for distilled water, 100 l capacity, on wood base	2. 18. 0
Total	£ 212. 3. 0

I) Dark Room.

	£ s. d.
50,385. 1 large Photographic Work Table, 1.80 m long, with rincing basin, 2 drawers and bottle rack	5. 5. 0
50,392. 1 Bottle Stand, 1 m wide, 20 cm deep, 2 m high	1. 8. 0
50,393. 1 Photometry Board, 4 m long	2. 8. 0
50,394. 1 Hot Water generator, gas-heated	1. 15. 0
Total	£ 10. 16. 0

Total Cost of Collection I.

	£ s. d.	£ s. d.
A) Class Room (for Physics)	**108. 17. 0**	
With Experimental Switchboard and Heliostat		**140. 7. 0**
B) Preparation Room (for Physics)	**73. 16. 2**	**73. 16. 2**
C) Collection Room „ „	**58. 15. 0**	**58. 15. 0**
D) Scholars' Work Room „ „	**65. 15. 0**	**65. 15. 0**
E) Class Room (for Chemistry)	**111. 18. 0**	
With Experimental Switchboard		**136. 3. 0**
F) Preparation Room (for Chemistry)	**67. 4. 2**	**67. 4. 2**
G) Collection Room „ „	**78. 17. 0**	**78. 17. 0**
H) Scholars' Work Room (for Chemistry)	**212. 3. 0**	**212. 3. 0**
I) Dark Room „ „	**10. 16. 0**	**10. 16. 0**
Grand Total, without Heliostat or Switchboard	**£ 788. 1. 4**	
Grand Total, including Wall Heliostat and Experimental Switchboards		**£ 843. 13. 4**

Collection 2. Moderate Equipment.

A) Physics Class Room.

	£ s. d.
50,002. 1 Lecture Table (Weinhold's), 3.5 m long, with all accessories	24. 4. 0
50,083. 1 Travelling Table on movable double castors	5. 5. 0
Carried forward	£ 29. 9. 0

	£ s. d.
Brought forward	29. 9. 0
50,090. 1 Draught Chamber for placing on the draught flue in the lecture table	1. 7. 0
50,095. 1 Draught Pipe	0. 17. 0
50,105. 4 Shades for electric glow lamps, without lamps: each £ 0. 3. 6.	0. 14. 0
In the case of gas lighting being available in lieu of above, then:	
50,104. 1 Gas Distributing Device £ 1. 10. 0	
50,103. 3 Lighting Burners with large shade, at £ 0. 11. 0 each „ 1. 13. 0	
£ 3. 3. 0	
50,115. 1 I-beam with traveller.	1. 12. 0
50,127. 1 Arzberger and Zulkowsky Aspirator and 1 Force Pump, mounted together on 1 board	6. 0. 0
50,168. 1 Blackboard Stand with fluted substructure, with a blackboard 1.8 m long and 1 m high	6. 15. 0
50,181. 1 Wall Stink Cupboard, lined out with slate slabs and with 1 burner for draught flame; without gas lead	12. 0. 0
50,182. 1 Window Darkener, for 3 windows, size of window taken as 1.8 m×3 m. For 1 window at £ 7. 5. 0	21. 15. 0
50,185. 1 Rope Pulley, large	0. 13. 6
50,187. 1 Winder, with auto-catch, large	0. 19. 0
50,189. 10 m Wire Rope, at £ 0. 0. 9	0. 7. 6
Total	£ 82. 9. 0

Additional to above:	£ s. d.
50,206. 1 Wall Heliostat, wall thickness taken as 60 cm	4. 15. 0
— 1 Experimental Switchboard, Type B_1 (220 volts), as blackboard, with dead-beat precision instruments.	24. 5. 0

For Estimates as to Projector Outfits, see Special Section of this List.

B) Physics Preparation Room.

	£ s. d.
50,239. 1 Preparation Table, 2.50 m long	8. 15. 0
50,241. 1 Work Table, 1.80 m long	2. 10. 0
50,247 a. 1 Tool Cupboard, with joiner's and mechanic's tools	5. 10. 0
50,323. 1 Chemical Cupboard, 1.00 m long	6. 2. 0
50,332. 1 Laboratory Basin	2. 5. 0
Total	£ 25. 2. 0

C) Physics Museum.

	£ s. d.
50,281. 1 Free-standing Glass Cupboard, 2.3 m long, 2.3 m high, 0.85 m inside depth.	18. 15. 0
50,283. 2 Wall Cupboards, 2.3 m long, 2.3 m high, 0.6 m inside depth: at £ 14. 1. 0	28. 2. 0
Total	£ 46. 17. 0

D) Chemistry Class Room.

	£ s. d.
50,051. 1 Chemistry Lecture Table, 3.50 m long	28. 18. 0
50,090. 1 Draught Chamber for placing on the flue in lecture table; with door	1. 7. 0
Carried forward	£ 30. 5. 0

	£ s. d.
Brought forward	30. 5. 0
50,095. 1 Draught Pipe for placing on the flue in lecture table	0. 17. 0
50,105. 4 Shades for electric glow lamps, without lamps, at £ 0. 3. 6	0. 14. 0
If for gas lighting instead of above, then:	
50,104. 1 Gas Distributing Device . £ 1. 10. 0	
50,103. 3 Lighting Burners, with large shade, at £ 0. 11. 0 . . . ,, 1. 13. 0	
	£ 3. 3. 0
50,168. 1 Blackboard Frame with pillar substructure, with a blackboard 1.8 m long and 1 m high	6. 15. 0
50,181. 1 Wall Stink Cupboard, lined out with slate slabs, and with 1 burner for the draught flame; without gas lead	12. 0. 0
50,127. 1 Aspirator (Arzberger and Zulkowsky's) and 1 force pump, mounted on 1 board	6. 0. 0
Total £	56. 11. 0

Additional:	£ s. d.
— 1 Type B_1 Experimental Switchboard (220 volts), as blackboard, with dead-beat precision instruments	24. 5. 0

For Estimates as to Projector Outfits, see Special Section of this List.

E) Chemistry Preparation Room.

	£ s. d.
50,239. 1 Work Table, 2.5 m long	8. 15. 0
For above: Gas Lead, water lead, porcelain basin with waste and one bottle stand on the work table	3. 18. 0
50,255. 1 Tool Board with 2 drawers	3. 5. 0
50,297. 1 Stink Cupboard, 1.15 m long, 2.30 m high, 0.7 m deep, with gas and water leads	12. 10. 0
50,323. 1 Chemical Cupboard, 1 m long	6. 2. 0
50,328. 1 Flushing Table and drying board	4. 4. 0
Total £	38. 14. 0

F) Chemistry Collection Room.

	£ s. d.
50,283. 2 Wall Cupboards, 2.3 m long, 2.3 m high, 0.6 m deep inside, at £ 14. 1. 0	28. 2. 0

G) Scholars' Work Room.

	£ s. d.
50,291. 2 Students' Work Tables each for 8 scholars: 3 m long, 1.40 m wide, 0.90 m high, at £ 38. 10. 0 each	77. 0. 0
50,300. 1 3-compartment Stink Cupboard, 3 m long, 2.30 m high, 0.70 m deep, with gas and water leads	29. 15. 0
50,324. 1 Chemical Cupboard, 1.30 m long, 2.20 m high, 0.30 m deep inside	7. 10. 0
50,328. 1 Rincing Table and Drying Board	4. 4. 0
50,267. 2 Wall brackets on which to erect the balances, at £ 0. 18. 0 each	1. 16. 0
50,271. 1 Blast Table, for glass-blowing, with cylindrical bellows, glass cutting knives, glass-working tools and burners	4. 15. 0
50,282. 1 Wall Cupboard for Apparatus, 3 m long	17. 10. 0
Total £	142. 10. 0

Total Cost of Collection 2.

	£ s. d.	£ s. d.
A) Class Room (for Physics)	**82. 9. 0**	
With Wall Heliostat and Experimental Switchboard (for Physics)		**111. 9. 0**
B) Preparation Room (for Physics)	**25. 2. 0**	**25. 2. 0**
C) Museum ,, ,,	**46. 17. 0**	**46. 17. 0**
D) Class Room (for Chemistry)	**56. 11. 0**	
With Eperimental Switchboard		**80. 16. 0**
E) Preparation Room (for Chemistry)	**38. 14. 0**	**38. 14. 0**
F) Collection Room ,, ,,	**28. 2. 0**	**28. 2. 0**
G) Students' Work Room (for Chemistry)	**142. 10. 0**	**142. 10. 0**
Grand Totals: Without Heliostat or Experimental Switchboard	**£ 420. 5. 0**	
With Wall Heliostat and Experimental Switchboard		**£ 473. 10. 0**

Collection 3. Simple Equipment.

A) Physics Class Room.

	£ s. d.
— 1 Weinhold Lecture Table, 3 m long, without gas flue, otherwise as No. 50,001	21. 0. 0
— 1 Travelling Table (on 4 legs), running on turning double castors	3. 12. 0
50,105. 4 Shades for glow lamps: without lamps. Each £ 0. 3. 6	0. 14. 0
In case gas is laid on, then instead of above:	
50,104. 1 Gas Distributing Device £ 1. 10. 0	
50,103. 3 Lighting Burners with large shade; each £ 0. 11. 0 . . ,, 1. 13. 0	
£ 3. 3. 0	
50,128. 1 Arzberger and Zulkowsky aspirator and 1 force pump, mounted on one board: aspirator with mercury manometer	5. 10. 0
50,168. 1 Blackboard Frame (pillar substructure), with a blackboard: board 1.8 m long, 1 m high	6. 15. 0
50,182. 1 Window Darkener for 3 windows: size of windows taken as 1.8×3 m. For 1 window £ 7. 5. 0	21. 15. 0
50,185. 1 Rope Pulley	0. 13. 6
50,187. 1 Winder with auto-catch	0. 19. 0
50,189. 10 m Wire Rope at £ 0. 0. 9 per meter	0. 7. 6
Total £	61. 6. 0

B) Physics Preparation Room.

	£ s. d.
— 1 Work Table, 2.5 m long, with 30 mm mortised oak top, on 4 legs, with 3 drawers	4. 11. 0
50,248. 1 Wall Board with 2 boxes; containing Mechanics' and Joiners' Tools	3. 15. 0
Total £	8. 6. 0

C) Physics Museum.

	£ s. d.
50,281. 1 Free-standing Glass Cupboard, 2.3 m long, 2.3 m high, 0.85 m deep inside	18. 15. 0
50,283. 2 Wall Cupboards, 2.3 m long, 2.3 m high, 0.6 m deep inside. Each £ 14. 1. 0	28. 2. 0
Total £	46. 17. 0

D) Chemistry Class Room.

	£ s. d.
50,050. 1 Chemistry Lecture Table, 3 m long .	25. 12. 0
50,090. 1 Draught Box for setting on the gas offtake in the lecture table, with door .	1. 7. 0
50,095. 1 Draught Pipe for placing over the flue in the lecture table	0. 17. 0
50,105. 4 Shades for electric glow lamps: without lamps. Each £ 0. 3. 6	0. 14. 0
In case gas-lighting is used instead, then:	
50,104. 1 Gas Distributing Device. £ 1. 10. 0	
50,103. 3 Lighting Burners with large shade. Each, £ 0. 11. 0 . „ 1. 13. 0	
£ 3. 3. 0	
50,128. 1 Arzberger and Zulkowsky Aspirator (with mercurial gauge), and 1 force pump: mounted on 1 board	5. 10. 0
50,168. 1 Blackboard Frame (with pillar substructure), with a blackboard 1.8 m long and 1 m high	6. 15. 0
50,181. 1 Wall Stink Cupboard, lined out with slate slabs, and with burner for the draught flame: without gas lead	12. 0. 0
Total £	52. 15. 0

E) Chemistry Preparation Room.

	£ s. d.
— 1 Work Table, 2.5 m long, with 4 legs and 3 drawers, with half-round porcelain basin having waste valve, and 1 tap above	6. 2. 0
50,323. 1 Chemical Cupboard, 1 m long	6. 2 .0
50,328. 1 Flushing Table and drying board . .	4. 4. 0
Total £	16. 8. 0

F) Chemistry Collection Room.

	£ s. d.
50,283. 2 Wall Cupboards, 2.3 m long, 2.3 m high, 0.6 m deep inside. Each £ 14. 1. 0	28. 2. 0
Total £	28. 2. 0

G) Students' Work Room for Chemistry.

	£ s. d.
— 2 Free-standing Work Tables, 3 m long, 1.40 m wide, 0.90 m high, with mortised oak top and 6 massive legs of pine, 8 lock-up drawers, 8 gas taps, 2 water taps and 1 half-round porcelain basin. Each £ 18. 0. 0	36. 0. 0
— 1 Stink Cupboard, 2 m long, 0.70 m deep, 2.30 m high, with 2 compartments, gas and water leads, resting on 4 massive legs	14. 10. 0
50,328. 1 Flushing Table and drying stand . .	4. 4. 0
50,323. 1 Chemical Cupboard, 1 m long	6. 2. 0
Total £	60. 16. 0

Total Cost of Collection 3.

	£ s. d.
A) Class Room . . . . . (for Physics)	**61. 6. 0**
B) Preparation Room . . . . . „ „	**8. 6. 0**
C) Museum . . . . . „ „	**46. 17. 0**
D) Class Room . . . . . (for Chemistry)	**52. 15. 0**
E) Preparation Room . . . . . „ „	**16. 8. 0**
F) Museum . . . . . „ „	**28. 2. 0**
G) Students' Work Room . . . „ „	**60. 16. 0**
Grand Total £	**274. 10. 0**

Where Physics and Chemistry are taught in one Room.

Collection 4. Elaborate Equipment.

A) Class Room for Physics and Chemistry.

	£ s. d.
50,003. 1 Weinhold Lecture Table, 4 m long, with all accessories	27. 0. 0
50,012. 1 Extending Leaf, 80 cm long.	1. 8. 0
50,083. 1 Travelling Table on movable double castors, 1 m long	5. 5. 0
50,090. 1 Draught Box for placing over the gas flue in the lecture table, with door . . .	1. 7. 0
50,095. 1 Draught Pipe for setting on the draught channel in the lecture table	0. 17. 0
50,109. 1 Electric Soffit Curtain for lighting the lecture table and the blackboard, 4 m long, with 8 glow lamp sockets	7. 0. 0
In case of gas lighting, the following must be selected in lieu of the curtain:	
50,104. 1 Gas Distributing Device. £ 1. 10. 0	
50,103. 4 Lighting Burners with large shade. Each £ 0. 11. 0 . „ 2. 4. 0	
£ 3. 14. 0	
Carried forward £	42. 17. 0

	£ s. d.
Brought forward	42. 17. 0
50,115. 1 I-beam with traveller	1. 12. 0
50,116. 1 Screw Pulley for 100 kg carrying capacity	2. 5. 0
50,118. 1 Bracket for the mirror galvanometer.	0. 8. 0
50,124. 1 Transparent Scale of frosted glass, 2 m long	0. 17. 0
50,127. 1 Arzberger and Zulkowsky Aspirator and 1 force pump, mounted on 1 board .	6. 0. 0
50,167. 1 Blackboard Frame with cupboard substructure, with 2 blackboards: each board 1.8 m long, 1 m high, both movable . .	13. 10. 0
50,181. 1 Wall Stink Cupboard lined out with slate slabs, and with 1 burner for the draught flame: without gas lead	12. 0. 0
50,182. 1 Window Darkener for 3 windows; size of window taken as 1.8 m × 3 m. For 1 window £ 7. 5. 0	21. 15. 0
50,185. 1 Rope Pulley, large	0. 13. 6
50,187. 1 Hoisting Gear, large	0. 19. 0
50,189. 10 m Wire Rope at £ 0. 0. 9 per metre	0. 7. 6
Carried forward £	103. 4. 0

	£ s. d.
Brought forward	103. 4. 0
50,228. 1 Hoisting Device for plans, drawings, tables, etc.	1. 0. 0
50,323. 1 Chemical Cupboard, 1 m long	6. 2. 0
50,332. 1 Laboratory Basin	2. 5. 0
Total	£ 112. 11. 0

Additional:	£ s. d.
50,209. 1 Wall Heliostat, thickness of wall taken as 66 cm	7. 5. 0
— 1 Experimental Switchboard, Type B_1, as blackboard, with dead-beat precision instruments, for 220 volts direct current	24. 5. 0

For Estimates as to Projector Outfits, see Special Section of this List.

B) Preparation Room for Physics and Chemistry.

	£ s. d.
50,240. 1 Work Table, 3 m long	10. 0. 0
For above: Gas lead, water lead, porcelain basin with waste and 1 bottle stand on the work table	3. 18. 0
50,241. 1 Work Table, 1.8 m long	2. 10. 0
50,242. 1 Parallel vice, rotary and detachable	1. 7. 0
50,243. 1 Small Anvil	0. 18. 0
50,244. 1 Wall Rack for glass tubes and rods	2. 15. 0
50,245. 1 Cupboard for materials, with 6 drawers	3. 10. 0
50,246. 1 Tool Cupboard with mechanic's and turning tools	8. 12. 0
50,247. 1 Tool Cupboard with Carpentry tools	4. 10. 0
50,256. 1 Grindstone	2. 0. 0
50,257. 1 Slide-rest Lathe for treadling	19. 0. 0
— 1 Planing Bench, 1.80 m long, with front and back press	3. 12. 0
50,267. 1 Balance Wall-bracket	0. 18. 0
50,271. 1 Glass-blowing Table, with cylindrical bellows, glass-cutting knife and tools, and burners	4. 15. 0
50,297. 1 Stink Cupboard, 1.15 m long, 2.30 m high and 0.7 m deep, with gas and water leads	12. 10. 0
50,314. 1 Iron Table with hood: table 1.50 m long, 0.60 m wide, 0.90 m high, covered with red tiles	7. 5. 0
— 1 Chemical Cupboard, 1.5 m long, 2.2 m high; body 50 cm deep; top 30 cm deep	9. 2. 0
50,328. 1 Rincing Table and drying board	4. 4. 0
50,182. 1 Window Darkener for 1 window taken as measuring 1.8×3 m	7. 5. 0
50,184. 1 Rope Pulley, small	0. 9. 6
50,186. 1 Winder with auto-catch, small	0. 13. 6
50,188. 10 m Wire Rope at £ 0. 0. 5	0. 4. 2
Total	£ 109. 18. 2

C) Museum.

	£ s. d.
50,280. 2 Free-standing Glass Cupboards, 3 m long, 2.3 m high, 0.85 m inside depth. Price for one £ 23. 15. 0	47. 10. 0
50,282. 2 Wall Cupboards, 3 m long, 2.3 m high, 0.6 m deep inside. Each £ 17. 10. 0	35. 0. 0
50,381. 1 Mineral Cupboard with 4 show cases and 24 drawers	20. 2. 0
Total	£ 102. 12. 0

D) Students' Work Room.

	£ s. d.
50,291. 2 Students' Work Tables for Chemistry, each arranged for 8 scholars, 3 m long, 1.40 m wide. Each £ 38. 10. 0	77. 0. 0
— 1 Students' Work Table for Physics, arranged for 8 scholars, 3 m long, 1.40 m wide	11. 10. 0
50,298. 1 double-compartment Stink Cupboard, 2 m long, 2.30 m high, 0.70 m deep, with gas and water leads	21. 10. 0
— 1 Chemical Cupboard, 1 50 m long, 2.20 m high. Lower part 50 cm deep, upper 30 cm deep	9. 2. 0
50,244. 1 Wall Rack for glass tubes and rods	2. 15. 0
50,267. 1 Balance wall-bracket	0 18. 0
50,271. 1 Glass-blowing Table, with cylindrical bellows, and with glass-cutting knife and tools, also burners	4. 15. 0
50,282. 1 Wall Cupboard for physical and chemical apparatus, 3 m long	17. 10. 0
50,314. 1 Iron Table with hood: table 1.50 m long, 60 cm wide, 90 cm high, covered with red tiles	7. 5. 0
50,328. 1 Rincing Table with drying board	4 4. 0
— 1 Standing Vessel for distilled water, 100 l capacity, on wood support	2. 18. 0
Total	£ 159. 7. 0

E) Dark Room.

	£ s. d.
50,385. 1 large Photographic Work Table, 1.80 m long, with rincing basin, 2 drawers and bottle rack	5. 5. 0
50,392. 1 Bottle Stand, 1 m wide, 20 cm deep, 2 m high	1. 8. 0
50,393. 1 Photometry Board, 4 m long	2. 8. 0
50,394. 1 Hot Water generator, gas-heated	1. 15. 0
Total	£ 10. 16. 0

Total Cost of Collection 4.

	£ s. d.	£ s. d.
A) Class Room for Physics and Chemistry	**112. 11. 0**	
With Wall Heliostat and Experimental Switchboard		**144. 1. 0**
B) Preparation Room for Physics and Chemistry	**109. 18. 2**	**109. 18. 2**
C) Museum for Physics and Chemistry	**102. 12. 0**	**102. 12. 0**
D) Students' Work Room for Physics and Chemistry	**159. 7. 0**	**159. 7. 0**
E) Dark Room	**10. 16. 0**	**10. 16. 0**
Grand Totals: Without Heliostat or Switchboard	**£ 495. 4. 2**	
With Wall Heliostat and Experimental Switchboard		**£ 526. 14. 2**

Collection 5. Moderate Euipment.

A) Class Room for Physics and Chemistry.

	£ s. d.
50,002. 1 Weinhold Lecture Table, 3.5 m long, with all accessories	24. 4. 0
50,090. 1 Draught Box for covering the draught offtake in lecture table	1. 7. 0
50,095. 1 Draught Pipe for setting on the draught channel in lecture table	0. 17. 0
Carried forward	£ 26. 8. 0

	£ s. d.
Brought forward	26. 8. 0
50,105. 4 Shades for electric glow lamps, without lamps. Each £ 0. 3. 6	0. 14. 0
In case gas-lighting is employed, then in lieu of above:	
50,104. 1 Gas Distributing Device . £ 1. 10. 0	
50,103. 3 Lighting Burners with large shades, at £ 0. 11. 0 each „ 1. 13. 0	
£ 3. 3. 0	
50,127. 1 Arzberger and Zulkowsky Aspirator and 1 force pump mounted on one board	6. 0. 0
50,168. 1 Blackboard Frame with pillar substructure, with a blackboard 1.8 m long and 1 m high	6. 15. 0
50,181. 1 Wall Stink Cupboard, lined out with slate slabs and with burner for the draught flame; without gas lead	12. 0. 0
50,182. 1 Window Darkener, for 3 windows, size of window taken as 1.8×3 m. For 1 window £ 7. 5. 0	21. 15. 0
50,185. 1 Rope Pulley, large	0. 13. 6
50,187. 1 Winder, with auto-lock, large	0. 19. 0
50,189. 10 m Wire Rope, at £ 0. 0. 9 per metre	0. 7. 6
Total £	75. 12. 0

For above:	£ s. d.
50,206. 1 Wall Heliostat, wall thickness taken as 66 cm	4. 15. 0
— 1 Experimental Switchboard, Type B_1, as blackboard, with dead-beat precision instruments, for 220 volts direct current	24. 5. 0

For Estimates as to Projector Outfits, see Special Section of this List.

B) Preparation Room for Physics and Chemistry.

	£ s. d.
50,238. 1 Work Table, 2 m long	7. 5. 0
For above:	
— Gas Lead, Water Lead, Porcelain Basin with water-waste and bottle stand	3. 18. 0
50,247 a. 1 Tool Cupboard with Mechanics' and Carpenters' Tools	5. 10. 0
50,323. 1 Chemical Cupboard, 1 m long	6. 2. 0
Total £	22. 15. 0

C) Museum.

	£ s. d.
50,281. 1 Free-standing Glass Cupboard, 2.3 m long, 2.3 m high, 0.85 m deep inside	18. 15. 0
50,283. 1 Wall Cupboard, 2.3 m long, 2.3 m high, 0.6 m deep inside	14. 1. 0
Total £	32. 16. 0

Total Cost of Collection 5.

	£ s. d.	£ s. d.
A) Class Room for Physics and Chemistry	**75. 12. 0**	
With Wall Heliostat and Experimental Switchboard		**104. 12. 0**
Carried forward	75. 12. 0	104. 12. 0
Brought forward	75. 12. 0	104. 12. 0
B) Preparation Room for Physics and Chemistry	**22. 15. 0**	**22. 15. 0**
C) Museum for Physics and Chemistry	**32. 16. 0**	**32. 16. 0**
Grand Totals:		
Without Heliostat or Switchboard . £	**131. 3. 0**	
With Wall Heliostat and Experimental Switchboard . . . . . £		**£ 160. 3. 0**

Collection 6. Simple Equipment.

A) Class Room for Physics and Chemistry.

	£ s. d.
— 1 Weinhold Lecture Table, 3 m long, without draught flue, otherwise as No. 50001	21. 0. 0
50,105. 4 Shades for electric glow lamps, without lamps. Each £ 0. 3. 6	0. 14. 0
In case gas-lighting is used, then in lieu of above:	
50,104. 1 Gas Distributor . . . . £ 1. 10. 0	
50,103. 3 Burners with large shade. Each £ 0. 11. 0 „ 1. 13. 0	
£ 3. 3. 0	
50,128. 1 Arzberger and Zulkowsky Aspirator with mercury manometer, and 1 force pump, mounted on one board	5. 10. 0
50,172. 1 Blackboard Frame with pillar substructure with a blackboard 1.5 m long, 1 m high	6. 0. 0
50,181. 1 Wall Stink Cupboard, lined out with slate slabs and with burner for the draught flame; without gas lead	12. 0. 0
50,183. 1 Window Darkener, for 3 windows, size of windows taken as 1.8×3 m; simple construction, blinds of sail cloth. One window £ 5. 10. 0	16. 10. 0
50,185. 1 Rope Pulley, large	0. 13. 6
50,187. 1 Winder with auto-catch, large	0. 19. 0
50,189. 10 m Wire Rope. Per metre £ 0. 0. 9	0 7. 6
Total £	63. 14. 0

B) Preparation Room for Physics and Chemistry.

	£ s. d.
— 1 Work Table, 2 m long, with 4 legs, 2 drawers and shelves; top of oak, 30 mm thick, composed of frame and pannellings	3. 12. 0
50,248. 1 Wall Board with 2 drawers, with mechanic's and carpenter's tools	3. 15. 0
50,323. 1 Chemical Cupboard, 1 m long	6. 2. 0
Total £	13. 9. 0

C) Museum.

	£ s. d.
50,281. 1 Free-standing Glass Cupboard, 2.3 m long, 2.3 m high, 0.85 m deep inside	18. 15. 0
50,283. 1 Wall Cupboard, 2.3 m long, 2.3 m high, 0.6 m deep inside	14. 1. 0
Total £	32. 16. 0

Total Cost of Collection 6.

	£ s. d.
A) Class Room for Physics and Chemistry	**63. 14. 0**
B) Preparation Room for Physics and Chemistry	**13. 9. 0**
C) Museum for Physics and Chemistry	**32. 16. 0**
Total £	**109. 19. 0**

Fittings for the Class Rooms,

selected according to the work **"Technik des Physikalischen Unterrichts nebst Einführung in die Chemie"**, by Prof. Friedr. C. G. Müller, Brandenburg a. H. Berlin, 1906.

The page and figure numbers given refer to the above work; the list numbers to our Price List No. 50.

* The items preceded by an asterisk are constructed in accordance with the original directions of Prof. Friedr. C. G. Müller, whose sanction for the construction has been obtained.

The work contains in the sections re fittings, a number of supplies and apparatus for general use. These will be summarised in our price list later. The heliostat mentioned later on in the book (but which has already appeared in the installations) appears in the following collections, under the fittings for the class room.

Collection 7.

Equipment of the Lecture Room for Physics and Chemistry.

	£ s. d.
50,328. Rinsing Table with drying board (p. 2)	4. 4. 0
— 1 wider Drying Board (p. 10)	0. 9. 0
— Table with opening, 1.50 m long, 40 cm wide (p. 2)	1. 15. 0
50,042. * Lecture Table, 3 m long, with 2 protecting flaps (pp. 2—4, 5, 10)	25. 6. 0
50,113. Table and Microscopy Lamp for electricity (p. 4)	0. 10. 0
In case gas-lighting is used, then instead of above:	
50,111. Incandescent Table and Microscopy Lamp £ 0. 12. 0	
50,093. * Stink Cupboard (p. 4)	2. 5. 0
50,127. Aspirator and Force Pump on one board (p. 4)	6. 0. 0
or:	
50,146 a. * Water Jet Blower (Fig. 90) £ 1. 0. 0 and	
50,134. Wetzel Water Jet Pump, £ 1. 3. 0.	
50,044. * Blast Table for setting on the Lecture Table (p. 5)	4. 6. 0
50,096. * 2 Oak Supports (Fig. 2)	1. 16. 0
50,174. * Blackboard with pillar substructure, with 1 fixed and 1 movable wood slab, 1.50 m wide and 1.05 m high (p. 6)	8. 0. 0
50,313. * Smoke Pipe (p. 7)	0. 11. 0
— Experimental Switchboard, Type B_1, for 220 V. (pp. 7 and 248)	24. 5. 0
The price is proportionately increased in the case of a different kind of current or voltage.	
50,267. Wall Bracket for carrying the balance (p. 7)	0. 18. 0
50,182. Hand-driven window darkener (p. 7), 3 windows taken as 1.8 m, for each window £ 7. 5. 0	21. 15. 0
50,283, Wall Cupboard, 2.30 m long (p. 11)	14. 1. 0
50,177—50,180. Blackboard, T-square, set-square, try-square, ruler, and wood compasses (drawing materials, p. 12)	0. 17. 0
50,323. 2 Chemical Cupboards, 1 m long, each £ 6. 2. 0 (pp. 2 and 12)	12. 4. 0
50,213. * Clockwork Heliostat (p. 13 and Fig. 124)	5. 15. 0
— For Erecting the Heliostat, according to prevailing conditions (p. 13). Subject to alteration	1. 5. 0
Total	£ 136. 2. 0

Equipment of the Apparatus Room.

	£ s. d.
50,280. Free-standing Glass Cupboard, 3 m long (p. 13)	23. 15. 0
50,282. 3 Wall Cupboards, 3 m long (p. 13), each £ 17. 10. 0	52. 10. 0
— 3 Cupboards, 1 50 m long, 2.50 m high, 40 cm deep (p. 13), each £ 8. 5. 0	24. 15. 0
— 1 Work Table, 2.50 m long, 60 cm wide, on 6 legs, and with 2 wide drawers; also having 2 electric terminals (p. 13)	3. 6. 0
— 3 Tables for taking apparatus, each 1.50 m long, 50 cm wide, each having 2 drawers (p. 13), each £ 2. 2. 0	6. 6. 0
Total	£ 110. 12. 0

Equipment of the Workshop.

	£ s. d.
— Work Table, 1.50 m long, 80 cm wide, with 2 drawers and deepening for the anvil (p. 15)	2. 12. 0
50,242. Parallel Vice, 8 kg weight	1. 7. 0
50,243. Small Anvil with horn (p. 15)	0. 18. 0
50,250. 3 Wall Boards for tools (p. 15)	3. 10. 0
— Table, 2 m long, 50 cm wide, with 3 drawers and 1 open cupboard and beading round inside edge (p. 15)	2. 15. 0
— Simple Cupboard with 4 shelves, 1 m long, 1 m high, 0.20 m deep (p. 15)	2. 0. 0
50,251. Tools for Metal-work (p. 15)	12. 10. 0
50,252. Tools for woodworking, etc. (p. 16)	1. 15. 0
50,253. Measuring and Drawing Instruments (p. 16)	5. 15. 0
50,254. Various Materials (p. 16)	6. 10. 0
50,257. Slide-rest Lathe for treadling (p. 17).	19. 0. 0
50,259. Self-centering Drilling and Turning Chuck (p. 17)	2. 10. 0
50,260. Flange for screwing on wood discs	0. 12. 0
50,261. 12 Cylindrical Wood Chucks	0. 5. 0
50,262. 10 Slide Rest steel tools (p. 17)	0. 12. 0
50,263. 2 hollow and 2 flat hand turning tools (p. 18)	0. 2. 6
50,263 a. 2 Angular tools and 1 flat tool	0. 3. 8
50,264. 6 Wood Handles (p. 18)	0. 1. 3
50,265. 40 Twist Drills with wood block (p. 18)	1. 2. 0
50,266. Emery Disc on wood shaft (p. 18)	0. 9. 0
Total	£ 64. 9. 5

Total Cost of Collection 7.

	£ s. d.
Equipment of Class Room for Physics and Chemistry	**136. 2. 0**
Equipment of the Apparatus Room	**110. 12. 0**
Equipment of the Workshop	**64. 9. 5**
Grand Total	**£ 311. 3. 5**

Experimental Switchboards and Experimental Resistances for Educational Institutions and Laboratories.

General.

With the introduction of heavy currents of electricity for teaching purposes, the necessity has arisen for an experimental switchboard in connection with which all experiments can be made which were hitherto carried out in conjunction with galvanic batteries or accumulators. It must be borne in mind that most of the experimental electrical apparatus, especially in regard to the resistance conditions, are constructed in such manner that they can be worked with a few cells, and with a low voltage require a greater current intensity, while the working voltage is as a rule 220 volts, or in a number of cases, 110 volts.

50471. 1 : 8.

On the other hand, the switchboard should permit of such experiments being made which are only rendered possible by heavy currents, such as the demonstration of the electric arc light, the singing arc, and others.

The switchboard must accordingly be so constructed that on connecting up to a heavy current network, work can be carried on with a low or a high current intensity, as also at a high and a low voltage. The last condition especially must be satisfied in the case of apparatus working with an interrupted current, such as Ampere's table, the spark coil with platinum interrupter, the electric bell, etc. It must be observed that this is not realised simply by inserting resistances in series, since at the moment of breaking the circuit the full network voltage would prevail at the contacts, and the contacts themselves become fused together. Rather must the voltage be distributed by a shunt method of grouping so that it is impossible for the voltage to exceed a certain value.

The switchboard must in addition be provided with measuring instruments for the current and voltage. In the case of the potential, it must be possible to measure the voltage at the apparatus as well as in the network; it is also desirable to measure both the total current taken from the main and the current consumed in the experimental apparatus alone.

We have constructed a switchboard which entirely fulfils the conditions just prescribed and permits of the carrying out of all experiments which may need to be conducted in teaching or in the laboratory. We have already supplied this type of switchboard to a very large number of educational institutions, and they have met with universal approval, resulting in repeat orders being received from a number of towns. The names of the institutions are appended at the end of this section, together with some testimonials appreciative of our switchboards.

A number of forms of switchboards are described in the following pages partly from data obtained from a study of the various voltage conditions and kinds of currents of electricity works and partly as the result of the differing needs and means of the educational institutions.

The Selection of an Experimental Switchboard.

Type of Current and Construction.

In selecting an experimental switchboard, one is first of all guided by the type of current and the voltage available on the spot. Moreover, the board may be stationary (for fixing to the wall), portable, or arranged as a travelling distribution board.

The most suitable and practical type of current for purposes of demonstration is naturally direct current, as with this all fundamental experiments can be carried out. In view of arc lamps and arc experiments, the voltage should be at least 65; in the majority of cases 110, 160 or 220 volts are available. If funds allow it, it is advisable to provide a switchboard with 2 circuits; the conditions are then particularly favourable: if the central station has a 3-wire main, it is desirable for many reasons to be able to connect to all three lines. With a board of this type it is then possible to carry out two experiments in parallel, or the accumulators can be charged from one circuit while experimenting with the other. Often, in order to have different potentials available, one circuit is connected to 110 and the other to 220 volts in the case of a 3-wire system of 2×110 volts. Also it is possible to connect only one circuit up to heavy current, while the other is connected to a battery of a few cells.

If various types of current, e. g., direct and alternating current or direct and triphase current, are available, the switchboards can be adapted to work with one common circuit for the two types of current, or, better, the two sorts of current can be distributed through two circuits with the one board (one circuit for each type of current). In using a switchboard with a common circuit for the two kinds of current, either a special change-over switch is provided for changing from one current to the other, or plugs can be used in conjunction with plug boxes. If one of the currents is D. C., and the other alternating or three-phase, hot wire instruments must be used for measuring, as these alone indicate correctly on both types of current.

Switchboard with dead-beat standard measuring instruments should be given the preference over those with simple instruments having air damping, as the reading can be taken at once, since the pointer of the standard instruments does not swing to and fro on deflecting, and the scale is equally divided.

We construct the Standard Experimental Switchboards with one Circuit, for direct current, in 3 types:

(1) **Type A,** for connecting to **110—160** volts working voltage, for taking currents of from **0.03 to 30 amps.** and voltages of 0,3—110 (or 160) volts, with rheostat of **36 ohms** in **30 steps.**

(2) **Type B,** for connecting to **220 volts** working pressure, for taking currents of **0.04 to 20 amps.** and pressures of 0.4—220 volts, with a **48 ohm** rheostat in **30 steps.**

(3) **Type C,** for connecting up to **110 volts** working pressure, for taking currents of from **0.04 to 20 amps.** and pressures of 0.4—110 volts, with a rheostat of **24 ohms** in **21 steps.**

(The currents and voltages given are those applying when the resistance of the apparatus connected up is 10 ohms.)

Each of these 3 types is further supplied in two separate patterns: (1) with large dead-beat standard measuring instruments and with an ammeter switch, for measuring the current strength in the apparatus and the total current; (2) with measuring instruments having air damping, of 120 mm scale diameter, without ammeter switch.

From these we accordingly have Types A^1, B^1, C^1, and A^2, B^2, C^2.

The standard experimental switchboards for 2 circuits for the same kind of current and for the same current strength are constructed in corresponding patterns and the individual types, corresponding exactly with the previous ones, are designated D^1, E^1, F^1 and D^2, E^2, F^2 respectively.

We have also constructed a number of switchboards for special cases; this price list includes some of those which are pretty frequently used and which are typical in their form. Of these may be mentioned Types G^1 and H^1 having two circuits for different current densities.

For low pressures all switchboards can be employed forthwith, the lower limit of the current densities diminishing in the same ratio in which the pressure is reduced. If it be desired, say, to use the switchboard at one time for the listed pressure and on another occasion for a considerably lower accumulator voltage, it is desirable to order a switchboard fitted with instruments for 2 ranges.

Construction.

The switchboards are substantially constructed in an expert manner, all boards being constructed to the Safety Specifications of the German Society of Electrical Engineers; they can therefore be connected up at will to any heavy current main. White marble solely is used for the slabs.

The switchboards are supplied in three patterns, viz., as wall boards, portable, or of the travelling type. In the **Wall Type** the resistances are placed in an iron housing which is screwed firmly to the wall, care being taken to ensure good ventilation. The housing has a marble slab in front on which are mounted the various switches and measuring instruments (see No. 50,471). This arrangement has the advantage that the experimental switchboard does not take up a large amount of wall surface. If desired, or if the local conditions warrant it, the resistance is arranged separate from the switchboard and connected thereto by a number of leads (see Nos. 50,477 and 50,504). **The Portable Type** can only be recommended for switchboards with but one circuit, otherwise the resultant board is too heavy. In construction it is similar to the wall boards, with the difference that it rests on feet and has two handles (see Fig. 50,471A). This switchboard can be removed from the lecture room when it is desired that the scholars' attention should not be drawn to it; and in laboratories the switchboard can be used in any spot desired, it being only necessary to have at the places in question a plug box to take the plug connected with the switchboard. The **Travelling Type** possesses the advantages just mentioned but in a higher degree. These switchboards can be constructed with two circuits and they can be manipulated by a single person. These boards are in table form, the resistances being contained in a box-shaped lower portion, and the measuring instruments and switches being mounted on a marble slab placed above this lower part (see No. 50,472). The instruments are mounted in a sloping position on iron supports so as to be easily read. The experimental switch-table runs on rollers having rubber tyres, the rollers turning laterally and therefore always being in the direction of travel. The resistance can also, together with the double switch contacts, be separated from the switchboard and made of the travelling type as shown in Fig. 50,471 B. In this form of construction the resistance can be used without the switchboard as a series or regulating resistance in the laboratory or preparation room. This construction will be considered in cases where the resistance when not being used should take up no space. Only 3 leads need be laid between the switchboard and the resistance.

The demands put upon the experimental switchboard are very great, for the highest possible current-density is desired as well as a regulation in very close stages. This circumstance must be taken into account both in the construction of the regulating device and the dimensioning of the resistances. The regulating apparatus is therefore constructed in the **Weinhold Double Switch Contact form.** The double switch contact arrangement consists of contact pieces arranged in a circle, upon which slide the contact springs of two levers insulated from each other. The figures at the side of the contact pieces give the resistance in ohms between one contact piece and the contact piece 0. The handles of the levers are placed laterally on the levers themselves, so that both switch contacts (or levers) can be placed on the same contact piece. This switch permits (1) the employment of the resistances in series with the apparatus; (2) one portion of the resistance being put in series with the apparatus to be tested and another portion in parallel with the same, i. e., in shunt, thus obtaining a division of tension.

By this arrangement alone a multiplicity of positions in the regulating stages is attained, and this can be made use of in its entirety for instructional purposes and in the laboratory, as the transition from one form of grouping to another in the arrangement which we have adopted can be carried out with great rapidity by simply cutting a single switch in and out of the circuit. The resistance is connected up as a series resistance when the shunt switch is open, and as a shunt resistance when the shunt switch is closed. By employing a large number of contacts (30 in the ordinary and 21 in the simple type of construction) the graduation is brought to a suitable degree of fineness. Another important advantage is secured by the adoption of the double contact lever arrangement, viz., the possibility of securing coarse regulation with one handle and fine with the other; this has proved to be of great value, and, indeed, almost indispensable, for educational purposes and in the laboratory. If it be desired to keep the fineness of regulation within still narrower limits, a Sliding Rheostat is put in series with the apparatus to be tested; this type of resistance is especially desirable in laboratories. The resistances belonging to the switchboards are dimensioned to correspond to the wide range of regulation which is always demanded of experimental switchboards. By organically combining the resistances with the switchboard to which they pertain, it is not generally necessary to have a special room for the resistances. The resistances are designed for continuous loading with the currents stated in the price list, when the correct contacts are used. When a continuous and heavy load is applied to the resistances, a fairly large amount of heat is radiated from them on to the back of the marble slab.

As such considerable heating on one side may under certain conditions be deleterious to the marble slab, heat-insulating layers are, by a new and practical arrangement, placed between the

resistances and the marble: these layers consisting of asbestos and air. The asbestos strata hold off the heat from the slab, and the air-strata, being heated by the heat given off by the asbestos, take an upward direction, thereby effecting good ventilation. But the intermediate layers of asbestos fulfil another purpose: the leads from the switch contact are carried between two of them to the individual resistance spirals. Thus a number of undesirable wire crossings immediately behind the switchboard are obviated, and under these conditions the resistance spirals cannot accidentally come into contact with the connecting leads. The factor of safety of these new switchboards is therefore essentially higher than in the old construction.

As to switchgear and measuring instruments for each circuit, there are: 1 two- or three-pole fuse, 1 main switch, one double connection switch for regulating the current, 1 switch for the shunt, 1 change-over switch for measuring the potential in the supply line and at the apparatus, 1 change-over switch for measuring the current in the main circuit and in the shunt (this switch and the measuring resistance pertaining to it are only employed in connection with switchboards which are fitted with precision instruments), 2 measuring resistances (shunts) to enable these current measurements to be made one after the other without interrupting the current; 1 plug box for making connection with the apparatus to be tested; 1 ammeter and 1 voltmeter. Connection to the supply line is in the case of the stationary switchboards, made by means of terminals; and in the travelling and portable types of board, a flexible lead terminating in a plug is used for the purpose. This plug is inserted in plug boxes fitted at the places where it is desired to use the board. The measuring instruments priced in the list differ in size and construction in the various switchboards, and in some cases instruments with 2 ranges are employed. All these circumstances must be duly taken into consideration in judging of the price.

Arrangement of Connections.

Method I. Rheostat as Series Resistance.

This arrangement can be employed with advantage for the charging of accumulators, the excitation of electro-magnets, and for working an arc lamp up to the current capacity of which the switchboard permits. The illustration appended shows the scheme of connections.

Switch for Shunt open. — Switch contact I of the double switch contact is on the last contact to the right, and switch contact (or lever) II on 0. The current starting from +, takes the path indicated in the figure by thick lines and arrows: positive pole 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, plug box 12 (the experimental apparatus is connected to this), 13, 14, lever II of the double switch contact, resistance 15, 16, 17, lever I, 18, 19, 20, 21, 22, 23, negative pole. The diagram shows, in addition, by dotted lines, the connection of the shunt leads at 6, 7, 9, 10 to the ammeter switch, and at 5 and 19 and 11 and 13 respectively to the voltmeter switch (and from these switches to the measuring instruments themselves). The switch for the voltmeter is placed on "Netzspannung" (network voltage), and the ammeter switch on "Stromstärke im Apparat" (current in the apparatus). By changing over the latter to "Gesamtstromstärke" (total current) will, with this method of connecting, give the same deflection of the pointer.

In this method of connections the resistance inserted is always equal to the difference between the numbers placed alongside the contact pieces on which the lever is placed. At the position of the lever indicated in Diagram I the resistance in circuit is the total resistance of the double contact lever, e. g., by employing a Type A[1] switchboard as listed, it is 36 ohms. If the plug box is short circuited by connecting the contacts of same with a terminal, we have, with the position of the lever given:

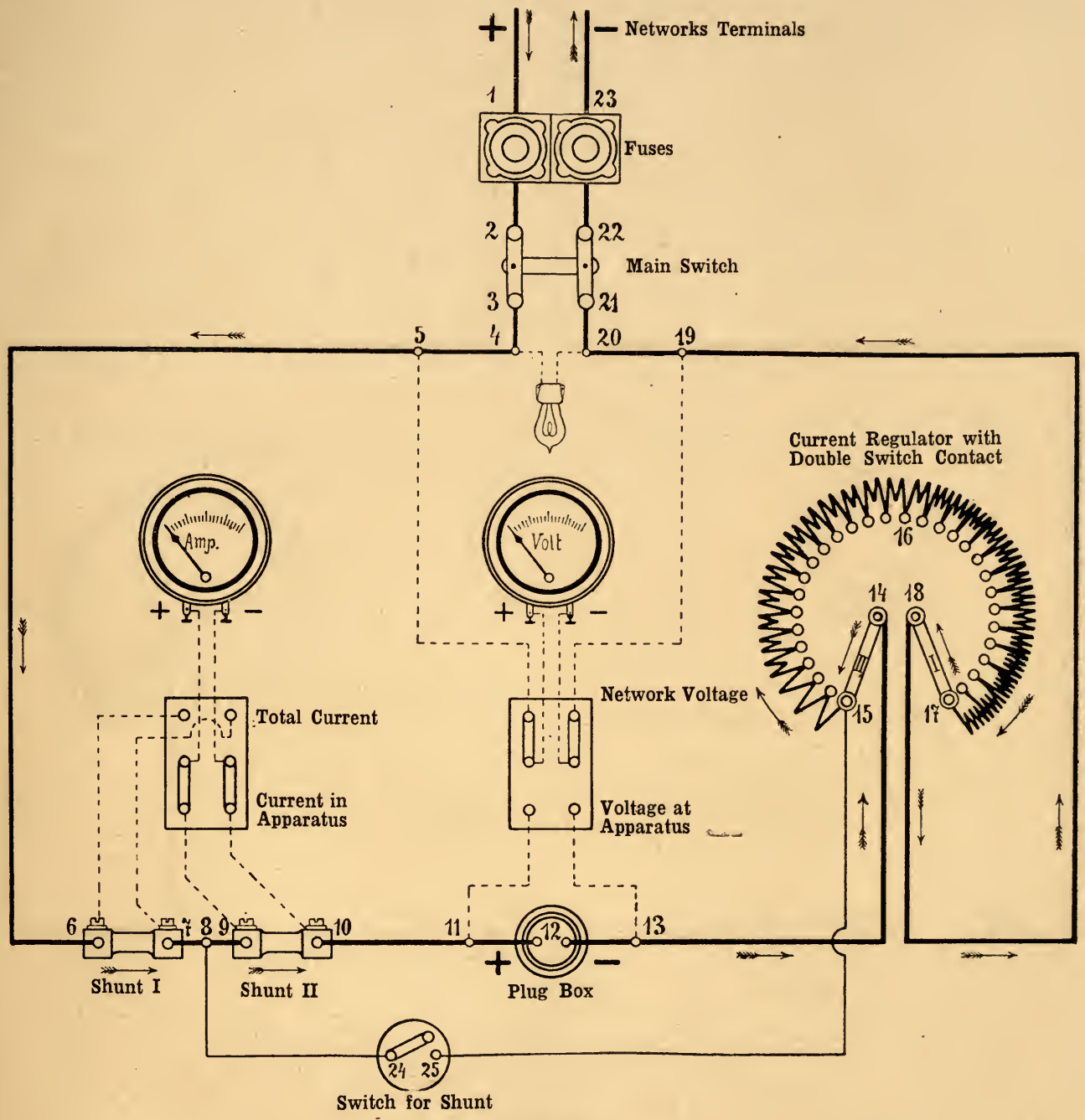
with Type **A** and 110 Volts working pressure a current of $\frac{110}{36} = 3.05$ amperes;

with 160 Volts working pressure $\frac{160}{36} = 4.44$ amperes;

with Type **B** and 220 Volts working pressure $\frac{220}{48} = 4.58$ amperes;

with Type **C** and 110 Volts working pressure $\frac{110}{24} = 4.58$ amperes.

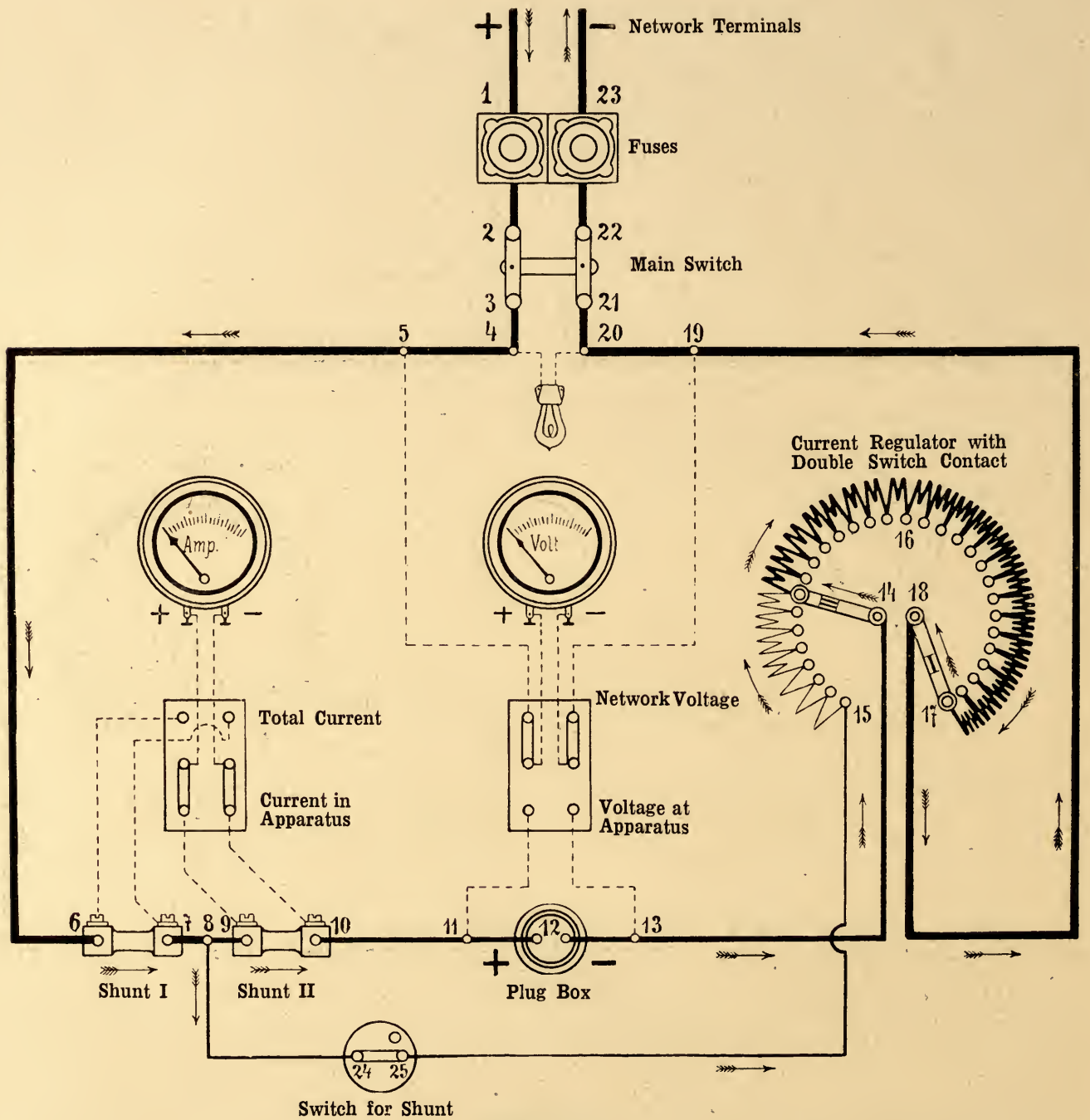
[1]) In the case of all switchboards not constructed with a change-over switch for current measurements and with measuring resistances, the ammeter remains permanently in circuit.



Scheme I.

The thickness of the wire forming the resistance spirals increases in steps for a maximum continuous load of I, in Type **A** 5—30 amps., in Type **B** 5—20 amps. so that even when the plug box is short circuited or when the resistance of the apparatus put in the circuit is very low (e. g., in glowing experiments), the resistance spirals do not become unduly heated when only Switch Contact I is used and the currents of 30 and 20 amps. respectively are not exceeded. As a rule Switch Contact I will first be placed on 0, and Switch Contact II on the highest resistance value to the right, and then Switch Contact I will be turned backwards; finally, the current is slightly increased with the aid of Switch Contact II.

As the charging of accumulators is of interest, we will illustrate this by an example. Let us suppose a 6-cell battery with a charging current of 6 amps. These cells have a pressure of 12 volts, and at 110 volts working pressure there is thus 110—12 = 98 volts to overcome, requiring, with a current of 6 amperes, $\frac{98}{6} = 16.33$ ohms. At 220 volts 220—12 = 208 volts have to be overcome, necessitating $\frac{208}{6} = 34.66$ ohms. The current regulator is thus sufficient in these cases. If, on the



Scheme II.

other hand, the battery of 6 cells has a charging current of only 3 amps., then at 110 volts pressure $\frac{98}{3} = 32.6$ ohms, and at 220 volts $\frac{208}{3} = 69.3$ ohms will be necessary, and the resistance of 48 ohms of Type **B** and on 24 ohms of the Type **C** will not be sufficient. From what has been said it will be seen that when the resistance of the apparatus in circuit is low, and with small currents, the No. I Connections can no longer be utilised. In these cases recourse is had to No. II scheme.

Method II. Rheostat as a Shunt Resistance for Division of Tension.

The connections are the same as the preceding, **only the switch for the shunt is closed.** Switch Contact I is on the last contact to the right and Switch Contact II on another contact. The current, starting at + follows the course shown in the illustration by lines and arrows:

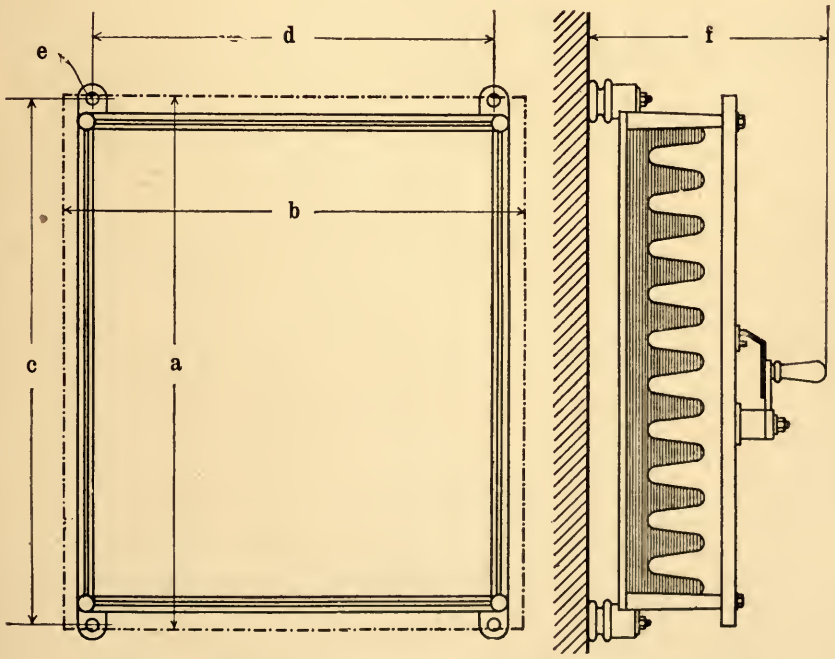
$$+, 1, 2 \ldots\ldots 8 \left\{ \frac{9, 10, 11, 12, \text{Expt. Apparatus}, 13, 14, \text{Lever II}}{24,\ 25,\ 15} \right\} \mathbf{16, 17}, \text{Switch Contact I}, \mathbf{18, 19} \ldots\ldots \mathbf{23}, —.$$

The current branches off to the two shunts, a portion going from 8—14 in the apparatus, the other part passing by the shunt switch into the current regulator; at the contact stud on which Switch Contact II rests the two branches re-unite and from this the whole current flows to the negative pole. In other words, a portion of the potential prevailing at the ends of the resistances 15 and 17 (which prevails at 14 and 17) is removed and conducted to this part of the apparatus. **Potential Distribution.** — The unshunted current is shown in the illustration by thick lines, and the shunted by thinner lines.. The farther apart the Switch Contacts are removed, the lower the tension existing in the apparatus, and the weaker, therefore, the current flowing through the apparatus. As a rule Switch Contact I is placed on the greatest resistance value to the right and Switch Contact II on the lowest to the left, the latter being turned forward until the pressure desired at the apparatus (and therefore the current density) is attained. If Switch Contact II is near the left hand end contact, and if it be desired to increase the current slightly, it is better to move Switch Contact I back than to move No. II forward. Even when this method of connections is adopted it is thus possible to obtain fine regulation with one Switch Contact and coarse with the other.

If it be desired to feed with current an apparatus which works with an interrupted current (e. g. an induction coil with platinum interrupter or an Ampere table), it may be desirable that at the moment of making the circuit not too high a pressure prevails so as not to burn the contacts by the spark at break. In such cases, when large currents are being used, Switch Contact II should be left in the region of the smaller resistances, while Switch Contact I should be turned backwards. The pressure at the apparatus at the time when no current is being taken off, is to the working voltage as the resistance values placed alongside the contacts on which the Switch Lever rests are to each other.

A regulation of the current to an extraordinarily fine degree (e. g., in electrolytic operations) is obtained when the apparatus to be connected up is not joined directly to the plug contact provided for the purpose, but a regulating Sliding Rheostat of 2 ohms resistance (No. 50,523, p. 127 of this list) put in series with this apparatus. With this sliding rheostat it is possible to regulate the current in stages of about $^1/_{50}$ ampere. The smallest current which it is possible to take from the main is nearly $^1/_{50}$ ampere. Of course if it is desired to measure such low current strengths, a special ammeter must be used, as the ammeter of the switchboard only admits of reading to $^1/_1$ ampere; instruments with two ranges must therefore be ordered in this case.

In order to charge the 6-cell battery of 3 amperes charging current previously mentioned, with Type A and 110 volts pressure, Switch Contact II should be placed on 12 ohms and Switch Contact I on 36 ohms, the current in the apparatus being then 3 amperes, the shunted current 1 ampere, and the total current consumption 4 amperes.



Overall Dimensions of Switchboards Types A, B and C.

Measurements, mm	a	b	c	d	e	f
Types A_1, A_2, B_1, B_2	720	620	710	540	16	360
Types C_1, C_2	610	510	610	430	16	310

With Type B and 220 volts working pressure Switch Contact II must be on 6 ohms and Switch Contact I on 48 ohms; the current in the apparatus being 3 amperes and the shunted current 2 amperes, and the total current consumption 5 amperes. Let the voltage of the supply current be S_1, the position of the Switch Contacts K_1 and K_2 respectively, the resistance of the apparatus A, the pressure to the apparatus S_2, the current in the portion of resistance between Switch Contact I and Switch Contact II J_1, the current density in the apparatus J_2, the current in the part of the resistance between Contact II and 0 $J_3 = J_1 - J_2$; then

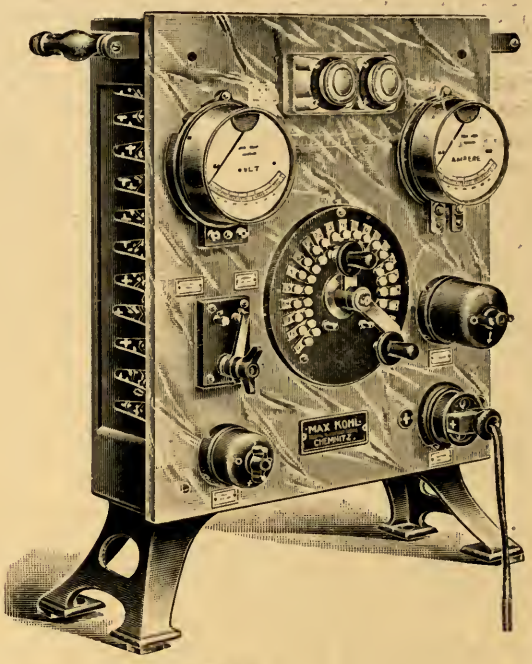
$$S_2 = \frac{A\,S_1\,K_2}{K_1\,(A + K_2) - K_2^2}$$

$$J_1 = \frac{S_1\,(A + K_2)}{K_1\,(A + K_2) - K_2^2}$$

$$J_2 = \frac{S_1\,K_2}{K_1\,(A + K_2) - K_2^2}$$

$$J_3 = \frac{A\,S_1}{K_1\,(A + K_2) - K_2^2}$$

50471. 1 : 8.



50471 A. 1 : 11.

Prices.

£ s. d.

The currents and voltages given assume the resistance of the apparatus to be connected up to be 10 ohms.

Direct Current Switchboards with I Circuit, with Standard Instruments.

50,471. **Experimental Switchboard Type A_1 (Wall Pattern),** Figure, for connecting to **110—160 volts** C. C., for taking currents of **0.03—30 amperes** and voltages of 0.3—110 (or 160) volts from the main, with standard pattern instruments and Double Switch Contact Current Regulator with 30 stages 24. 0. 0

Weight, net, about 70 kg; gross, about 105 kg. For dimensions, see dimension sketch and table on p. 113. Packing for land transport. 0. 15. 0

The Switchboard carries: 1 rheostat of 36 ohms variable in 30 stages, for a max. load of 5 to 30 amps., with Double Lever Switch having 30 contacts; 2 terminals for connecting up the network; 2 fuses; 1 main switch (quick break type); 1 dead-beat standard ammeter; 2 measuring resistances; 1 ammeter switch; 1 dead-beat standard voltmeter; 1 voltmeter switch; 1 switch for the shunt for potential-distribution; 1 plug box with plug, and 4 m flexible.

When ordering, please give network voltage. If this is not stated, the voltmeter is arranged for 125 volts.

Fitting a Lamp Bracket for lighting purposes, with switch and 2 fuses . . . . . **Extra** 1. 0. 0

Portable Construction as in Fig. 50,471 A . . . . . **Extra** 0. 10. 0

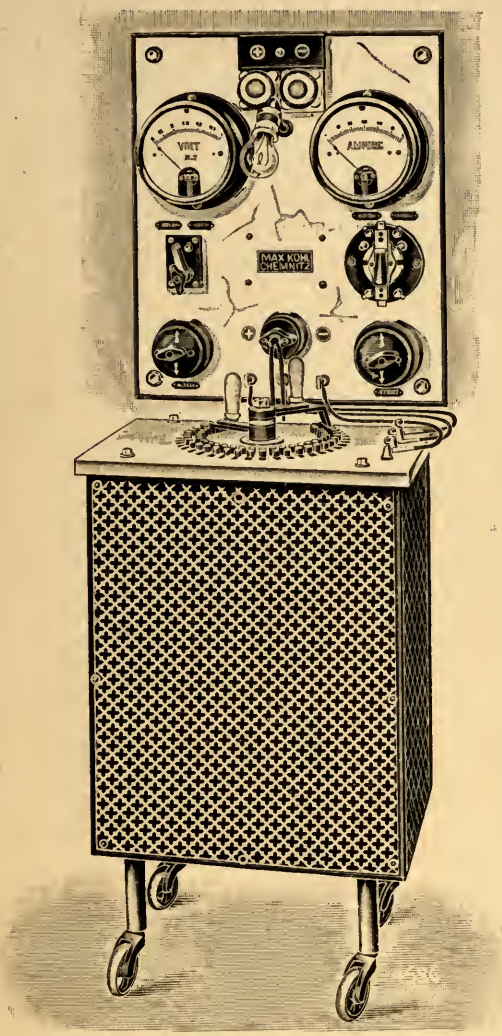
Sliding Rheostat for fine Regulation, fitted on the panel, adaptable to 20 amps., with a resistance of nearly 0.9 ohm . . . . . **Extra** 1. 5. 0

Resistance and Double Switch Contacts **separate** from the panel, and arranged so as to be portable (Fig. 50,471 B) . . . . . **Extra** 5. 0. 0

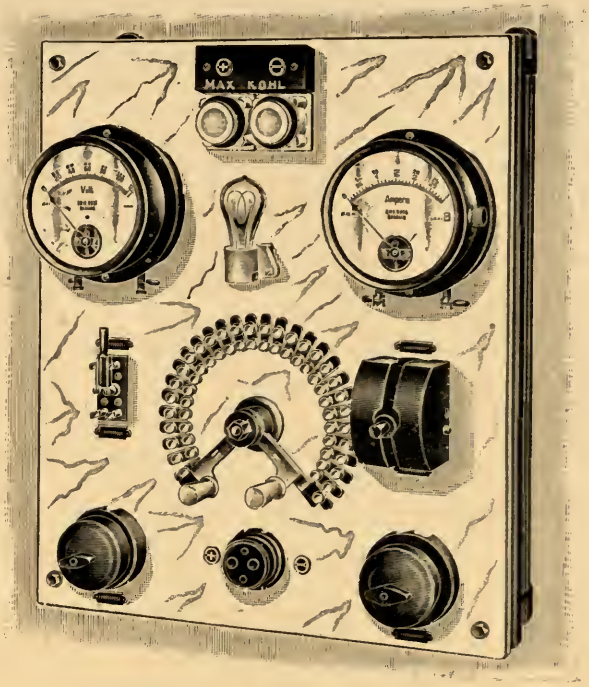
Measuring Instruments with two ranges, Fig. 50,471 C, to admit of the measurement also of small currents and voltages . . . . . **Extra** 2. 10. 0

The ranges are respectively 0—30 and 0—3 amps. and 0—120 and 0—12 volts, or 0—160 and 0—16 volts.

Lamp Resistance, consisting of 4 glow lamps arranged on the slab (Fig. 50,471 D), for putting in series with the current regulator in order to diminish the current consumption in the shunt when low currents are needed; with switch. The lamp resistance can also be used alone, the current being then taken off by a plug box when the lamps are switched in . . . . . **Extra** 2. 0. 0

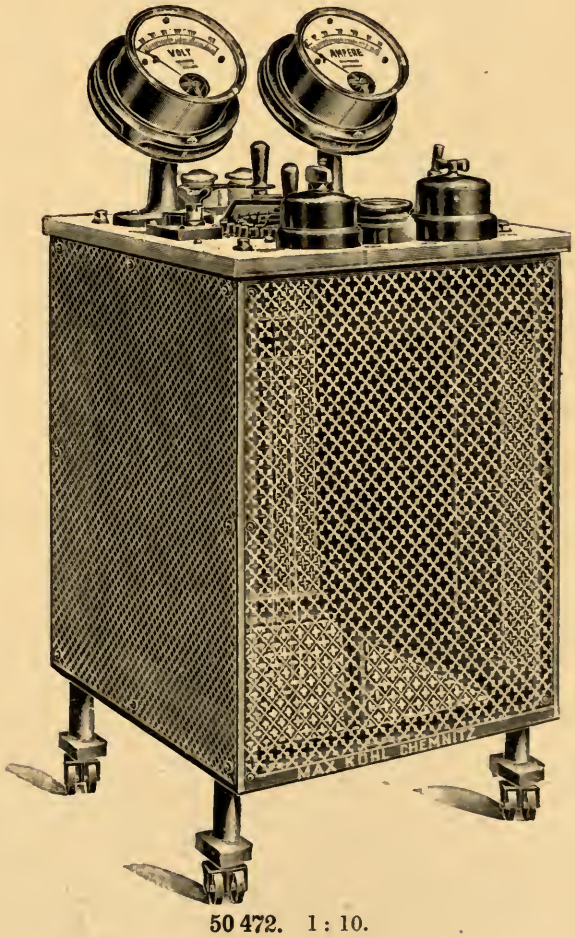


50 471 B. 1 : 12.



50 471 C. 1 : 9.

50 471 D. 1 : 10.



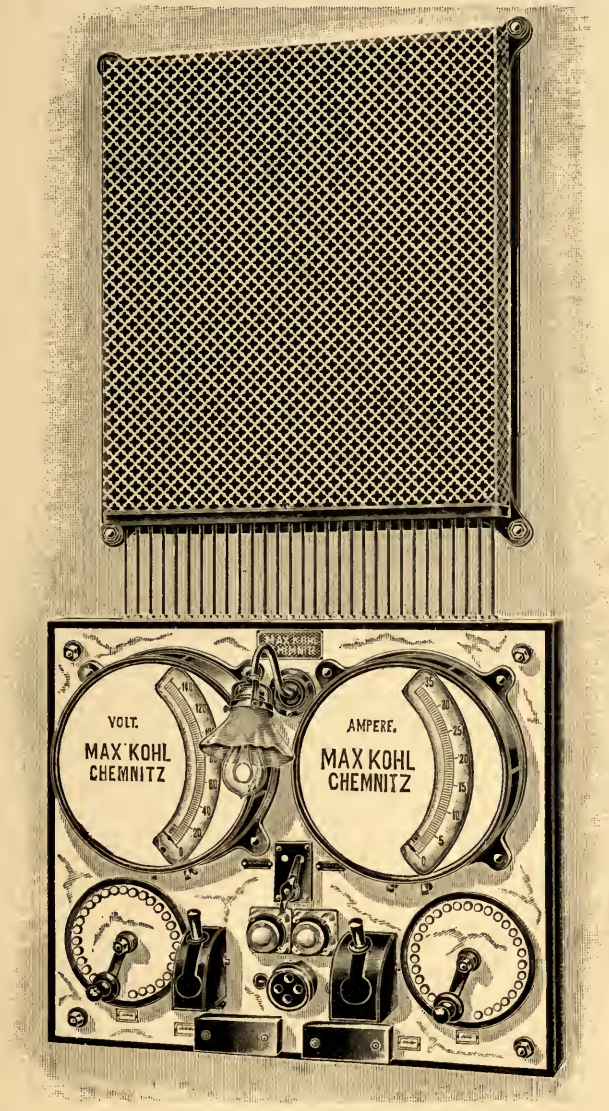
50 472. 1 : 10.

50,472. **Travelling Type Experimental Switchboard (Type A_1)**, (Figure), with stout castors fitted to the feet, otherwise as No. 50,471 . . . . . £ 26. 0. 0

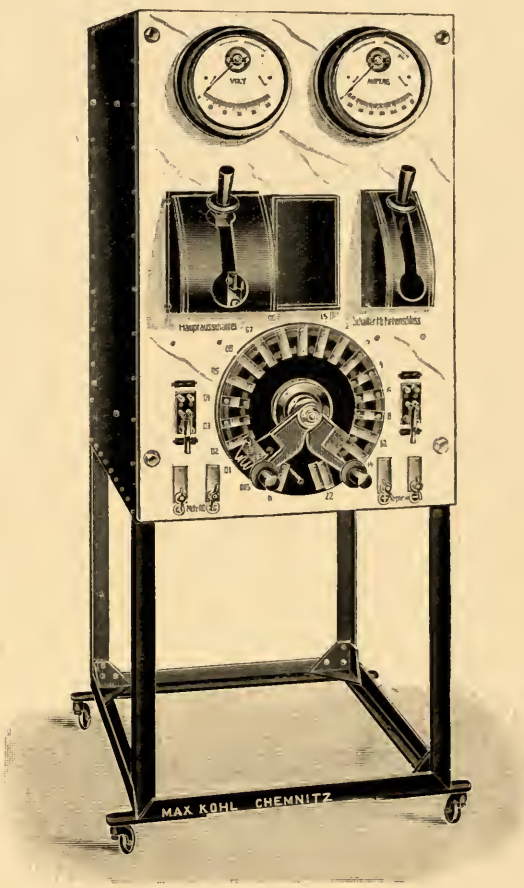
Weight, net, about 87 kg; gross, about 130 kg. **Packing** for land transport . . . . . £ 0. 16. 0

In ordering, the network voltage should be given. If this is not stated, the voltmeter is arranged for 125 volts.

	£ s. d.
50,473. **Experimental Switchboard, Type B_1, for fixing to wall** (cf. Fig. 50,471), for connecting up to **220 volts** Direct Current, for taking currents of **0.04—20 amps.** and pressures of 0.4—220 volts from the mains, with standard pattern instruments and Double Switch Contact having 30 stages	24. 5. 0
Weight, net, about 82 kg; gross, about 125 kg. For dimensions, see dimension sketch and table on p. 113. **Packing** for land transport	0. 15. 0
The switchboard carries: 1 regulating resistance of 48 ohms, variable in 30 steps, for a max. load of 5—20 amps., with Double Switch Lever having 30 contacts; 2 terminals for connecting up to the network; 2 fuses; 1 main switch (quick break type); 1 dead-beat standard ammeter; 2 measuring resistances; 1 ammeter switch; 1 dead-beat standard voltmeter; 1 voltmeter switch; 1 switch for the shunt for potential-distribution; 1 plug box with plug and 4 m flexible.	
For currents to 30 amperes **Extra**	3. 10. 0
Fitting a Lamp Bracket for lighting purposes, with switch and 2 fuses **Extra**	1. 0. 0
Portable Construction as in Fig. 50,471 A **Extra**	0. 10. 0
Sliding Rheostat fitted to the slab, adaptable up to 20 amps., having a resistance of 0.9 ohm **Extra**	1. 5. 0
Rheostat and Double Switch Contact **arranged separately** from the board and made of travelling type (see Fig. 50,471 B) **Extra**	5. 0. 0
Measuring Instruments with 2 ranges (cf. Fig. 50,471 C), permitting of accurately measuring small currents also **Extra**	2. 10. 0
The ranges are 0—30 and 0—3 amps. and 0—250 and 0—25 volts.	
50,474. **Travelling Type Experimental Switchboard (Type B_1),** (cf. Fig. 50,472), fitted with massive castors; apparatus and measuring instruments as in No. 50,473	26. 5. 0
Weight, net, about 100 kg, gross, about 145 kg. **Packing** for land transport	0. 16. 0
50,475. **Experimental Switchboard Type C_1,** for fixing to a wall (cf. Fig. 50,471), for connecting up to **110 volts** Direct Current, and for taking currents of **0.04—20 amps.** and pressures of 0.4—110 volts from the network; with standard pattern instruments and Double Switch Contact Current Regulator with 21 stages	19. 0. 0
Weight, net, about 50 kg; gross, about 75 kg. For dimensions, see dimension sketch and table on p. 113. **Packing** for land transport	0. 12. 0
The switchboard carries: 1 24-ohm regulating resistance variable in 21 stages, and for a max. load of 5—20 amps., with Double Switch Contact having 21 contacts; 2 terminals for the feed supply; 2 fuses; 1 main switch (quick break type); 1 dead-beat standard ammeter; 2 measuring resistances; 1 ammeter switch; 1 dead-beat standard voltmeter; 1 voltmeter switch; 1 switch for the shunt for potential-division; 1 plug box with plug and 4 m flexible.	
Fitting a Lamp Bracket for lighting purposes, with switch and 2 fuses **Extra**	1. 0. 0
Portable Construction (cf. Fig. 50,471 A) **Extra**	0. 10. 0
Sliding Rheostat, fitted on the slab, adaptable up to 20 amps., with resistance of 0.9 ohm **Extra**	1. 5. 0
Resistance and Double Switch Contact arranged **separately** from the switchboard and made of travelling type (see Fig. 50,471 B) **Extra**	5. 0. 0
Measuring Instruments with 2 ranges (cf. Fig. 50,471 C), to admit also of measuring exactly small currents and pressures **Extra**	2. 10. 0
The ranges are 0—20 and 0—2 amps. and 0—110 and 0—11 volts.	
50,476. **Travelling Type Experimental Switchboard, Type C_1** (cf. Fig. 50,472), fitted with massive castors; apparatus and instruments exactly as in No. 50,475	21. 0. 0
Weight, net, about 68 kg; gross, about 100 kg. **Packing** for land transport	0. 13. 0
50,477. **Experimental Switchboard, Wall Type,** with extra large Standard Measuring Instruments, two Switch Contacts arranged separately and resistance for placing over the switchboard (Figure), for connecting up to **110—160 volts** Direct Current, for taking currents of **0.03—30 amps.** and pressures of 0.3—110 (or 160) volts from the main	37. 10. 0
The instrument bases are 295 mm diameter. It is possible to read the scale even at a considerable distance away. The levers (or handles) of the Double Switch Contact used in our other switchboards are fixed separately, and there is a separate circuit for each lever. The resistances are not placed behind the switchboard but over the latter, being connected to the switchboard by special leads.	
The switchboard is fitted with: 1 Regulating Resistance of 36 ohms in 30 steps, for a max. load of 5—30 amps. and two switch levers each with 30 contacts; 2 fuses; 1 main switch; 1 dead-beat standard type ammeter with 2 measuring resistances and 1 dead-beat standard type voltmeter, each instrument having a diameter of base of 295 mm; 1 ammeter switch; 1 voltmeter switch; 1 switch for the shunt for potential-division; 1 lamp bracket with 2 fuses; 1 plug box with plug and 4 m flexible; also terminals for main and apparatus.	
50,477 a. — The preceding, for connecting to a **220 volt** Direct Current main, for taking currents of **0.04—20 amps.** and pressures of 0.4—220 volts from the network	38. 10. 0
The resistance is 48 ohms in 30 stages for a max. load of 5—20 amps.; in other respects the construction is the same as that of Switchboard No. 50,477.	



50 477. 1 : 10.



50 480. 1 : 18.

50,478. — The preceding, for connecting to a **110 volt** Direct Current main, for taking currents of **0.04—20 amps.** and pressures of 0.4—110 volts from the network . . . . £ 36. 0. 0

The resistance is 24 ohms in 21 steps, for a max. load of 5—20 amps., the two switch levers have each 21 contacts; in other respects this board is similar to No. 50,477.

50,479. **Experimental Switchboard for Low Currents,** Wall Pattern, for connecting to **110 volts** Direct Current, for taking currents of **0.03—5 amps.** and pressures of 0,3—120 volts from the network, with Double Switch Contact Regulator and Sliding Rheostat . . . 23. 0. 0

The switchboard carries: 1 Regulating Resistance of 50 ohms, variable in 21 steps, for a max. load of 2—5 amps.; 1 Double Switch Lever with 21 contacts; 2 terminals for the feed supply; 2 fuses; 1 main switch (quick break); 1 dead-beat standard ammeter with 2 ranges of 0—1 and 0—5 amps. respectively; 1 ammeter switch; 1 dead-beat standard voltmeter with 2 ranges of 0—12 and 0—120 volts respectively; 1 voltmeter switch; 1 switch for the shunt; 1 plug box with plug and 4 m flexible.

50,480. **Travelling Type Experimental Switchboard for large Currents** (Figure), for connecting to **110 volts** Direct Current, for taking currents of **0.1—150 amps.** and pressures of 0.3—110 volts from the network; with Double Switch Contact Rheostat and Standard Measuring Instruments 54. 0. 0

The switchboard, together with the resistances, travels on rollers, and carries: 1 rheostat of 22 ohms, variable in 21 steps, for a maximum load of 5—150 amps.; 1 Double Switch Lever with 21 contacts; 2 fuses; 1 main switch; 1 dead-beat precision ammeter; 1 ammeter switch; 1 dead-beat precision voltmeter; 1 voltmeter switch; 1 switch for the shunt for potential-division; 2 terminals each for connecting up with the network and for the apparatus.

Direct Current Experimental Switchboards with I Circuit and with Air-damped Instruments.

£ s. d.

50,481. **Experimental Switchboard Type A_2, Wall Pattern,** for connecting to **110—160 volts Direct Current,** and for taking currents of **0.03—30 amps.** and pressures of 0.3—110 (or 160) volts from the main, with air damped measuring instruments of 120 mm scale diameter, and Double Switch Contact Rheostat having 30 steps 22. 0. 0

Weight, net, about 70 kg; gross, about 105 kg. For dimensions, see dimension sketch and table on p. 113. **Packing** for land transport 0. 14. 0

The switchboard carries: 1 36-ohm Rheostat variable in 30 steps and for a max. load of 5 to 30 amps., with Double Switch Lever having 30 contacts; 2 terminals for connecting to network; 2 fuses; 1 main switch (quick break); 1 ammeter; 1 voltmeter; 1 voltmeter switch; 1 switch for the shunt for obtaining division of potential; 1 plug box with plug and 4 m flexible.

Portable Type as Fig. 50,471 A . . . . . **Extra** 0. 10. 0

Sliding Rheostat for fine regulation, fitted on switchboard, adaptable for up to 20 amps., having resistance of 0.9 ohm . . . . . **Extra** 1. 5. 0

50,482. **Portable Experimental Switchboard Type A_2,** resting on stout rollers, apparatus and instruments exactly as in Switchboard 50,481 . . . . . 24. 0. 0

Weight, net, about 87 kg; gross, about 130 kg. **Packing** for land transport 0. 15. 0

50,483. **Experimental Switchboard, Type B_2, Wall Pattern,** for connecting to **220 volts** Direct Current; for taking currents of **0.04—20 amps.** and pressures of 0.4—220 volts from the network, with air-damped instruments of 120 mm scale diameter and Double Switch Contact Rheostat having 30 stages 22. 5. 0

Weight, net, about 82 kg; gross, about 125 kg. For dimensions, see dimension sketch and table on p. 113. **Packing** for land transport 0. 14. 0

The switchboard carries: 1 48-ohm Rheostat variable in 30 steps and for a max. load of 5 to 20 amps., with Double Switch Lever with 30 contacts; 2 terminals for connecting up to network; 2 fuses; 1 main switch (quick break); 1 ammeter; 1 voltmeter; 1 voltmeter switch; 1 switch for the shunt for obtaining division of potential; 1 plug box with plug and 4 m flexible.

For Currents to 30 amperes . . . . . **Extra** 3. 10. 0

Portable Construction as Fig. 50,471 A . . . . . **Extra** 0. 10. 0

50,484. **Portable Experimental Switchboard Type B_2** resting on stout rollers; apparatus and instruments exactly as in Switchboard 50,483 . . . . . 24. 5. 0

Weight, net, about 100 kg; gross, about 150 kg. **Packing** for land transport 0. 15. 0

50,485. **Experimental Switchboard Type C_2, Wall Pattern,** for connecting up to **110 volts** Direct Current, for taking currents of **0.04—20 amps.** and pressures of 0.4—110 volts from the network; with air-damped instruments of 120 mm scale diameter and with Double Switch Contact Rheostat having 21 stages 17.10. 0

Weight, net, about 50 kg; gross, about 76 kg. For dimensions, see dimension sketch and table on p. 113. **Packing** for land transport 0. 12. 0

The switchboard contains: 1 24-ohm Rheostat variable in 21 steps and for a max. load of from 5—20 amps., with Double Switch Lever having 21 contacts; 2 terminals for connecting up to the main; 2 fuses; 1 main switch (quick break); 1 ammeter; 1 voltmeter; 1 voltmeter switch; 1 switch for the shunt for obtaining division of potential; plug box with plug and 4 m flexible.

Portable Construction as Fig. 50,471 A . . . . . **Extra** 0. 10. 0

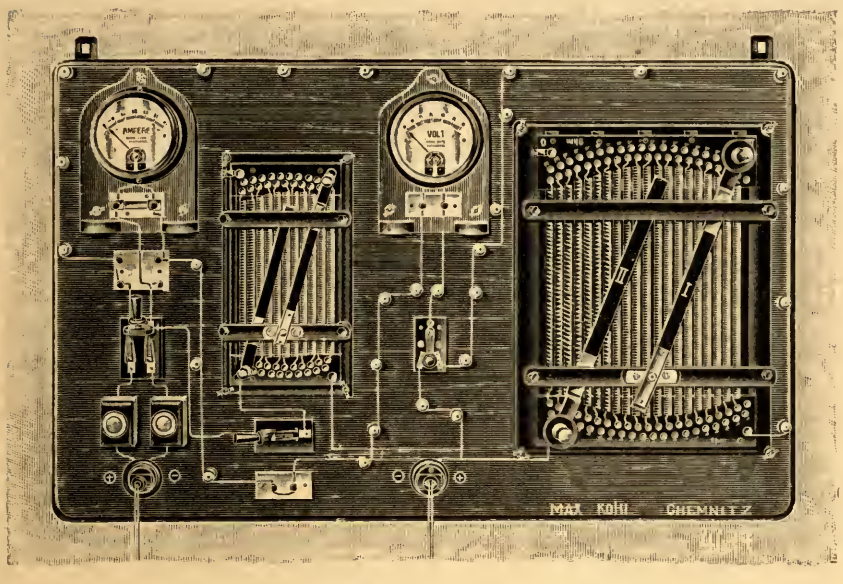
50,486. **Travelling Type Experimental Switchboard (Type C_2),** resting on massive rollers; apparatus and instruments exactly as in Switchboard No. 50,485 . . . . . 19.10. 0

Weight, net, about 68 kg; gross, about 105 kg. **Packing** for land transport 0. 12. 0

50,487. **Dismountable Experimental Switchboard** (Brüsch's), Figure, with leads laid in the open; for connecting up to **110 volts** Direct Current, for taking currents of **0.03 to 30 amps.** and pressures of 0.3—110 volts from the main; Portable construction, on wood slab. 26.10. 0

This switchboard is suitable for educational purposes and for the laboratory; the more important apparatus can be detached and used singly. The volt- and ammeter are fitted to special wood sockets. The switchboard carries: 1 plug for inserting in a plug box connected with the main by the length (2 m) of flexible supplied; 2 fuses; 1 main switch; 1 contact plate for rapidly removing the ammeter from the main lead and switching it into the lead being used; 1 ammeter; 1 main rheostat; 1 plug box with plug and 4 m flexible for connecting up the apparatus; 1 shunt regulator; 1 switch for the shunt for division of potential; 1 voltmeter; 1 voltmeter switch; 1 contact plate for connecting up a further ammeter for exact measurements, 1 galvanometer, precision instrument or the like.

The main and shunt regulators fitted to the slab can be used separately as Brüsch Double Switch Contact Resistances (see No. 50,516 and No. 50,518) (1) as series resistance, (2) as shunt resistance for



50 487. 1 : 15.

50 490. 1 : 12

any current-density (potential divider), (3) as a shunt resistance for small current-densities. For further details, see under the List Numbers given. | £ s. d.

50,488. **Travelling Type Wood Stand** on which to set the switchboard so that it may be used in different rooms | 2. 2. 0

50,489. — The preceding Switchboard (50,487) **on marble slab,** for fixing permanently to the wall . . . . . | 29. 0. 0

Direct Current Experimental Switchboard with two Circuits for Equal Currents, and with Standard Type Instruments.

50,490. **Experimental Switchboard with 2 Circuits, Wall Pattern, Type D_1,** Figure, for connecting up to **110—160 volts** Direct Current, and for taking currents of **0.03—30 amps.** and pressures of 0.3—110 (or 160) volts in each of the two circuits, with Standard Instruments and Double Switch Contact Rheostat having 30 stages . . . . . | 41. 0. 0

The switchboard contains in each of the two circuits: 2 fuses; 1 main switch; 1 dead-beat standard ammeter; 1 ammeter switch; 1 switch for the shunt for obtaining potential-division; 1 36-ohm regulating resistance variable in 30 steps, for a max. load of 5—30 amps.; 1 Double Switch Lever with 30 contacts; 1 plug box with plug and 4 m flexible; 2 terminals for connecting the switchboard to the network. The board also contains for the two circuits in common: 1 dead-beat precision voltmeter and 1 voltmeter switch for 4 circuits.

Fitting a Lamp Bracket for lighting purposes, with switch and 2 fuses . . . . . **Extra** | 1. 0. 0

Sliding Rheostat for fine regulation, fitted to the board, adaptable for up to 20 amps., having a resistance of about 0.9 ohm . . . . . **Extra for the 2 circuits** | 2. 10. 0

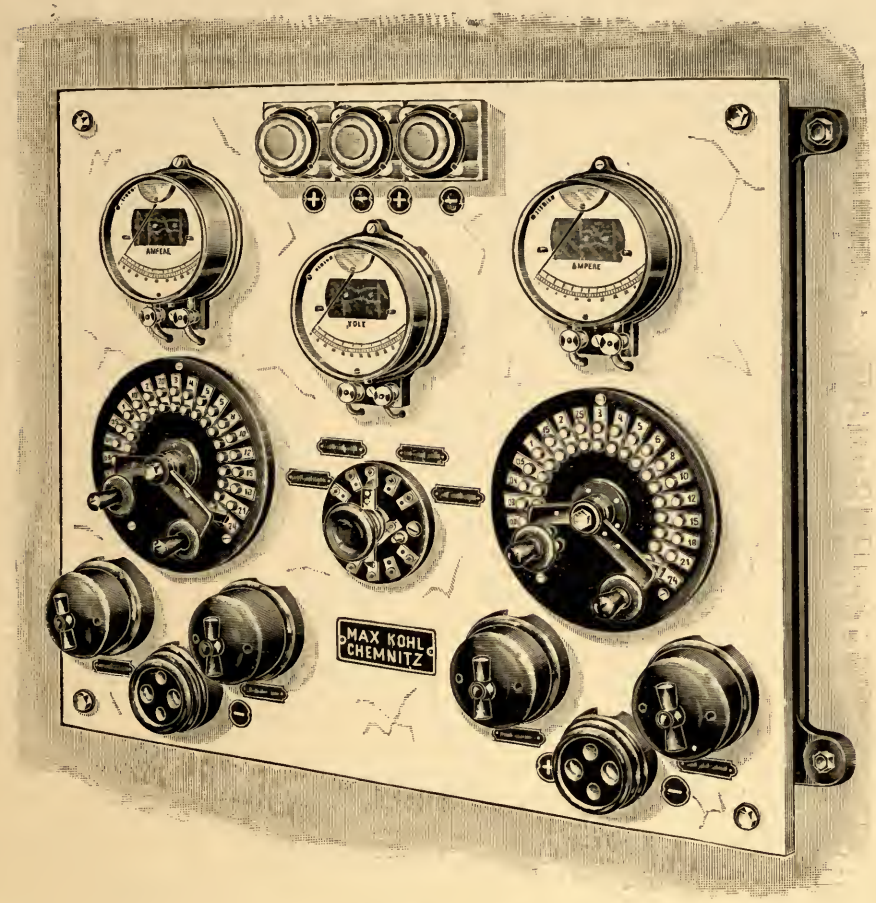
Measuring Instruments with 2 ranges, from 0—30 and 0—3 amps. respectively and 0—120 and 0—12 volts, or 0—160 and 0—16 volts . . . . . **Extra** | 3. 15. 0

50,491. **Travelling Type Experimental Switchboard with 2 Circuits (Type D_1),** cf. Fig. 50,472, resting on massive castors; apparatus and instruments exactly as in No. 50,490 . . | 43.10. 0

	£ s. d.
50,492. **Experimental Switchboard with 2 Circuits, Wall Pattern (Type E_1)**, Fig. 50,490, for connecting up to **220 volts** Direct Current, and for taking currents of **0.04—20 amps.** and pressures of 0.4—220 volts in each of the circuits; with Standard Instruments and Double Switch Contact Rheostat with 30 stages	41.10. 0
The switchboard contains in each of the two circuits: 2 fuses; 1 main switch; 1 dead-beat standard ammeter; 1 ammeter switch; 1 48-ohm rheostat variable in 30 steps, and for max. load of 5 to 20 amps.; 1 Double Lever Switch with 30 contacts; 1 plug box with plug and 4 m flexible; 2 terminals for connecting the switchboard to the network. The board also has for the two circuits in common: 1 dead-beat precision voltmeter and 1 voltmeter switch for 4 circuits.	
Sliding Rheostat for fine regulation, fitted to the board, adaptable for up to 20 amps., and having a resistance of about 0.9 ohm . . . . . **Extra for the 2 circuits**	2. 10. 0
Fitting a Lamp Bracket for lighting purposes, with switch and 2 fuses . . . . . **Extra**	1. 0. 0
Measuring Instruments with 2 Ranges, from 0—30 and 0—3 amps. and 0—220 and 0—22 volts . . **Extra**	3. 15. 0
50,493. **Travelling Type Experimental Switchboard with 2 Circuits, Type E_1** (cf. Fig. 50,472), resting on stout castors; apparatus and instruments exactly as in No. 50,492	44. 0. 0
50,494. **Experimental Switchboard with 2 Circuits, Type F_1 (Wall Pattern)**, cf. Fig. 50,490, for connecting up to **110 volts** Direct Current, and for taking currents of **0.04—20 amps.** and pressures of 0.4—110 volts in each circuit; with Standard Instruments and two Double Switch Contact Rheostats with 21 steps	29. 0. 0
The switchboard contains in each of the two circuits: 2 fuses; 1 main switch; 1 dead-beat standard ammeter; 1 ammeter switch; 1 switch for the shunt; 1 24-ohm Rheostat variable in 21 stages and for a max. load of 5—20 amps.; 1 Double Switch Lever with 21 contacts; 1 plug box with plug and 4 m flexible; 2 terminals for connecting the switchboard to the network. The board also has for the two circuits in common: 1 dead-beat standard voltmeter and 1 voltmeter switch for 4 circuits.	
Fitting a Lamp Bracket for lighting purposes, with switch and 2 fuses . . . . . **Extra**	1. 0. 0
Sliding Rheostat for fine regulation, fitted to the board, adaptable for up to 20 amps., and having a resistance of about 0.9 ohm . . . . . **Extra for the 2 circuits**	2. 10. 0
Measuring Instruments with 2 Ranges, from 0—30 and 0—3 amps. and 0—120 and 0—12 volts . . **Extra**	3. 15. 0
50,495. **Travelling Type Experimental Switchboard with 2 Circuits (Type F_1)**, cf. Fig. 50,472, resting on stout castors; apparatus and instruments exactly as in No. 50,494	31.10. 0

Direct Current Experimental Switchboards with 2 Circuits for Equal Currents, and with Air-damped Measuring Instruments.

50,496. **Experimental Switchboard with 2 Circuits, Type D_2 (Wall Pattern)**, cf. Fig. 50,490, for connecting up to **110—160 volts** Direct Current, and for taking currents of 0.03 to 30 amps. and pressures of 0.3—110 (or 160) volts in each of the two circuits; with air-damped measuring instruments having a scale-diameter of 120 mm and two Double Switch Contact Rheostats with 30 stages	38. 0. 0
The switchboard contains in each circuit: 2 fuses; 1 main switch; 1 ammeter; 1 switch for the shunt for division of potential; 1 36-ohm Rheostat variable in 30 steps, for 5—30 amps. max. load; 1 Double Switch Lever with 30 contacts; 1 plug box with plug and 4 m flexible; 2 terminals for connecting the switchboard to the network. The board also has in common for the two circuits: 1 voltmeter and 1 voltmeter switch for 4 circuits.	
Sliding Rheostat for fine regulation, fitted to the switchboard, adaptable for up to 20 amps., and having a resistance of about 0.9 ohm . . . . . **Extra for both circuits**	2. 10. 0
50,497. **Travelling Type Experimental Switchboard, Type D_2** (cf. Fig. 50,472), resting on massive castors; apparatus and instruments exactly as in No. 50,496	40.10. 0
50,498. **Travelling Type Experimental Switchboard (Type E_2)**, cf. Fig. 50,490, for connecting up to **220 volts** Direct Current, and for taking currents of **0.04—20 amps.** and pressures of 0.4—220 volts in each of the two circuits; with air-damped measuring instruments of 120 mm scale-diameter and two Double Switch Contact Rheostats with 30 stages	38.10. 0
The switchboard contains in each circuit: 2 fuses; 1 main switch; 1 ammeter; 1 switch for the shunt for obtaining division of potential; 1 48-ohm rheostat variable in 30 steps and for 5—20 amps. max. load; 1 Double Switch Lever with 30 contacts; 1 plug box with plug and 4 m flexible; 2 terminals for connecting the switchboard to the network. The board has in common for both circuits: 1 voltmeter and 1 voltmeter switch for 4 circuits.	
Sliding Rheostat for fine regulation, fitted to the switchboard, adaptable for up to 20 amps. and having a resistance of about 0.9 ohm . . . . . **Extra for both circuits**	2. 10. 0
50,499. **Travelling Type Experimental Switchboard with 2 Circuits, Type E_2** (cf. Fig. 50,472), resting on stout castors; apparatus and instruments exactly as in No. 50,498	41. 0. 0



50 500. 1 : 10.

50 502. 1 : 10.

50,500. **Experimental Switchboard with 2 Circuits, Type F_2, Wall Pattern** (Figure), for connecting up to **110 volts** Direct Current, for taking currents of **0.04—20 amps.** and pressures of 0.4—110 volts in each of the two circuits, with air-damped measuring instruments of 120 mm scale-diameter and two Double Switch Contact Rheostats with 21 steps . . . . . £ s. d. 26. 0. 0

The switchboard contains in each circuit: 2 fuses; 1 main switch; 1 ammeter; 1 switch for the shunt for obtaining division of potential; 1 24-ohm Rheostat variable in 21 stages and for 5—20 amps. max. load; 1 Double Switch Lever with 21 contacts; 1 plug box with plug and 4 m flexible; 2 terminals for connecting the board to the network. In addition there are for the two circuits in common: 1 voltmeter and 1 voltmeter switch for 4 circuits.

50,501. **Travelling Type Experimental Switchboard with 2 Circuits, Type F_2** (cf. Fig. 50,472), resting on stout castors; apparatus and instruments exactly as in No. 50,500 . . . . 28.10. 0

Direct Current Experimental Switchboards with 2 Circuits of different Current-density, with Standard Type Instruments.

50,502. **Experimental Switchboard, Type G_1, Wall Pattern** (Figure), with 2 circuits for currents of different strength, for connecting up to 110—160 volts Direct Current, and for taking currents of 0.03—30 amps. and pressures of 0.03—110 (or 160) volts from one circuit, and currents of 0.01—5 amps. and pressures of 0.3—110 (or 160) volts from the other circuit, with Standard Instruments and two Double Switch Contacts with 30 and 21 stages respectively 36. 0. 0

In ordering, please state pressure of network. If this is not given, the voltmeter is supplied for 125 volts.

Weight, net, about 120 kg; gross, about 175 kg. **Packing** for land transport 1. 2. 0

The switchboard contains **for the 30 ampere circuit:** 2 fuses; 1 main switch; 1 dead-beat standard ammeter; 1 switch for the shunt for obtaining division of potential; 1 36-ohm Rheostat variable in

30 steps, for a max. load of 5—30 amps.; 1 Double Switch Lever with 30 contacts; 1 check lamp; 1 plug box with plug and 4 m flexible; 2 terminals for connecting up to the network. £ s. d.

For the 5-ampere circuit the switchboard contains: 2 fuses; 1 main switch; 1 dead-beat standard ammeter; 1 switch for the shunt for obtaining division of potential; 1 36-ohm Rheostat variable in 21 steps, for a max. load of 5 amps.; 1 Double Switch Lever with 21 contacts; 1 sliding rheostat for fine regulation; 1 plug box with plug and 4 m flexible; 2 terminals for connecting to the network.

The following are **for both circuits in common:** 1 dead-beat standard voltmeter; 1 voltmeter switch for 4 circuits; 1 double-pole plug box (with fuse) for 6 amps. for connecting up lamps for lighting or the like.

Two-range Measuring Instruments . . . . . **Extra** 3. 15. 0

50,502 a. **Travelling Type Experimental Switchboard, Type G_1,** with two circuits for different Current-strengths (cf. Fig. 50,472); switches and instruments as in No. 50 502 . . 38.10. 0

Weight, net, about 130 kg; gross, about 190 kg. **Packing** for land transport 1. 3. 0

50 502 b. **Experimental Switchboard, Type H_1, Wall Pattern** (cf. Fig. 50,502), **with two Circuits for different Current-strengths,** for connecting up to **220 volts** Direct Current, and for taking currents of **0.04—20 amps.** and pressures of 0.4—220 volts from one circuit and currents of **0.01—4 amps.** and pressures of 0.4—220 volts from the other circuit; with Standard Instruments and two Double Switch Contacts with 30 and 21 stages respectively 36.10. 0

Weight, net, about 120 kg; gross, about 175 kg. **Packing** for land transport 1. 2. 0

The switchboard contains **for the 20-ampere circuit:** 2 fuses; 1 main switch; 1 dead-beat standard ammeter; 1 switch for the shunt for obtaining division of potential; 1 48-ohm Rheostat variable in 30 steps, for a max. load of 5—20 amps.; 1 Double Switch Lever with 30 contacts; 1 plug box with plug and 4 m flexible; 2 terminals for connecting up to the network.

The circuit **to 4 amperes contains:** 2 fuses; 1 main switch; 1 dead-beat standard ammeter; 1 switch for the shunt for obtaining division of potential; 1 60-ohm Rheostat variable in 21 steps, for a max. load of 4 amps.; 1 Double Switch Lever with 21 contacts; 1 sliding rheostat for fine regulation; 1 plug box with plug and 4 m flexible; 2 terminals for connecting up to the network.

The following are provided **for both circuits in common:** 1 dead-beat standard voltmeter; 1 voltmeter switch for 4 circuits; 1 double-pole switch (with fuse) for 6 amps. for connecting up lamps for lighting purposes or the like.

Double-range Measuring Instruments . . . . . **Extra** 3. 15. 0

50,502 c. **Travelling Type Experimental Switchboard, Type H_1,** with two Circuits of different Current-strength (cf. Fig. 50,472); switches and instruments as in No. 50,502 b . 39.10. 0

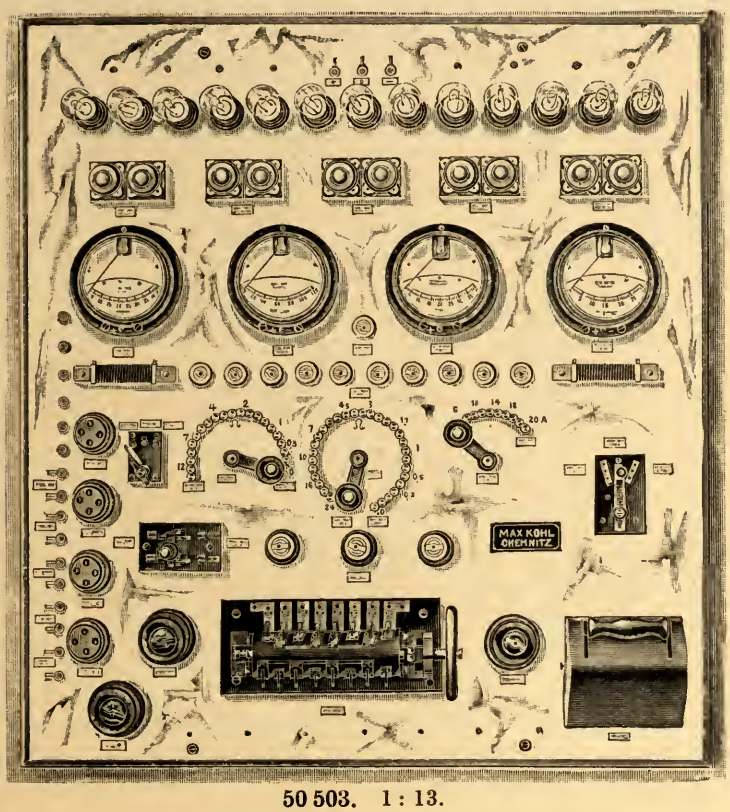
Weight, net, about 130 kg; gross, about 190 kg. **Packing** for land transport 1. 4. 0

Direct Current Experimental Switchboards with 2 Circuits for Connecting up to Three-wire Mains.

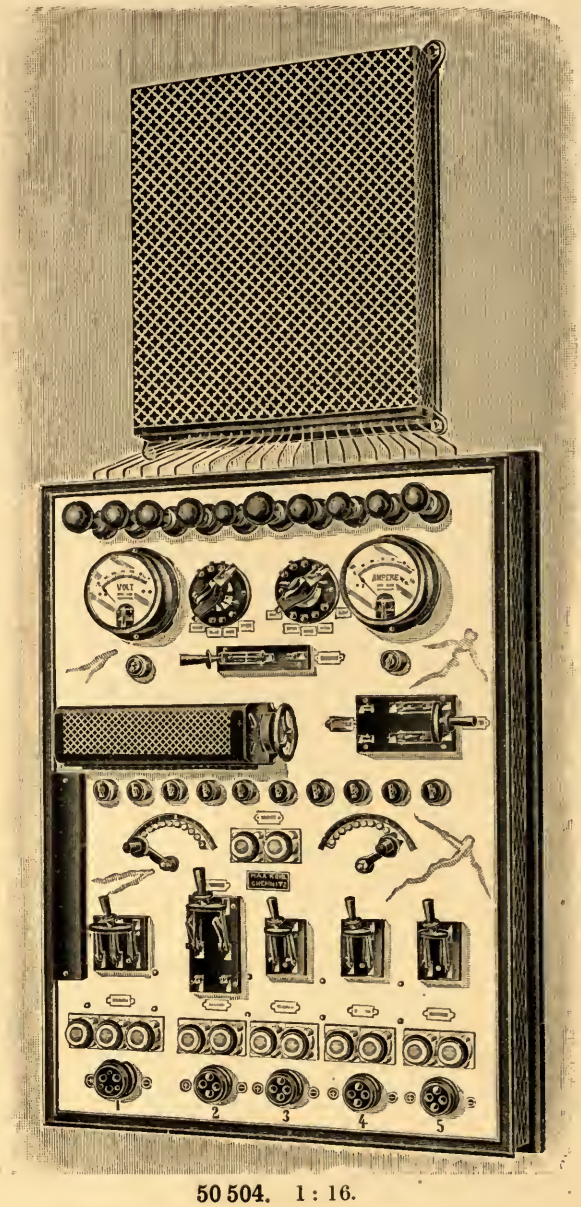
The great variety of ways in which these experimental switchboards can be made up has led us to include in this list a few of the examples which we have already constructed. The advantage of a 3-wire system is that two different voltages are available. In case it should seem necessary, we would ask that an estimate be solicited, stating local conditions and any special wishes.

50,503. **Experimental Switchboard (Wall Pattern) for connecting up to a Three-wire Direct Current System,** Figure, for mains of **2×110** volts working pressure, for taking **0—40 amperes** and **0—110 volts** from one and **0—30 amperes** and **0—40 volts** from the other branch of the network. The current from one branch is intended for feeding the projection lamp, the galvanometer lamps and for the charging of accumulators, the current from the other branch being utilised for experimental purposes. As supplied to the Oberrealschule, Fürstenwallstrasse, Düsseldorf 71. 0. 0

The switchboard is fitted with the following apparatus: 1 3-pole main switch for 40 amps., encased pattern; 10 40-amp. fuse plugs; 4 plug boxes with plugs for 30 amps., one each for the main circuit, for the lamp circuit, for discharging accumulators and for the projection lamp; 1 each dead-beat standard ammeter for 0—40 and 0—30 amps.; 1 each dead-beat standard ammeter for 0 to 120 and 0—40 volts; 1 change-over switch for alternately putting the shunt resistance in parallel with the main rheostat and with the lamp resistance; 1 voltmeter switch; 1 double-pole switch for connecting either the main current or the lamp current to the bus-bars of the board; 1 contact circuit each for the main and shunt rheostats; 10 wall sockets with glow lamps; 10 single-pole switches for preceding; 1 contact circuit for the projector lamp; 1 multiple commutator for 4 circuits, for connecting the cells



50 503. 1 : 13.



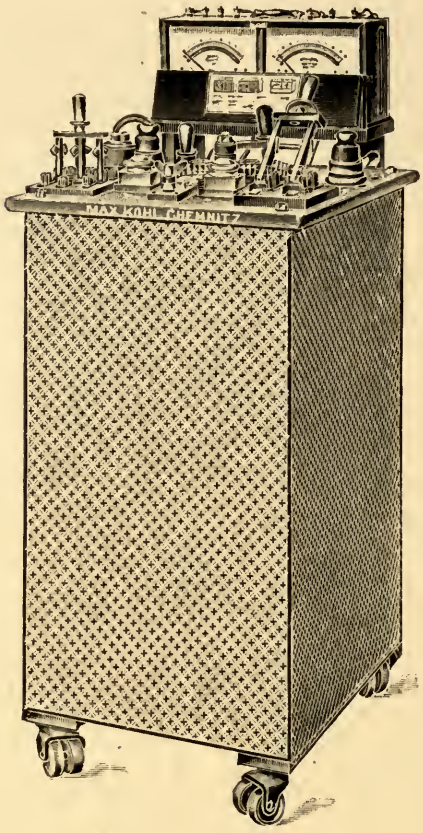
50 504. 1 : 16.

of the accumulator in series or parallel either singly or in pairs; 3 2-pole switches for the galvanometer lamps; 1 2-pole switch for the projector lamp; 3 glow lamps with wall sockets and 1 double-pole switch for charging the accumulators; in addition to the necessary terminals, resistances, leads and 4 m flexible. £ s. d.

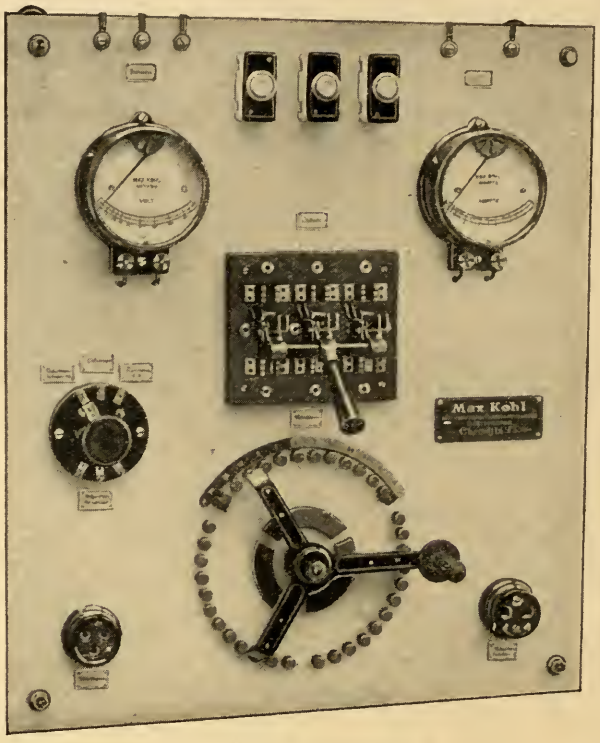
50,504. **Experimental Switchboard for connecting up to Three-Wire Direct Current Systems of 2×110 volts** (Figure), for connecting the experimental board (1) to 2×110 volts without regulating resistance, (2) to 110 or 220 volts without regulating resistance, (3) to 110 volts with regulating resistance in series, (4) to 220 volts with regulating resistance in series; also for charging Accumulators. As supplied to the Luisenschule, Düsseldorf 60. 0. 0

The switchboard contains the apparatus for 5 circuits, viz.: 1 3-pole switch; 3 2-pole switches; 1 2-pole change-over switch with necessary fuses; 2 Switch Regulators each with 10 stages, one for coarse and one for fine regulation; 1 multiple commutator; 1 lamp-battery of 10 lamps with main fuse and single fuses; 1 single-pole shunt switch; 1 2-pole change-over switch, for switching in the lamp battery as a shunt; 1 dead-beat precision voltmeter with switch; 1 switch for the voltmeter; 1 dead-beat precision ammeter with switch; 1 change-over switch for the ammeter. The following are given in with the board: 4 m triple flex.; 4 m twin flex. together with the necessary plug boxes and plugs and 1 resistance, to be fitted separate from the switchboard, with connecting leads and the necessary terminals.

The permissible load of the rheostat is, according to the position of the Switch Lever on the contacts, 10—30 amps.; pressures of 2, 4, 8, 12 or 24 volts can be taken from the accumulators by means of the multiple commutator. In order to render the leads behind the switchboard readily accessible, the wall can be cut away behind the switchboard.



50507. 1 : 12.



50508. 1 : 8.

Experimental Switchboards for two kinds of Current.

£ s. d.

50,505. **Experimental Switchboard (Wall Pattern), with 1 Circuit,** arranged for **Direct** and **Alternating Current,** for connecting up to **120 volts** working pressure and for taking currents up to 30 amperes 29. 0. 0

The switchboard contains: 1 36-ohm Rheostat, variable in 30 stages and for a max. load of 5—30 amps.; 1 Double Switch Lever with 30 contacts; 2 fuses; 1 main switch (quick break); 1 hot-wire ammeter with 2 ranges; 1 ammeter switch; 1 hot-wire voltmeter with 2 ranges; 1 voltmeter switch; 1 switch for the shunt; 1 switch for connecting the board to a direct or alternating current supply at will; 1 plug box with plug and 4 m flexible; 4 terminals for connecting to the supply circuit.

50,506. — The preceding, for working pressures to **220 volts** with a current of 20 amps. 32. 0. 0

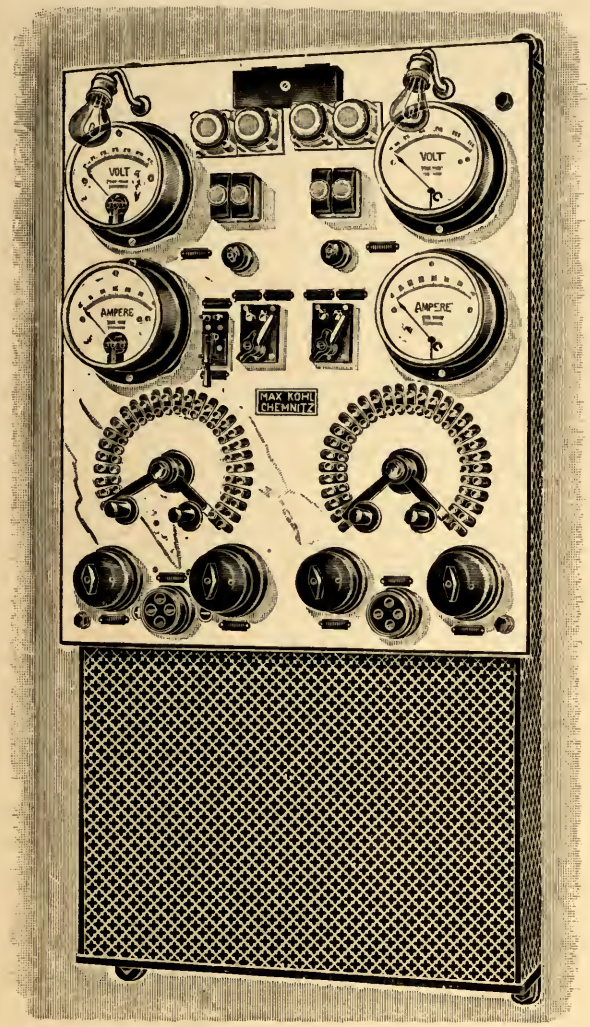
50,507. **Travelling Type Experimental Switchboard, with 1 Circuit,** arranged for **Direct** and **Alternating Current,** Figure, for connecting to working pressures of up to **230 volts,** and for taking currents of up to 30 amperes from the network 40. 0. 0

The switchboard contains: 1 36-ohm Rheostat, variable in 30 stages and for a max. load of 30 amps.; 1 Double Switch Lever with 30 contacts; 2 fuses; 1 2-pole main switch; 1 hot-wire voltmeter for direct and alternating current with 2 ranges 0—130 and 0—260 volts; 1 hot-wire ammeter for direct and alternating current with two ranges 0.5—5 and 5—50 amps.; 1 voltmeter switch; 1 switch for the shunt; 1 plug box with plug and 4 m flexible.

When the switchboard is used for direct **and** alternating current two plug boxes should be fitted at each point of connection . . . . . **Each** 0. 1. 6

50,508. **Experimental Switchboard (Wall Pattern),** for **Alternating or Triphase Current,** with 1 triphase Circuit, Figure, for connecting up to a working pressure of **110 volts,** and for taking currents of **4—10 amps.** from the network. 24. 0. 0

The switchboard contains: 1 Rheostat of 3 × 15 ohms, variable in 12 stages, for a max. load of 10 amps.; 1 3-pole switch; 3 fuses; 1 ammeter and 1 voltmeter, air-damped, of 120 mm scale-diameter; 1 voltmeter switch; 2 plug boxes with plugs, for alternating or 3-phase current and 4 m flexible; 2 terminals for the A. C. supply main and 3 terminals for the 3-phase supply.



50 509. 1 : 12.

50 510, 50 512. 1 : 14.

50,509. **Experimental Switchboard (Wall Pattern), with 2 Circuits,** for connecting up simultaneously to a Direct and an Alternating Current Supply, having a voltage of **110** to **160 volts,** for taking currents of **0.3—30 amps.** and pressures of 0.3—110 (or 160) volts, Figure . . . . . £ s. d. 43. 0. 0

The switchboard is equipped **for Direct and for Alternating Current** with the following: 1 Rheostat each of 36 ohms, variable in 30 stages and for a max. load of 5—30 amps.; each 1 Double Switch Lever with 30 contacts; each 2 fuses; each 1 main switch; each 2 terminals for connecting up to the supply lead; also each 1 switch for the shunt; each 1 plug box with plug and 4 m flexible; each 1 glow lamp bracket with switch and 2 fuses. In addition, for Direct Current: 1 dead-beat standard ammeter, 1 ammeter switch; 1 dead-beat precision voltmeter and 1 voltmeter switch; for Alternating Current: with 1 ammeter, 1 voltmeter and 1 voltmeter switch.

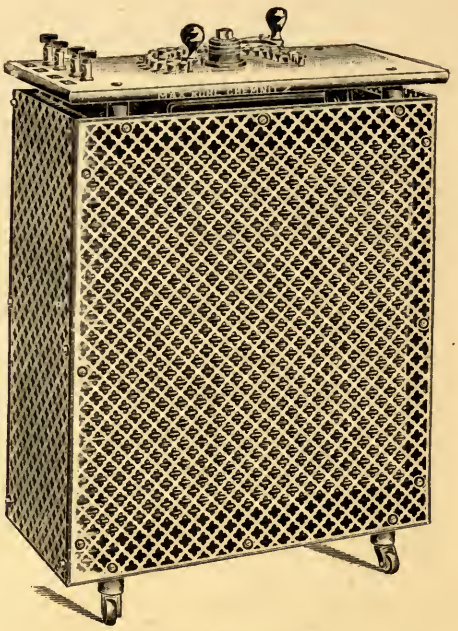
Rheostats.

50,510. **Double Switch Contact Rheostat, Wall Type,** Figure, for connecting up to **110 to 160 volts** working pressure, without measuring instruments and switchgear, with regulating resistance of 36 ohms, variable in 30 steps, for 5—30 amps. maximum load; can be employed either as a series resistance or shunt resistance for division of potential 14. 0. 0

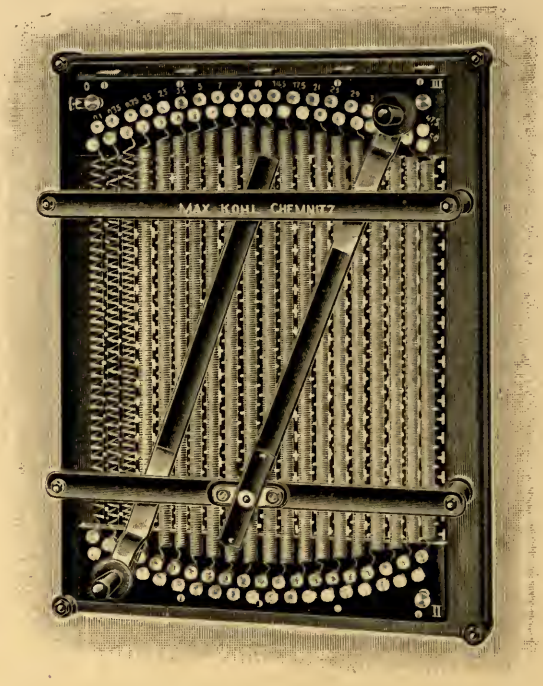
50,511. — The preceding, **table form,** travelling on rollers, Figure on page 126. 15. 0. 0

50,512. **Double Switch Contact Rheostat, Wall Pattern,** Figure, for connecting up to a working pressure of **220 volts;** without measuring instruments and switchgear; with regulating resistance of 48 ohms, variable in 30 steps, for 5—20 amperes maximum load; can be used either as a series resistance or a shunt resistance for potential-division 14. 0. 0

50,513. — The preceding, **Table Pattern,** travelling on rollers, Figure 15. 0. 0



50511, 50513, 50515. 1 : 10.



50516, 50517. 1 : 10.

	£ s. d.
50,514. **Double Switch Contact Rheostat (Wall Pattern)**, cf. Fig. 50,410, for connecting up to **110 volts** working pressure, without measuring instruments or switchgear; with 24 Ohm Regulating Resistance variable in 21 steps, for a max. load of 5—20 amps.; can be employed either as a series resistance or as a shunt resistance for division of potential	10.10. 0
50,515. — The preceding, **Table Type,** travelling on rollers, Figure	11.10. 0
50,516. **Experimental Switchboard with 2 Switch Handles, Type A,** Figure, (Brüsch's), for taking any small or large currents at low or high terminal voltage from networks of **110 volts**	6.15. 0
Weight, net, about 30 kg; gross, about 42 kg. **Packing** for land transport	0. 5. 0

This rheostat can be used (1) **as a Series Rheostat** for apparatus which works without interruption of the current, and especially with heavy currents at high terminal voltages at the apparatus (e. g., working an arc lamp); (2) **as a Shunt Resistance** for division of potential or for taking any heavy current (within the load limits corresponding to the individual positions of the switch on the contacts) at low tension; and (3) **as a Shunt Resistance** for division of potential or for taking small currents up to 2 amps.

Complete description and instructions for use on application. The rheostat has 39 contacts, **36 ohms** resistance and admits of a load of from **5 to 30 amps.** according to the position of the switch contact; with the aid of this it is possible to take currents of 0.03—30 amps. and pressures of 0.3 to 110 volts from the 110 volt network.

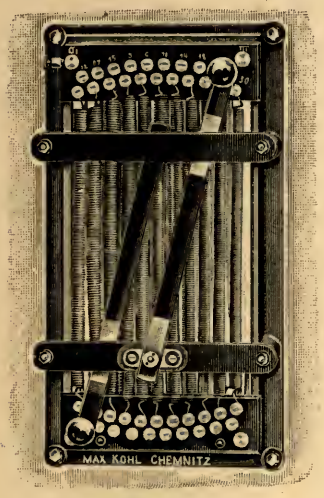
50,517. — The preceding, **Type B,** for **220 volts**	6.15. 0

This rheostat has 39 contacts, **48 ohms** resistance and admits of a load of **5—20 amps.** according to the position of the switch contact; with the aid of this rheostat it is possible to take currents of 0.08—20 amps. and pressures of 0.8—220 volts from a 220 volt network.

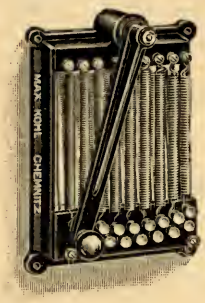
50,518. — The preceding, **smaller, Type C,** for **110 volts,** Figure	4.10. 0
Weight, net, about 12 kg; gross, about 17 kg. **Packing** for land transport	0. 3. 0

This rheostat is intended for lesser loads; it has 21 contacts, **24 ohms** resistance and admits of a load of **5—20 amps.** according to the position of the switch contact; with it currents of 0.08 to 20 amps. and pressures of 0.8—110 volts can be taken from a 110 volt network.

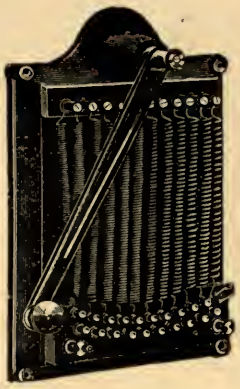
50,519. **Rheostat** with 17 contacts, Figure, **20 ohms** resistance, for a max. load of **2—15 amps.,** in iron frame, for fixing to the wall	1.15. 0
50,520. — The preceding, **larger,** Figure, with 21 contacts, **25 ohms** resistance, for **2—20 amps.** max. load	2. 5. 0
50,521. — The preceding, with 21 contacts, **30 ohms** resistance, for **2—25 amps.** max. load.	2.15. 0
50,522. — The preceding, **larger,** with 38 contacts, Figure, **50 ohms** resistance, for **2—20 amps.** max. load	4. 5. 0



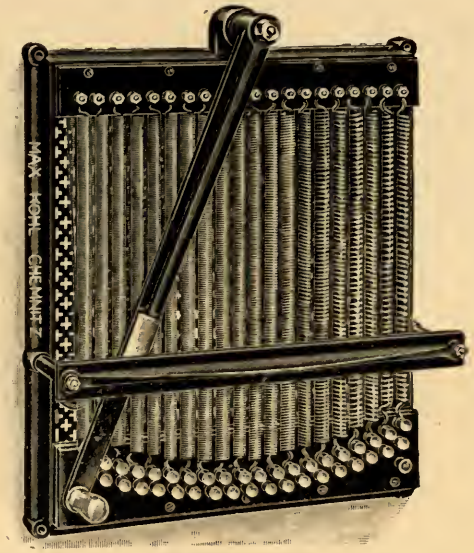
50 518. 1 : 9.



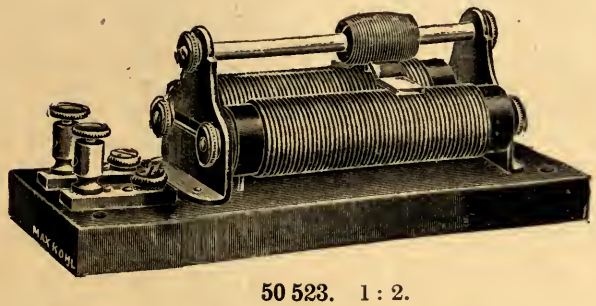
50 519. 1 : 9.



50 520. 1 : 9.

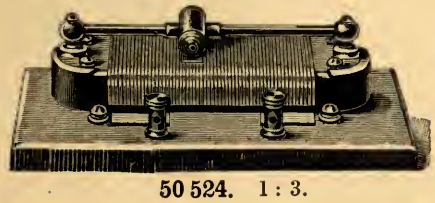


50 522. 1 : 9.

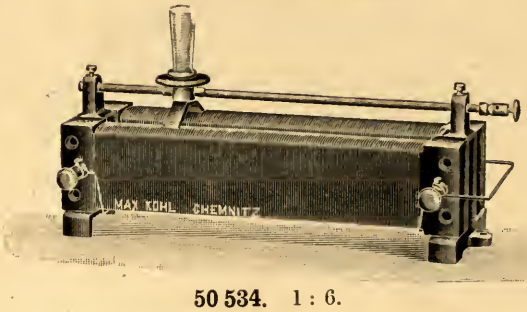


50 523. 1 : 2.

50 527. 1 : 4.



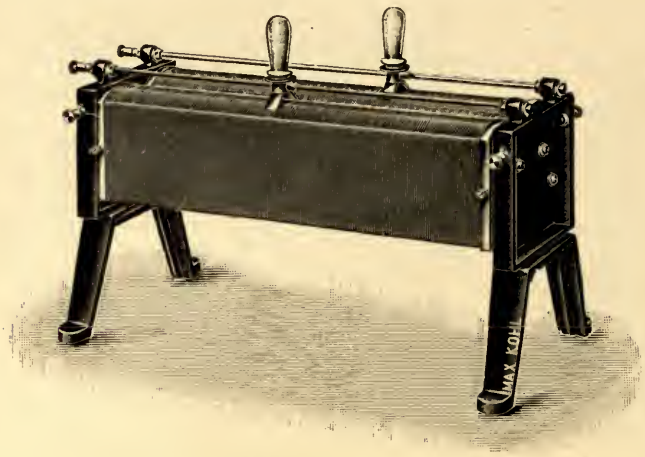
50 524. 1 : 3.



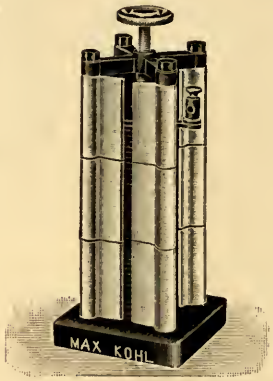
50 534. 1 : 6.

	£ s. d.
50,523. **Sliding Resistance,** Figure, with **2 ohms** resistance and load of **4 amps.** . . .	0. 18. 0
50,524. **Sliding Resistance,** Figure, 14 cm long, with resistance of **6 ohms** and **3 amperes** load	0. 15. 0
50,525. — The preceding, **larger,** 23 cm long, with **20 ohms** resistance and **2 amperes** load.	1. 0. 0
50,526. — The preceding, with fine winding; resistance **380 ohms;** load **0.5 amps.**	1. 8. 0
50,527. — The preceding, can also be used as **shunt resistance** (cf. Figure), on serpentine stone slab	1. 10. 0
50,528. — The preceding; resistance about **1100 ohms** for **0.1 ampere,** Figure	1. 10. 0
50,529. — The preceding, with thick winding; resistance, **0.9 ohms;** load **20 amperes,** on serpentine stone slab, without shunt terminal	1. 8. 0
50,530. — The preceding, **but larger,** 35 cm long, resistance **1.5 ohm;** load **12 amperes**	1. 15. 0
50,531. **Sliding Resistance** (cf. Fig. 50,534); resistance wires wound on slate; resistance about **2,000 ohms,** for currents up to **0.3 ampere**	1. 16. 0
50,532. — ditto, about **700 ohms** for **1 ampere**	1. 16. 0
50,533. — ditto, about **100 ohms** for **3 amperes**	1. 16. 0
50,534. — ditto, about **34 ohms** for **5 amperes**	1. 16. 0
50,535. — ditto, about **10 ohms** for **10 amperes**	2. 0. 0
50,536. — ditto, about **2.5 ohms** for **20 amperes**	2. 0. 0

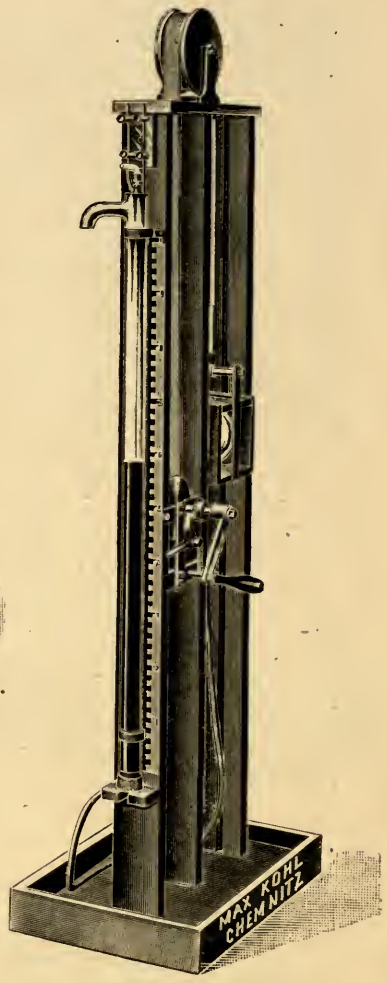
Cl. 3770, 5309, 2283, 5306, 2281, 5351, 2285, 4121.



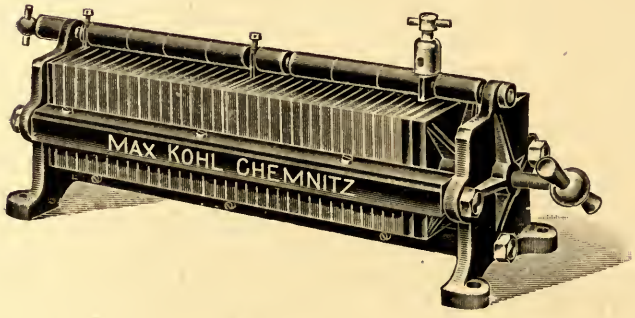
50 537. 1 : 10.



50 539 et 50 543. 1 : 7.



50 547. 1 : 14.



50 544. 1 : 5.

50,537. **Large Sliding Resistance,** Figure, with two windings of different thickness, can be used in various directions as a series or shunt resistance; about **50 ohms** for **5 amperes** and **350 ohms** for **2 amperes** . . . . . £ 4. 15. 0

50,538. — The preceding, about **36 ohms** for **8 amps.** and about **350 ohms** for **2 amps.** £ 4. 15. 0

Graphite Resistance, adjustable by depression screw:

List No.	50,539	50,540	50,541	50,542	
Amps.	1.5	4	6	8	
Resistance adjustable from	0.2	0.25	0.15	0.15	ohm
Resistance adjustable to	8	5	3.5	3.5	ohms
Prices £	**1. 4. 0**	**2. 7. 0**	**2. 10. 0**	**2. 14. 0**	

The material of which the resistances are made up is cotton and graphite. The currents given can be used without overheating when the resistance is used to its fullest extent; the resistances can also be overloaded.

50,543. **Intermediate Terminal** for cutting out a portion of the resistance or introducing a shunt, Figure £ 0. 5. 0

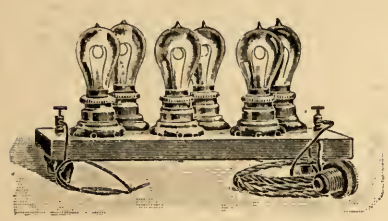
Carbon Plate Resistance, Figure, substantially constructed, for large currents.

List No.	50,544	50,545	50,546	
Amps.	20	35	80	
Resistance adjustable from	0.05	0.03	0.01	ohm
Resistance adjustable to	2.5	1.5	0.8	ohms
Prices £	**4. 10. 0**	**5. 10. 0**	**12. 0. 0**	

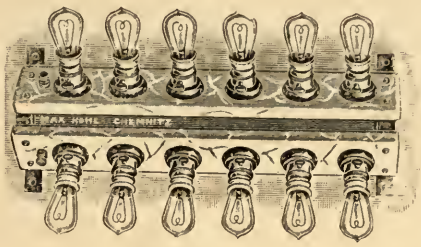
50,547. **Carbon Resistance** (Gross'), Figure, water-cooled, regulation being obtained by adjusting a mercury level; for **120 volts** and **8—60 amperes** . . . . . £ 6. 15. 0

The resistance of two carbon rods in series can be finely regulated by adjusting the mercury level. The portion of the rod-shaped resistance traversed by the current is surrounded by cold water.

Cl. 5318, 5256, 2790, 3554.



50 549. 1 : 8.



50 550. 1 : 10.

50 551. 1 : 12.

	£ s. d.
50,548. **Lamp Resistance of 3 Glow Lamps** (cf. Figure), with 1 screw plug for Edison sockets and 2 m lamp cord; for currents to 3 amperes at 110 volts . . . . . In ordering please state network voltage.	0. 18. 0
50,549. — The preceding, **with 6 lamps,** for currents to 6 amperes at 110 volts . .	1. 4. 0
50,550. **Lamp Resistance with 12 Glow Lamps** (Figure), for fixing to the wall, the holders being mounted on marble; for currents to 12 amperes at 110 volts . . . . . In ordering please state network voltage. The sockets have switches.	3. 0. 0
50,551. — The preceding, **with 40 Glow Lamps.** The sockets are fixed to wood. For currents to **40 amperes at 110 volts.** All lamps to be put in parallel	5. 10. 0

Some Testimonials as to Experimental Switchboards (Translated).

Chrudim, 22nd August 1908.

From six months' experience of the use of the switchboard supplied by you, we are glad to express our entire satisfaction with it as regards the faultless working of the fittings. The rheostat and measuring instruments have been constructed with great precision; and the whole arrangement is constructed in such an elegant manner that your switchboard is quite an ornament in our Physics Lecture Room.

Direction of the Girls' Lyceum.
Stanislav Kalandra, Physics Master. **Jiri Klima,** Rector.

Montevideo, 19th Aug. 1908.

I am pleased to inform you, and I am sure you will be interested to learn, that the system and construction of your switchboard are perfectly satisfactory, in particular on account of the facility with which electrolytical analyses are carried out by its aid, which renders only low current-densities necessary for getting the maximum of regulation when the shunt system is employed.

Chemical Institute of the Faculty of Medicine of the University.

Offenbach a. M., 30th March 1908.

With reference to the switchboard supplied about 3/4 year back (which has proved satisfactory), kindly quote, etc., etc. . . .

Techn. Lehranstalt, Fachlehrer **Trabert.**

Bernburg, 10th December 1907.

I take this opportunity of informing you that we are very pleased with the switchboard.

P. Nouvel, Herzogl. Karl-Realgymnasium.

Szarvas (Hungary), 4th November 1907.

I cannot refrain from expressing to you how pleased we are with the switchboard by reason of the multiplicity of its uses and its absolute reliability.

Director **Joh. Schulek,** Evangel. Obergymnasium.

Satmar (Németi), 20th July 1907.

We have received the switchboard made by you and submitted it to a test to our satisfaction.

Director **Joh. Perenyi,** Lehrerbildungsanstalt.

Bonn, 9th February 1907.

The switchboard supplied has proved satisfactory.

Privatdozent Dr. **Becher,**
Philosoph. Seminar der Kgl. Universität.

Innsbruck, 17th September 1906.

You have rendered a great service to our institution by complying with the wishes of the professors in sending plans and descriptions to the contractors while the buildings were in the rough. The internal equipment, carried out later, is excellent. The work tables, wall cupboards, specimen boxes, Arendt experimental table with switchboard and rectifier, the stink cupboards, blackboard frame, microscope table, etc. are all constructed in a workmanlike manner and work thoroughly well.

Our school is continually being visited by professors (German and foreign), and your work has evoked unstinted surprise.

Ernst Pechlaner,
Professor of Chemistry, Commercial Academy.

Northeim, 16th March 1906.

I would first like to express my satisfaction with all the fittings supplied by you for the physics and chemistry class rooms at the new Gymnasium here. The gas engine and dynamo work without a hitch. The nice switchboard has found a suitable place in the physics class room, and I can accordingly charge the accumulators (which will be placed under the lecture table) on the spot, and I am also enabled to employ the current from the machine direct to the arc light.

Prof. Dr. **Fest.**

St. Pölten, 29th June 1905.

The experimental switchboard has arrived, and I feel I must express to you my cordial thanks for the substantial and elegant manner in which it is constructed and for prompt delivery.

Verwaltung des N.-Oe. Landes-Lehrer-Seminars.

Dornbirn, 20th May 1905.

As the fittings supplied by you to the Staats-Oberrealschule here have been in use for more than $1^1/_2$ years, and all are in the same excellent condition in which they were when supplied, I am compelled to express my entire satisfaction.

The three large glass cupboards supplied for storing physical apparatus are faultless; they shut well and are really dust-proof. The Weinhold lecture table is perfect although composed of so many parts. The darkening arrangement for the 4 windows of the physics class rooms; aspirator and force pump; the blackboard frame and two blackboards, etc. have all proved excellent in spite of the great demands on them. The three-phase-direct current plant together with switchboard satisfies me in every respect: and also the numerous pieces of physical apparatus such as the large induction coil with the X-ray outfit, the outfit for the Tesla high-tension experiments, for wireless telegraphy, the Deprez d'Arsonval galvanometer, the quadrant electrometer, the large electro-magnet and the numerous auxiliary apparatus, etc. (all from your works) make the work of teaching both to teachers and students a genuine pleasure. In regard especially to the Roentgen-apparatus, we have been able to carry on difficult radioscopic and radiographic work.

Dr. **Hans Zuchristian,** K. K. Professor.

Berlin, 16th May 1905.

In accordance with my promise, I have to say that the switchboard supplied by you is now working and operates to my satisfaction. From an external point of view also the apparatus creates a good impression.

Frick, Oberlehrer der II. Realschule.

St. Gallen, 9th May 1905.

The lecture table is quite up to expectation and is excellently made. The table form experimental switchboard for 30 amps. and 120 volts D. C. with standard instruments is working without a hitch. The other apparatus are also satisfactory, and I must again this time express entire satisfaction with all instruments and apparatus supplied. We will not fail to let you know when we are requiring anything further.

Prof. Dr. **H. Renfer,** Commercial Academy.

Düsseldorf, 22nd May 1904.

I am perfectly satisfied with the switchboard delivered to my instructions.

Dr. **Berghoff,** Oberrealschule.

Berlin C 2, 6th November 1903.
Klosterstrasse 73.

The switchboard supplied by you is working faultlessly and is to our entire satisfaction.

Prof. Dr. **Kränzlin,**
Gymnasium zum grauen Kloster.

Berlin C 2, 5th November 1903.

The switchboard has been erected for some time in the anteroom of our chemistry class and greatly pleases by its nice appearance.

Oberlehrer **Hettwer,**
Gymnasium zum grauen Kloster.

Leipzig, 4th November 1903.

I hereby state that the following fittings have been supplied by Messrs. Max Kohl A. G., Chemnitz, for the new building of the lecture room in the Laboratory of Applied Chemistry, Leipzig University:

1. A lecture table constructed in modern style with electric switchboard, battery of accumulators, pneumatic water and mercury troughs, leads for compressed air and compressed gases with gas flues working from underneath; explosion slabs, installation for gas and water, etc.
2. The back wall of the lecture theatre with stink cupboards, blackboards and glass slabs; suspension device for plans, projection table, reagent stand, and other articles.
3. Three darkening devices, for the fanlight and the two rows of windows of various sizes on the side walls of the lecture theatre.
4. An electrically driven air blower.

All these fittings have been constructed in a neat and substantial manner, special attention being paid to the wishes expressed concerning them.

Die Direktion des Laboratoriums für angewandte Chemie der Universität Leipzig.
Prof. Dr. **Beckmann,** Director.

Stettin, 10th September 1903.

I have much pleasure in stating that the lecture table and experimental switchboard Type B which you supplied last year to the Friedrich-Wilhelm-Realgymnasium present a very neat and substantial appearance externally, and they have worn extremely well.

Dr. **Köhler,** Oberlehrer,
Friedrich-Wilhelm-Realgymnasium.

Stettin, 1st May 1903.

I beg to inform you that the Type B experimental switchboard supplied for our Physics Class Room works to my entire satisfaction.

Director Dr. **Grassmann,**
Friedrich-Wilhelm-Gymnasium.

Posen, 17th April 1903.

The equipment of the Physics Section in our new Augusta-Victoria-Gymnasium has met with the undivided approval of all my colleagues who have inspected it. The switchboard and darkening device work exceedingly well. The apparatus which your officials have handed over to us are made in a very complete manner and are nice in appearance.

Oberlehrer Dr. **Mühle,**
Augusta-Victoria-Gymnasium.

Waldshut, 3rd October 1901.

I have now completed the equipment. Both the darkening device and the switchboard are working without a hitch.

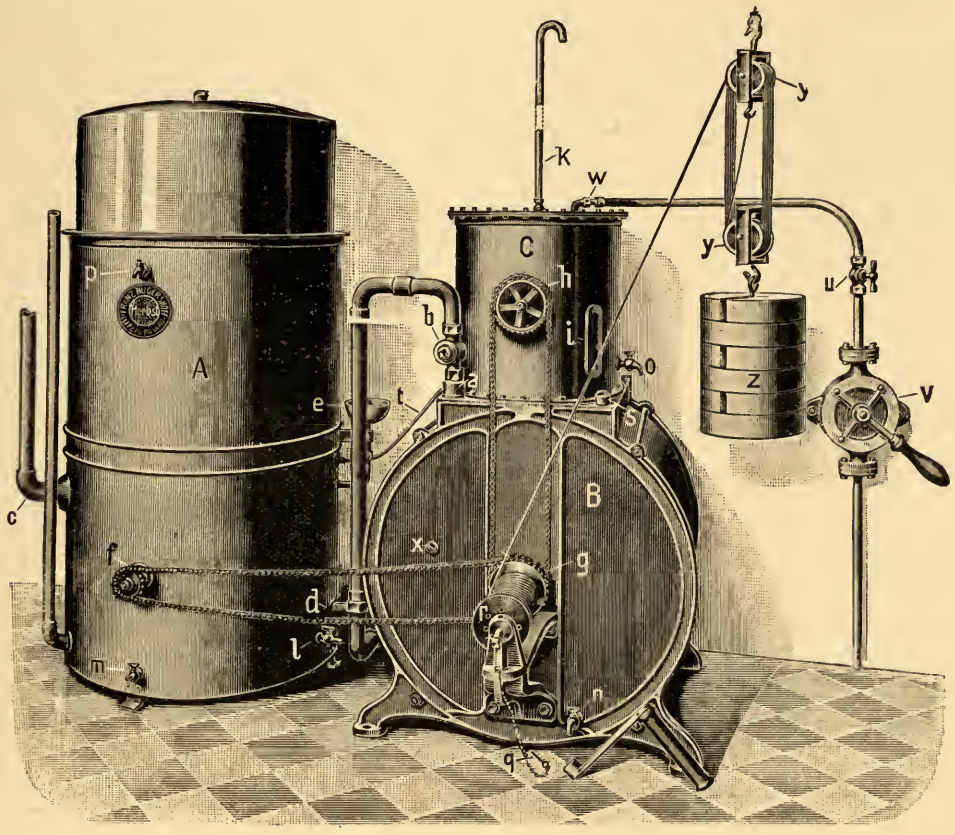
Dr. **Walter.**

Experimental Switchboards previously supplied.

Allenstein, Oberrealschule
Royal Gymnasium
Auerbach, Municipal Electricity Works
Baden-Baden, Oberrealschule
Gymnasium
Bamberg, Lyceum
Municipal Electricity Works
Berlin, Gymnasium zum grauen Kloster (2 switchboards)
2. Städt. Realschule
A. Dittmann
Ernst Quincke
Bernburg, High School for Girls
Beuthen, F. Jaeger, Chemist
Biebrich, Realschule
Biedenkopf, Royal Realprogymnasium
Blagoveschtschensk, Weibl. Alexeieff-Gymnasium
Bonn, Psychological Seminary of the University
Borna, near Leipzig, Realgymnasium
Bozen, Municipal Girls' School
Brake, Georg Rasmussen
Brandenburg a. d. H., Realgymnasium
Bregenz, Obergymnasium
Bremen, Heinrich Müller
Bremerhaven, Municipal Electricity Works
Gas and Water Works
Breslau, Pharmaceutical Institute
Briesen, Realgymnasium
Bromberg, Realschule
Brussels, Robert Drosten (6 switchboards)
Budapest, Ganz Electrical Company
Burgsteinfurt, Kgl. Lehrerseminar
Cassel, Mädchen-Mittelschule in der Luisenstr.
Amalienschule
Chaux-de-Fonds, École de Mécanique
Chrudim, Municipal Lyceum
Kgl. Landes-Ackerbauschule
Clausthal, Kgl. Gymnasium
Cleveland, Dept. of Physics, Case School of Applied Science (two switchboards)
Colmar, Physikzimmer im Mittelschulgebäude
Cöthen, Schultze & Leppert (4 switchboards)
Herzgl. Karls-Realgymnasium
Detmold, Gymnasium mit Realschule
Dieburg, Höhere Bürgerschule
Dillingen, Realgymnasium (2 switchboards)
Dornbirn, Oberrealschule (2 switchboards)
Dortmund, Realschule an der Münsterstrasse
Dresden, Veterinary High School (two switchboards)
Karl Warmbach
Dresden-Plauen, Kgl. Lehrer-Seminar
Duisburg, Municipal Higher Grade School
Municipal Higher Grade School for Girls
Düsseldorf, Oberrealschule an der Fürstenwallstrasse
Reformgymnasium
Luisenschule
Erfurt, Royal Mechanics' School
Fiume, Gustavo Wihrheim
Forst, Magistrat, Stadtbauamt
Frankenberg i. S., Royal Seminary
Realschule
Gera, Zabelschule
Graudenz, Oberrealschule
Gymnasium
Municipal Tramways, Electricity and Water Works
Groningen, Electrisch Bedrijf der Gemeente
Grunewald, Higher Grade School for Girls
Güstrow, Realgymnasium
Haag, J. Pohl
Hagen i. W., Higher Grade School for Girls
Allgemeine Elektrizitätsgesellschaft
Halberstadt, Kgl. Domgymnasium
Hamm, Municipal Higher Grade School for Girls
Helsingfors, Aktiebolaget Akademiska Bokhandeln
Herne, Higher Grade School for Girls
Innsbruck, Commercial Academy, Physics Section
Commercial Academy. chemical laboratory
Insterburg, Kreis-Krankenhaus
Itzehoe, Realschule
Kieff, Polytechnic Institute
Kiel, II. Higher Grade School for Girls
III. Higher Grade School for Girls (2 switchboards)
Kolozsvar, Franz Lutze
Konitz, Royal Gymnasium
Krakau, Physical Institute of the K. K. St. Ann's Gymnasium
Landsberg a. W., Royal Gymnasium with Realschule
Langensalza, Elektrizitätswerk Weiß & Söhne
Lankwitz, Realgymnasium
La Plata, Physics Institute of the National University
Lehe, Oberrealschule
Leipzig, Müller & Syrbe (2 switchboards)
University, Lab. for Applied Chemistry

Leipzig, Oskar Schoppe
Otto Pressler
Leva, Piaristen Obergymnasium
Linden, Humboldtschule
Mittelschule an der Bergstrasse
Lissa, Management of the Municipal Water, Lighting and Power Works
Löbau, Royal Progymnasium
Lübeck, Reform-Realgymnasium
Ernestinschule
Ludwigslust, Grossh. Realgymnasium
Lüneburg, Higher Grade School for Girls
Johanneum
Lund, Fysika Institutionen
Lundenburg, Kaiserin Elisabeth Obergymnasium
Madrid, Viuda de Aramburo (8 switchboards)
Magdeburg, Hermann Bleicher vorm. C. W. Hoffmeister
Maschinenbauschule
Baugewerkeschule
Mannheim, Rhein. Schuckert-Gesellschaft für Elektrische Industrie A. G.
Memel, Louisen-Gymnasium
Messkirch, Realschule
Meissen, Realschule
Mitau, Gymnasium
Mons, École des Mines (3 switchboards)
Institut commercial du Hainaut (4 switchboards)
Montreal, Chemists and Surgeons Supply Company (2 switchboards)
Moscow, E. S. Tryndin's Söhne (4 switchboards)
Munich, Kgl. Kreislehrerinnen-Bildungsanstalt
Münster, Gymnasium
Catholic High School for Girls
Nauheim, Higher Grade School
Neumark, Progymnasium
Odessa, Cadet Corps
Offenbach, Technical Training College
Oldesloe, Realschule (2nd switchboard)
Olmütz, Bauamt
Lehrerbildungsanstalt
Kommunal-Lehrerinnen-Bildungsanstalt
K. K. Böhm. Staatsgymnasium
Ölsnitz, Realschule mit Progymnasium
Osnabrück, Bürgerschule an der Hakenstrasse
Pannonhalma, Physics Section of the High School
Pecs, M. K. Honeod Hadaprodiskola
Pfarrkirchen, Kgl. Landwirtschaftsschule (2 boards)
Pforzheim, High School for Girls
Philadelphia, James G. Biddle (2 switchboards)
Pirna, Realschule
Pisek, K. K. Staatsgymnasium
Poltava, Weibl. Mariengymnasium
Männl. Gymnasium (2 boards)
Posen, Kgl. Berger Oberrealschule
Augusta-Viktoria-Gymnasium
Prossnitz, Physikal. Kabinett d. deutschen Landes-Oberrealschule
Przemysl, K. K. II. Staatsobergymnasium
Putbus, Kgl. Pädagogium
Quedlinburg, Guts-Muther Realschule
Kgl. Gymnasium
Radebeul, Realschule
Ratibor, Kgl. Gymnasium
Municipal Gas, Electricity and Water Works
Remscheid, Higher Grade School for Girls
Rheydt, Gymnasium
High School for Girls
Riesa, Realgymnasium
Riga, School of Commerce (2 boards)
Rorschach, Lehrerseminar
Rufach, Kaiserl. Landwirtschaftsschule
Sagan, Kgl. Gymnasium
Salzburg, K. K. Gymnasium
Mädchenlyceum
St. Gallen, Commercial Academy (2 boards)
St. Petersburg, Viktor Frantzenn
Pölten, Landes-Lehrerseminar
Schöneberg, Realschule
Schopfheim, Realschule
Sebnitz, Stadtschule
Sebastopol, Schiffs-Mechanikerschule
Solingen, Reformgymnasium
Sonderburg, Kgl. Oberrealschule
Sopron, Soproner Beleuchtungs- und Kraftübertragungs-A.-G.
Steglitz, Oberrealschule (2 boards)
Stettin, Friedrich-Wilhelm-Gymnasium
Schiller-Realgymnasium
Stadtgymnasium
Baugewerkschule
Maschinenbauschule
Strassburg, Bischöfl. Gymnasium
Swinemünde, Realgymnasium
Szatmar Nemeti, Kgl. Kathol. Lehrerbildungsanstalt
Tarnopol, K. K. Oberrealschule
Tetschen, Kommunal-Realgymnasium
Thorn, Kgl. Gymnasium und Realgymnasium (2 boards)
Vienna, A. Stögermeyer (3 boards)
Lenoir and Forster
K. K. Lehrmittelbureau
Wilhelmshaven, Verwaltungsressort der Kaiserl. Werft, Abt. 2 (4 boards)
Wilmersdorf, Goetheschule
Zehlendorf, Gymnasium
Zeitz, Realschule
Kgl. Stifts-Gymnasium
Znaim, Landesoberrealschule

Gas Generating Apparatus.

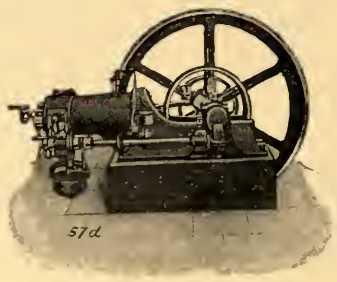


50 560. 1 : 18.

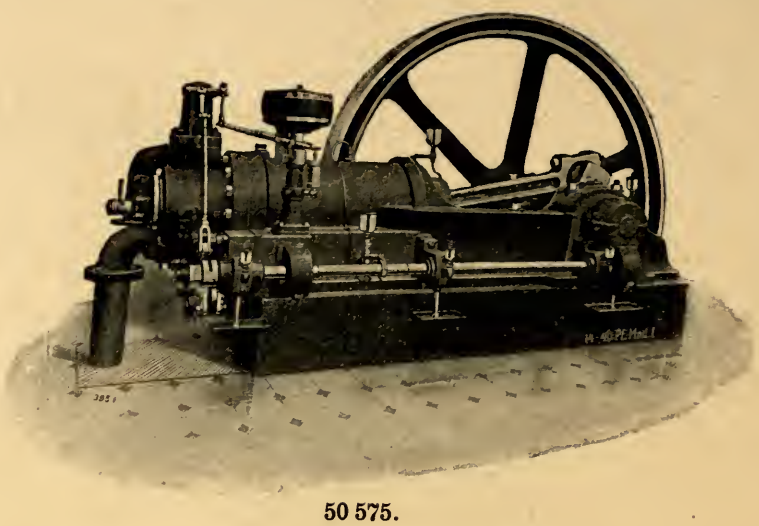
Gasoline Generators, Fig. 50,560, for producing gas for lighting, heating and power; very little attention required; gas always ready for use, being generated in accordance with the supply needed. The gasoline (also called **hydrine, soline** or **hexane**) is a petroleum distillate and consists of light hydro-carbons; Gasoline is a Gas formed for the greater part of air, it is non-poisonous, makes itself felt when interruptions occur by a smell which is not unpleasant; and danger of explosion is reduced to a minimum especially when compared with coal gas, acetylene, etc.

List-No.	Size	Capacity per Hour Cubic metres	Jets per 120 l consumption	Gas-Generator £ s. d.	Packing £ s. d.	Pipe connection inches	Dimensions Depth metres	Width metres	Height metres	Weight Nett kg	Gross kg	Necessary driving weight kg
50 556	1	2	16	**30. 0.0**	**1. 0.0**	3/4	0.80	1.28	1.10	150	250	150
50 557	2	3	25	**33.15.0**	**1. 5.0**	1	0.84	1.32	1.22	170	288	175
50 558	3	4.5	37	**38.15.0**	**1. 8.0**	1	0.90	1.44	1.37	195	315	225
50 559	4	6	50	**42.10.0**	**1.10.0**	1 1/4	0.97	1.54	1.52	235	365	300
50 560	5	9	75	**47.10.0**	**1.15.0**	1 1/2	1.00	1.67	1.68	290	458	400
50 561	6	12	100	**60. 0.0**	**2. 0.0**	1 1/2	1.12	1.83	1.85	370	510	600
50 562	7	15	125	**70. 0.0**	**2.10.0**	2	1.17	1.91	1.92	400	570	800
50 563	8	19.5	162	**82.10.0**	**3. 0.0**	2	1.24	2.25	2.10	440	640	900
50 564	9	23.5	195	**97.10.0**	**3.15.0**	2	1.42	2.40	2.35	505	750	1200
50 565	10	36	300	**117.10.0**	**4.10.0**	2 1/2	1.50	2.50	2.60	595	875	**motor drive**

The gas apparatus (see Fig. No. 50,560) comprises a gas generator and gasometer A, the air bellows B, and the gasoline tank C. A suction cylinder in the bellows, B, is set in motion by any convenient source of power (as a rule by a driving weight z), sucks air through an orifice in the back wall of the bellows, and forces the same at a certain pressure through the pipe line a—d, which is adjusted by the cock b, into the gas generator. The liquid in the generator is set into motion by means of the drive f actuated by a screw wheel. The gasoline flows from the tank C through a thin line of piping t, into the carburetter, the quantity being regulated to the consumption by an exhauster arrangement. The gas mixture generated contains only 1 kg gasoline in



50 571 — 50 574.



50 575.

4,000 litres of air. The only attention which it is necessary to give to the apparatus is to charge with gasoline from time to time and wind the weight up, this in most cases only being requisite once a day; if the fall of the weight can be increased the weight needs to be raised less often. Even when the apparatus is working the weight can be wound up without disturbing the generation of the gas.

The driving weights are only supplied **when expressly asked for,** as they can generally be obtained more cheaply on the spot. A pump No. 50,568 is necessary and the liquid for preventing freezing desirable. (Also the signalling device No. 50,570.) 30 m wire rope are given in with the apparatus as also the driving chain and handle for winding up the weight; if the height through which the weight drops is increased a correspondingly larger quantity of wire rope should be ordered extra.

	£ s. d.
50,566. **Driving Weights,** per 100 kg	1. 2. 0
The weight mentioned in the preceding table is necessary.	
50,567. **Wire Rope,** each further metre	0. 0. 6
50,568. **Pump** with adjusting cock, stand pipe with connections **and angle aspirator**	2. 0. 0
50,569. **Anti-freezing Liquid** for filling the apparatus 100 kg	0. 17. 0
50,570. **Signalling Device** with electric alarm, for showing automatically when the weight has run down: comprising contact, bell, cell and 10 m wire	0. 18. 0

Internal Combustion Engines.

Low Speed Gas Engines, horizontal type (see Figures).

List Number*)	50 571	50 572	50 573	50 574	50 575
Capacity, HP.	1	2	3	4	6
R. P. M.	250	250	250	240	240
a) **Gas Engine with heavy fly wheel and external bearings** £	60. 10. 0	76. 10. 0	92. 0. 0	110. 0. 0	143. 0. 0
b) **Foundation Parts** for masonry foundation £	0. 13. 0	1. 0. 0	1. 5. 0	1. 12. 0	5. 12. 0
c) **Gas Pressure Governer** £	3. 5. 0	3. 15. 0	3. 15. 0	3. 15. 0	4. 10. 0
d) **Cooling Tank** with cock £	2. 10. 0	3. 10. 0	3. 15. 0	4. 15. 0	4. 15. 0
e) **Oil purifier** £	2. 15. 0	2. 15. 0	2. 15. 0	2. 15. 0	2. 15. 0
f) **Starting Handle** with prevention against back shocks £	3. 5. 0	3. 5. 0	3. 5. 0	3. 5. 0	4. 2. 0
Weight of Gas Engine { nett about kg	700	950	1175	1560	1920
Weight of Gas Engine { gross about kg	800	1100	1375	1660	2070

*) When ordering, in addition to quoting the list number, please state the letters a, b, c, etc. placed before the price line.

The prices quoted above include the gas engine with heavy fly wheel, suitable for electric light work, external bearings, gas bag, tools and spare parts. The engines have tube ignition and guided valve motion.

Packing is charged separately, as is also erecting and the pipe lines which may be necessary. It is advisable to order a non-return starting handle, as when this is used it is not necessary to start the engine by turning the fly-wheel.

If the gas is taken from a light supply, it is desirable to provide a gas pressure governor so as to obviate any flickering of the lamps. The water necessary for cooling can be taken off the water supply; if water is not laid on, a cooling tank to fit in with the size of the motor should be ordered.

In working the above engines with gasoline, the use of magneto ignition is recommended instead of the tube ignition; this entailing an increase of price in the case of the 1—6 HP. motors of £ 10. The output of the

gasoline engines does not differ greatly from that of the engines working with illuminating gas. Exact data are given for each individual case on application.

For prices for direct coupled high speed gas-dynamos see p. 136.

The low speed engines listed on the previous page are characterised by particularly smooth running and the greatest certainty in their action.

Low Speed Internal Combustion Engines for liquid Fuels (cf. Figs. 50,571 and 50,575), horizontal type.

These engines can be fitted to work with petrol, heavy benzine, benzol, crude benzol, petroleum, spirit or ergin.

List Number *)	50 576	50 577	50 578	50 579
Continuous Capacity HP.	2	3	4	6
R. P. M.	250	275	275	260
a) **Internal Combustion Engines with heavy fly wheel and external bearings** £	91. 10. 0	94. 0. 0	109. 10. 0	130. 0. 0
b) **Foundation Parts,** for masonry foundation £	0. 19. 0	0. 19. 0	1. 5. 0	1. 12. 0
c) **Cooling Tank,** with piping and cock £	6. 5. 0	6. 15. 0	7. 10. 0	13. 15. 0
d) **Starting Handle,** with prevention against back shocks £	3. 5. 0	4. 2. 0	4. 2. 0	4. 2. 0
e) **Pipe Line** for normal conditions £	4. 10. 0	4. 10. 0	6. 5. 0	6. 5. 0
f) **Centrifugal Pump,** with union, for fuel £	1. 12. 0	1. 12. 0	1. 12. 0	1. 12. 0
Weight of Engines { nett about kg	1050	1085	1320	1650
Weight of Engines { gross about kg	1200	1250	1430	1800

*) When ordering, in addition to quoting the list number, please mention the letters a, b, c, etc. placed in front of the price line, and also the kind of fuel to be used.

	£ s. d.
50,580. **Fuel Tank** for 200 litres fuel	1. 5. 0
50,581. — do., for 300 litres	1. 15. 0

The following are included in the prices: the engine with heavy fly-wheel, suitable for electric light work, with lengthened shaft and external bearings, base plate and foundation parts to the external bearings for masonry foundation; benzoline tank, exhaust box, tools. The foundation parts for the engine itself should be ordered separately. The engines are supplied with magneto ignition and guided valve gear.

Packing and erection are charged separately.

The combustion engines are arranged for pressure-flow cooling, and the water necessary for this purpose can be taken from the water supply. If, however, water is not laid on, a cooling tank corresponding to the size of the engine should be ordered at the same time.

For prices for direct coupled high speed internal combustion engines with dynamos, see p. 137.

The preceding low speed engines are characterised by specially smooth running and greatest safety in working: the horizontal type securing easy access of the working parts and simplifying the work of the attendant.

High Speed Gas Engines.

List Number *)	50 582	50 583	50 584	50 585	50 586
Capacity, HP.	1	2	3	4	6
R. P. M.	1000	800	1100	900	750
a) **Gas Engine** £	36. 5. 0	43. 15. 0	50. 0. 0	75. 0. 0	100. 0. 0
b) **Packing** £	0. 10. 0	1. 6. 0	1. 10. 0	2. 0. 0	3. 0. 0
c) **Gas Pressure Governer** £	1. 2. 0	1. 2. 0	1. 2. 0	1. 2. 0	1. 2. 0
d) **Cooling Tank** for 10 hours working £	2. 0. 0	3. 5. 0	3. 15. 0	4. 10. 0	6. 0. 0
e) **Cooling Pump** £	—	—	1. 10. 0	1. 10. 0	1. 10. 0
f) **Silencer** £	1. 8. 0	1. 8. 0	1. 8. 0	1. 8. 0	1. 8. 0
Gross weight of engine about kg	165	235	275	350	520

*) When ordering, in addition to quoting the list number please mention the letters a, b, c, etc. in front of the line giving the price.

The above motors have magneto ignition. The smaller models up to 3 HP. are also supplied with tube ignition, entailing an increase in price of about £ 11. 5. 0. Magneto ignition secures a regular, smooth action.

The prices of the gas engines include the engine with foundation bearing, centrifugal governor, gas mixing valve, rubber bag, exhaust box, starting handle, foundation bolts, and a few accessories and spare parts. If engines fitted with tube ignition are desired, tubes with burners and chimney and a few spare tubes are sent with the engine.

The following are requisite for working the engines: a gas pressure regulator so as to obviate disturbing the lighting connected with the gas lead because of the engine; a cold water main connected to a pressure water lead (this must be made on the spot and cannot be quoted for beforehand); or a cooling tank, if the water is not laid on or if the water bill has to be kept low; together with a masonry or heavy wood base (which should be obtained on the spot), also a cooling pump where this is shown in the above table of prices, for increasing the circulation of the water; and an exhaust lead, to be provided on the spot. A silencer should also be provided.

For generating direct current for the projection lantern and other lighting or experimental purposes, one of the dynamos for 65 or 65/90 volts, listed on pp. 147 and 148 should be connected up with one of the gas engines by a belt drive. For prices for direct coupled gas dynamos, see p. 136.

High Speed Internal Combustion Engines for Liquid Fuels, Petrol, Benzol and Spirit.

List Number *)	50 590	50 591	50 592	50 593
Capacity, HP.	1.5	2.5	4	6
R. P. M.	1000	900	1250	1150
Internal Combustion Engine a) for petrol or benzol £	36. 5. 0	50. 0. 0	50. 0. 0	78. 10. 0
Internal Combustion Engine b) for spirit £	42. 5. 0	57. 0. 0	57. 0. 0	85. 10. 0
c) Packing £	0. 10. 0	1. 10. 0	1. 10. 0	2. 0. 0
d) Fuel Tank for 5 hours work, for petrol or benzol £	1. 17. 0	1. 17. 0	2. 4. 0	2. 4. 0
e) — do., for spirit £	1. 17. 0	2. 4. 0	2. 4. 0	2. 12. 0
f) Cooling Tank £	3. 12. 0	4. 4. 0	5. 0. 0	6. 15. 0
g) Cooling Pump £	—	—	—	1. 10. 0
h) Silencer £	1. 8. 0	1. 8. 0	1. 8. 0	1. 8. 0
Gross weight about kg	165	275	275	350

*) When ordering, in addition to quoting the list number, kindly mention the letters a, b, c, etc. placed in front of the line containing the price.

The prices of the engines include the engine itself with foundation base, centrifugal governor, magnetic apparatus, carburetter, exhaust box, starter handle, spanners, oil can, foundation bolts and spare parts.

Re the employment of the accessories mentioned in the table, kindly note the explanatory remarks regarding the high speed gas engines. A gas pressure governor is not used, but a fuel tank and 1 petrol conducting pipe (1 s. 4 d. per metre) are necessary.

For generating direct current for the projection lantern and for other lighting or experimental purposes, the dynamos for 65 or 65/90 volts, listed on pp. 147 and 148 should be connected up with one of the preceding engines by a belt drive. For direct coupled sets, see p. 137.

High Speed Gas Engines direct coupled with Direct Current Dynamos: Dynamos for 65 volts.

List Number *)	50 599	50 600	50 601	50 602
Capacity of Engine, HP.	1	2.5	4	8
Output of dynamo, about watts	570	1500	2500	5400
Current at 65 volts, about amperes	8.7	20	34	82
R. P. M.	1000	1000	1500	1000
a) Gas Engine with dynamo, coupling and base plate **) £	60. 10. 0	85. 0. 0	86. 10. 0	150. 0. 0
b) Packing £	1. 5. 0	2. 10. 0	2. 10. 0	4. 0. 0
c) Gas Pressure Governor £	1. 0. 0	1. 0. 0	1. 0. 0	1. 0. 0
d) Cooling Tank for 10 hours work £	2. 0. 0	3. 15. 0	4. 10. 0	10. 10. 0
e) Cooling Pump £	—	—	—	1. 10. 0
f) Silencer £	1. 5. 0	1. 5. 0	1. 5. 0	1. 5. 0
g) 4 Slip Rings, extra price £	5. 10. 0	8. 5. 0	8. 5. 0	12. 0. 0
h) Shunt regulator £	1. 15. 0	2. 0. 0	2. 0. 0	2. 5. 0
Weight of Engine with Dynamo-Coupling and Base-plate nett about kg	250	540	555	700
Weight of Engine with Dynamo-Coupling and Base-plate gross about kg	350	720	740	950

*) When ordering, in addition to quoting the list number, kindly mention the letters a, b, c, etc. placed in front of the line containing the price.

**) The gas engine has magnetic ignition. With tube ignition the prices of the engines to 4 HP. are about £ 11. 5. 0 lower. Magnetic ignition ensures regular, smooth working.

The prices of the engines comprise: the engine with dynamo on one base plate; foundation bolts; slide rails and ties for the dynamo, with elastic coupling, fly-wheel, centrifugal governor, magnetic ignition, gas bag and mixing valve, exhaust box with connections, but without lead; also some accessories and spares. If engines with tube ignition are desired, glow tubes with burner and chimney and some spare tubes are supplied along with the engine.

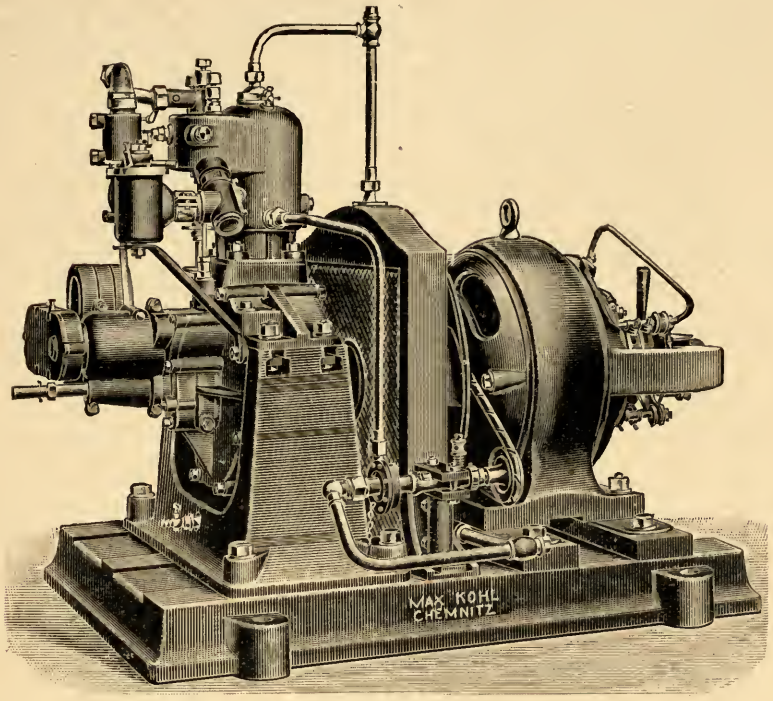
The following are necessary for working: a gas pressure governor, to prevent the lights connected up to the gas lead being disturbed by the running of the engine; a cold water lead connected to a pressure supply (this must be made on the spot and cannot be quoted for in advance); or a cooling tank, if there is no water lead available or if it be desired to cut down the water bill, together with a masonry or heavy wood base (to be provided on the spot); in addition, a cooling pump, where this is mentioned in the above table of prices, for increasing the circulation of the water; an exhaust lead, which should be provided on the spot; and a silencer. A gas meter is also supplied at an increase of price, if desired.

For regulating the pressure of the dynamo a shunt regulator is necessary. If it is desired to take off also alternating and three-phase current, an order should be given us for 4 slip rings to be fitted.

Regarding switchgear for the machines, we shall be happy to furnish a separate estimate, if desired. See also the estimates on p. 138.

For lighting purposes, the models to 4 HP. can only be employed when a battery is used simultaneously; even in the case of the larger models it is advisable to have a battery of accumulators in parallel. Prices of suitable dynamos and batteries on application. See also the estimates on p. 138.

If desired, dynamos for 110 or 220 instead of 65 volts can be supplied, as well as dynamos for charging accumulators without changing the speed.



50 611 and **50 611 h.** 1 : 18.

High Speed Internal Combustion Engines for Liquid Fuels, direct coupled to **Direct Current Dynamos (Fig. 50 611),** for petrol or benzol or for spirit; D. C. Dynamos for 65 volts.

List Number *)		50 611	50 612	50 613	50 614	50 615
Efficiency of Motor, about HP.		1.5	2	3	5	5.5
Output of Dynamo, about watts		860	1150	1750	3000	3500
Current at 65 volts, about amperes		13	17.5	27	46	54
R. P. M.		1000	1500	1000	1500	1000
Internal Combustion Engine with Dynamo, Coupling and Base-plate	a) for Petrol or Benzol £	63.10.0	65.10.0	86. 0.0	92.15.0	115. 0.0
	b) for Spirit £	69.10.0	71.10.0	93. 0.0	100. 0.0	122. 0.0
c) Packing	£	2. 0.0	2. 2.0	2. 5.0	2.10.0	3. 0.0
d) Fuel Tank for Petrol, for 5 hours working	£	1.13.0	1.13.0	1.13.0	2. 0.0	2. 0.0
e) — do., **for Spirit**	£	1.13.0	1.13.0	2. 0.0	2. 0.0	2. 7.0
f) Cooling Tank	£	2. 0.0	2. 0.0	3. 5.0	3.15.0	3.15.0
g) Cooling Pump	£	—	—	—	—	1.10.0
h) Silencer	£	1. 5.0	1. 5.0	1. 5.0	1. 5.0	1. 5.0
i) 4 Slips Rings, extra	£	6.15.0	7.10.0	9. 0.0	9. 0.0	9. 5.0
k) Shunt Regulator	£	1.15.0	1.15.0	2. 0.0	2. 0.0	2. 0.0
Weight of Engine with Dynamo and Coupling	nett about kg	250	275	540	550	495
	gross about kg	350	390	720	740	675

*) When ordering, in addition to quoting the list number kindly mention the letters a, b, c, etc. placed in front of the price line.

The prices of the engines include, internal combustion engine itself with dynamo, on one base plate, foundation bolts, slide rails and ties for the dynamo, elastic coupling, fly wheel, magneto ignition, carburetter, governor, starting handle, exhaust with unions but without lead, with lubricator and some spares for the engine and the ignition.

The following are necessary for working the engines: a fuel tank (this is supplied at the price quoted, is suitable for 5 hours' daily work, is safe from explosion, and is fitted with cock and other necessary fittings); a petrol conducting pipe (copper: per metre, 1 s. 4 d.); a cold water lead in conjunction with the pressure water pipe supply (water consumption 10—20 litres per hour), this must be made on the spot and cannot be quoted for in advance; or a Cooling Tank, should the water not be laid on or should it be desired to cut down the water bill, with masonry or heavy wood base, to be provided on the spot; together with a cooling pump where this is given in above table, for increasing the circulation of the water; an exhaust lead, to be provided on the spot. In addition, provision should be made for a silencer.

A shunt regulator is necessary for regulating the dynamo pressure. If it be desired in addition to take alternating or three phase current from the dynamo, an order should be given for 4 slip rings.

When requested we supply special estimate for switch-gear for the dynamos. See also estimates on p. 138.

For electric light work these models can only be employed if a battery of accumulators is used simultaneously; even in the case of the larger models it is desirable to have a battery of accumulators connected up in parallel. Prices of suitable dynamos and batteries on application.

If required, dynamos working at pressures of 110 or 220 instead of 65 volts can be supplied, also dynamos for charging accumulators without changing the speed.

Estimates
as to Electric Plant for Experimental Purposes with low speed Gas Engine, Dynamo and Battery of Accumulators.

In cases where there is neither an electricity works or other heavy current plant available, recourse must be had to the employment of one's own dynamo driven by a gas or petrol engine. It is, however, strongly advisable to install a battery of corresponding capacity at the same time, as in that case the working of the dynamo is more certain and the pressure more constant.

In the case of the demand for current being normal, there is no necessity to have the engine running each time current is actually required; it is simply necessary to charge the battery once or twice a week. If the current demand is particularly great, the dynamo and battery are run in parallel.

These plants are also adapted for supplying current for lighting the lecture room at the same time.

The voltage of the dynamo is 65, this sufficing for all school experiments. If desired, it can be supplied at a proportionate increase in price with 4 slip rings for supplying alternating and three phase current.

The accumulators are supplied ready built in with a view to facilitating erection and starting up.

List No.		50,625	50,626	50,627
Continuous Capacity of the low-speed Motor, HP.		1	2	3
Revolutions per minute		250	250	250
Output of Dynamo at 65 volts, Amps.		8.6	18.4	28.5
Capacity of Accumulators, ampere-hours		36	48	60
Max. charge and discharge current of the accumulators, amperes		12	16	20
Max. current in amperes which may be taken from the plant		20	34	48
Gas Engine with tube ignition, with heavy flywheel and External bearings	No.	50,571	50,572	50,573
	£	60. 10. 0	76. 10. 0	92. 0. 0
1 Set Foundation Bolts and Plates		0. 13. 0	1. 0. 0	1. 5. 0
1 Gas Pressure Governor		3. 5. 0	3. 15. 0	3. 15. 0
1 Starting Handle		3. 5. 0	3. 5. 0	3. 5. 0
All Piping necessary for ordinary conditions inside the Engine Room (subject to alteration)		6. 10. 0	7. 0. 0	7. 0. 0
Price of the D. C. shunt wound Dynamo (low-speed)		13. 0. 0	17. 0. 0	23. 15. 0
Tension Slider		0. 13. 0	0. 15. 0	1. 0. 0
Foundation Bolts		0. 3. 6	0. 6. 0	0. 8. 0
Shunt Regulator		2. 15. 0	2. 15. 0	3. 0. 0
Driving Belt for normal conditions		1. 0. 0	1. 10. 0	1. 18. 0
35 Accumulator Cells built into glass vessels		29. 0. 0	33. 15. 0	54. 10. 0
Acid for filling		0. 10. 0	0. 12. 6	0. 15. 0
1 Specific gravity Indicator (hydrometer)		0. 7. 6	0. 7. 6	0. 7. 6
1 Wood Stand, insulated		2. 10. 0	3. 5. 0	4. 6. 0
1 Device for preserving the acid		1. 0. 0	1. 0. 0	1. 0. 0
1 Hand Lamp for Battery Room		1. 0. 0	1. 0. 0	1. 0. 0
1 Engine Room Switchboard, white marble panel with simple wood frame, containing following apparatus: 1 precision ammeter, 200 mm diam.; 1 precision voltmeter, 200 mm diam., with 2 shunts, central zero; 1 double cell switch; 1 minimum cutout; 1 main switch; 1 changeover switch; 9 single-pole fuses; 1 ammeter switch; 1 voltmeter switch.		18. 0. 0	18. 0. 0	18. 0. 0
	Total £	144. 2. 0	171. 16. 0	217. 4. 6

1 Experimental Switchboard in accordance with complete list, should be provided; see pp. 107—132.

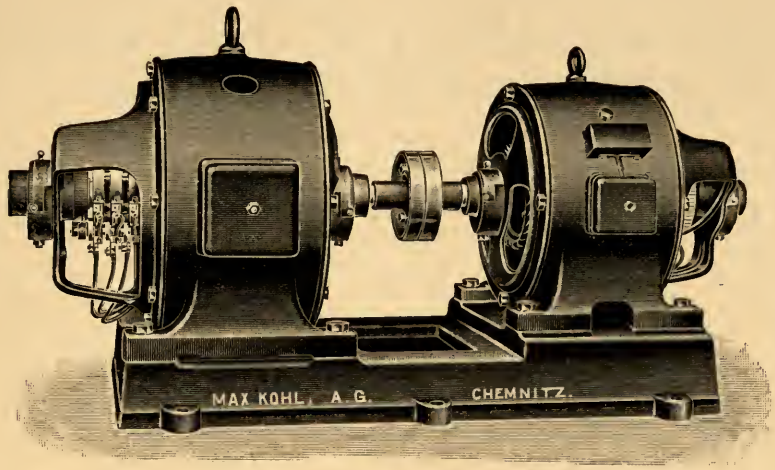
If a water-supply is not available, then a cooling vessel is necessary.

Extra prices:	£	2. 10. 0	3. 10. 0	3. 15. 0

The storage battery must be installed on an acid-proof flooring in a well ventilated room; the battery room is best placed alongside the engine room, and it must be separated from the latter by a masonry wall.

The following are not included in the above prices: freight, packing, erection; also the connecting leads between dynamo, accumulators and switchboards.

Estimates for installations with gas and petrol engines are supplied on application.



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Electric Transformers

for obtaining **Direct Current** in places where the Electricity Works supply **Three Phase, Two Phase** or **Monophase Alternating Current.**

The majority of electrical apparatus for experimental purposes require direct current, the direct employment of alternating or three phase currents being only seldom possible. If, therefore, only alternating or 3-phase current is available, arrangements must be provided for transforming this into direct current.

A motor generator is best suited for this purpose. Electrolytic or Koch rectifiers necessitate (1) the installation of a large battery of accumulators, and (2) they are more difficult to manipulate and keep in order. Such a motor generator consists of an electric motor for 3-phase or single phase alternating current with a continuous current dynamo coupled directly to it. Both machines are mounted on a massive iron base plate. A foundation is desirable but not absolutely necessary. For the small types especially it is sufficient to erect on a wood support.

The motor must, in conformity with the rules of a number of electricity works, be provided with a slip ring rotor, to allow of its being started without causing large current rushes. Since the motor can in the case in point start light, there is no objection, especially with the smaller types, to using the much cheaper motors having a short circuited rotor and connected in the star-delta method.

The dynamo is compound wound as a rule, and the compound winding can be switched out. The pressure best suited for general experimental purposes is 65 volts; it is e. g., sufficient for working a large arc lamp and for operating an induction coil in conjunction with a Wehnelt interrupter. If desired, however, the transformers are also supplied with voltages up to 300, at the same prices and with the same wattage.

An experimental switchboard (preferably a board of the $A_1^{\sim}$ type, No. **50,471**) is connected up direct to the terminals of the dynamo. With the aid of this switchboard it is not only possible to take off all desired current strengths, but also low voltages. Under the experimental switchboard are placed the switch and fuses for the motor in addition to the shunt regulator for the dynamo. There is also the starter in the case of motors with a slip ring armature. The starting of the motor and regulation of the dynamo can in this manner be conveniently carried out from the switchboard while the transformer itself is installed in another room.

If desired, the transformers are also supplied with Shunt Wound Dynamos for increased pressure regulation, e. g., for 5—65 volts, in accordance with the special table contained on p. 141. In this case, a contact resistance and a voltmeter and ammeter can be used instead of the experimental switchboard. It is strongly recommended that even in these cases an experimental switchboard be employed.

Should it be desired to be able to take alternating or three phase current from the dynamo in addition to Direct Current, the dynamos are provided with 4 slip rings at the extra prices shown in the table. In this case, in the transformers with compound winding, the compound winding must be cut out. As regards pressure, 46 volts can be taken off in the case of alternating and 40 volts in the case of three phase current.

Transformers for connecting up to Three Phase and Two Phase Alternating Current Networks.

Three Phase-Direct Current Transformers for constant pressure, Figure, for connecting up to 3-phase Current of 100—500 volts and 50 cycles per second: consisting of a **Three Phase Motor with** Short Circuit Rotor*) (for starting with a star-delta switch), coupled to a **Direct Current Compound Dynamo** for 65 volts, with compound winding which can be cut out; the two mounted on one base plate.

List Number		50 628	50 629	50 630	50 631	50 632
Motor	Efficiency, HP.	0.5	1	2	3	5
	R. P. M.	1410	1420	1425	1435	1440
Compound Dynamo	**Output, watts**	250	550	1100	1750	3100
	Current at 65 volts, amps.	3.8	8.5	17	27	48
Prices of Transformers for Network Voltages to	a) **120 volts** £	18. 10. 0	24. 5. 0	35. 0. 0	42. 10. 0	49. 5. 0
	b) **220 volts** £	18. 10. 0	24. 5. 0	35. 0. 0	42. 10. 0	49. 5. 0
	c) **500 volts** £	—	—	36. 0. 0	44. 0. 0	51. 0. 0
d) **Extra** for 4 Slip Rings £		1. 16. 0	2. 10. 0	3. 16. 0	4. 12. 0	5. 5. 0
e) **Packing** for Land Transport £		0. 12. 0	0. 15. 0	1. 0. 0	1. 4. 0	1. 8. 0
Prices of Accessories	f) **Star-Delta Switch** with case £	1. 13. 0	1. 13. 0	1. 13. 0	1. 13. 0	1. 13. 0
	g) **Shunt Regulator** £	1. 16. 0	1. 16. 0	1. 16. 0	2. 2. 0	2. 2. 0
Weight of Transformer with Coupling and Base-plate	nett. . . . about kg	88	125	165	230	315
	gross . . . about kg	130	190	240	320	420

The number of revolutions per minute at no-load is 1500; when loaded the speed falls to the value given in the table. For starting, it is advisable to employ a star-delta switch, and for regulating the voltage a shunt regulator is necessary.

When ordering, please give the network voltage and the frequency of the 3-phase supply.

— The preceding, **Three Phase Motor with Slip Ring Rotor.**

List Number		50 633	50 634	50 635	50 636
Motor	Efficiency, HP.	1	2	3	5
	R. P. M.	1420	1425	1435	1440
Compound Dynamo	**Output, watts**	550	1100	1750	3100
	Current at 65 volts, amps.	8.5	17	27	48
Prices of Transformers for Network Voltages to	a) **120 volts** £	28. 5. 0	40. 0. 0	47. 10. 0	55. 0. 0
	b) **220 volts** £	28. 5. 0	40. 0. 0	47. 10. 0	55. 0. 0
	c) **500 volts** £	—	41. 0. 0	48. 10. 0	56. 5. 0
d) **Extra** for 4 Slip Rings £		2. 10. 0	3. 16. 0	4. 12. 0	5. 5. 0
e) **Packing** for Land Transport £		0. 17. 0	1. 4. 0	1. 8. 0	1. 12. 0
Prices of Accessories	f) **Starter** for running at half load £	2. 2. 0	2. 2. 0	2. 8. 0	2. 8. 0
	g) **Shunt Regulator** £	1. 16. 0	1. 16. 0	2. 2. 0	2. 2. 0
Weight of Transformer with Coupling and Base-plate	net . . . . about kg	135	175	245	330
	gross . . . . about kg	200	250	340	450

A Starting Rheostat is necessary for starting the transformer, and a Shunt Regulator for regulating the voltage.

Two phase Alternating Current Motors of equal capacity are supplied instead of the 3-phase motors at the same prices.

*) In places where it is forbidden to connect up motors having squirrel-cage rotors and of the HP. efficiencies up to those mentioned in the table, the transformers listed further on should be selected, the 3-phase motors of which have rotors with slip rings.

Three Phase-Direct Current Transformers, for high Voltage-regulation, for connecting up to 100 to 500 volts **Three Phase Currents** at 50 cycles per second: comprising **Three Phase Motor** having Squirrel-cage Rotor*) (for starting by means of a star-delta switch), coupled to a **Direct Current Shunt Dynamo** for 5—65 volts pressure without change of speed or armature current; the two mounted on one base plate.

Motor	List Number	50 637	50 638	50 639	50 640	50 641	50 642
	Efficiency, HP.	0.5	1	2	3	4	6
	R. P. M.	1410	1420	1425	1435	1440	1450
Shunt Dynamo	**Output, watts**	175	485	1000	1620	2400	3600
	Constant Current at 65 volts, amperes	2.7	7.5	15.4	25	37	56
Prices of Transformers for Network Voltages to	a) **120 volts** £	19. 10. 0	25. 0. 0	35. 0. 0	43. 0. 0	48. 0. 0	56. 0. 0
	b) **220 volts** £	19. 10. 0	25. 0. 0	35. 0. 0	43. 0. 0	48. 0. 0	56. 0. 0
	c) **500 volts** £	—	—	36. 10. 0	44. 10. 0	49. 10. 0	57. 15. 0
d) **Extra** for 4 Slip Rings £		1. 16. 0	2. 10. 0	3. 16. 0	4. 12. 0	5. 5. 0	6. 0. 0
e) **Packing** for Land Transport £		0. 11. 0	0. 15. 0	1. 0. 0	1. 4. 0	1. 8. 0	1. 12. 0
Prices of Accessories	f) **Star-Delta Switch** with Protecting case £	1. 13. 0	1. 13. 0	1. 13. 0	1. 13. 0	1. 13. 0	1. 13. 0
	g) **Shunt Regulator** for Fine Regulation £	9. 10. 0	9. 10. 0	9. 10. 0	10. 15. 0	10. 15. 0	12. 0. 0
Weight of Transformer with Coupling and Base-plate	nett, about kg	88	125	165	230	305	365
	gross, about kg	130	190	240	320	410	480

The speed at no-load is 1500 r. p. m., and this falls to the value shown in the table when taking up the load. For starting, the use of a star-delta switch is recommended, and for regulating the voltage a Shunt Regulator is essential.

When ordering, please state the network voltage and the frequency of the A. C. The transformers can also be supplied for 40—60 cycles without change in price. The efficiencies and speeds vary with the change in frequency. If the network voltage is higher than is given under **a** and **b** in the table, the price of the next higher stage is charged. Kindly communicate with us if the voltage is above 500.

— The preceding, **Three Phase Motor with Slip Ring Rotor.**

Motor	List Number	50 643	50 644	50 645	50 646	50 647
	Efficiency, HP.	1	2	3	4	6
	R. P. M.	1420	1425	1435	1440	1450
Shunt Dynamo	**Output, watts**	485	1000	1620	2400	3600
	Constant Current at 65 volts, amperes	7.5	15.4	25	37	56
Prices of Transformers for Network Voltages to	a) **120 volts** £	30. 0. 0	40. 10. 0	47. 10. 0	53. 5. 0	63. 0. 0
	b) **220 volts** £	30. 0. 0	40. 10. 0	47. 10. 0	53. 5. 0	63. 0. 0
	c) **500 volts** £	—	41. 5. 0	48. 15. 0	55. 0. 0	64. 5. 0
d) **Extra** for 4 Slip Rings £		2. 10. 0	3. 16. 0	4. 12. 0	5. 5. 0	6. 0. 0
e) **Packing** for Land Transport £		0. 18. 0	1. 4. 0	1. 8. 0	1. 12. 0	1. 15. 0
Prices of Accessories	f) **Starter for Starting** on half load £	2. 2. 0	2. 2. 0	2. 8. 0	2. 8. 0	3. 0. 0
	g) **Shunt Regulator** for Fine Voltage-regulation £	9. 10. 0	9. 10. 0	10. 15. 0	10. 15. 0	12. 0. 0
Weight of Transformer with Coupling and Base-plate	nett about kg	135	175	245	315	375
	gross about kg	200	250	340	435	500

A starting switch is necessary for starting the transformer and a Shunt Regulator for regulating the voltage.

Two phase Alternating Current Motors of the same efficiencies are supplied in place of the three phase motors at the same prices.

*) In places where it is forbidden to connect up motors with squirrel-cage rotors and of the HP. efficiencies up to those mentioned in the table, a transformer should be selected from those listed further on, the 3-phase motors of which have rotors with slip rings.

Transformers for connecting up to Single Phase Alternating Current Networks.

Alternating-Direct Current Transformers for Constant Voltage (Figure on p. 139), for connecting up to 100—500 volts Alternating Current, 50 cycles per second: comprising an **Alternating Current Motor** with Squirrel-cage Rotor*) coupled to a **Direct Current Compound wound Dynamo** (the compound winding of which may be switched out) for 65 volts pressure, mounted on one base plate.

List Number		**50 648**	**50 649**	**50 650**	**50 651**	**50 652**
Motor	Efficiency, HP.	0.5	1	2	3	5
	R. P. M.	1410	1420	1425	1435	1440
Compound Dynamo	**Output, watts**	**250**	**550**	**1100**	**1750**	**3100**
	Current at 65 volts, amperes	3.8	8.5	17	27	48
Prices of Transformers for Network Voltages to	a) **120 volts** £	20. 10. 0	27. 0. 0	37. 10. 0	46. 5. 0	50. 0. 0
	b) **220 volts** £	20. 10. 0	27. 0. 0	37. 10. 0	46. 5. 0	50. 0. 0
	c) **500 volts** £	—	—	39. 0. 0	48. 0. 0	52. 10. 0
d) **Extra** for 4 Slip Rings £		1. 16. 0	2. 10. 0	3. 16. 0	4. 12. 0	5. 5. 0
e) **Packing** for Land Transport £		0. 12. 0	0. 15. 0	1. 0. 0	1. 4. 0	1. 8. 0
Prices of Accessories	f) **Phase Rheostat** and Reversing Switch £	2. 2. 0	2. 2. 0	2. 8. 0	3. 0. 0	4. 10. 0
	g) **Shunt Regulator** £	1. 16. 0	1. 16. 0	1. 16. 0	2. 2. 0	2. 2. 0
Weight of the Transformer with Coupling and Base-plate	nett .....about kg	125	165	230	315	355
	gross .....about kg	190	240	320	420	470

The speed at no-load is 1500 r. p. m., when the load is being taken up this speed drops to the values shown in the table.

A Phase Rheostat with switch is required for starting and a Shunt Regulator for regulating the voltage.

When ordering, kindly state the frequency of the A. C. network.

— The preceding, **Alternating Current Motor with Slip Ring Rotor.**

List Number		**50 653**	**50 654**	**50 655**
Motor	Efficiency, HP.	2	3	5
	R. P. M.	1425	1435	1440
Compound Dynamo	**Output, watts**	**1100**	**1750**	**3100**
	Current at 65 volts, amperes	17	27	48
Prices of Transformers for Network Voltages to	a) **120 volts** £	42. 0. 0	52. 10. 0	61. 0. 0
	b) **220 volts** £	42. 0. 0	52. 10. 0	61. 0. 0
	c) **500 volts** £	43. 5. 0	54. 0. 0	63. 0. 0
d) **Extra** for 4 Slip Rings £		3. 16. 0	4. 12. 0	5. 5. 0
e) **Packing** for Land Transport £		1. 4. 0	1. 8. 0	1. 12. 0
Prices of Accessories	f) **Starter** for starting on half load, with Choking Coil and Auxiliary Switch £	7. 5. 0	8. 10. 0	9. 0. 0
	g) **Shunt Regulator** £	1. 16. 0	2. 2. 0	2. 2. 0
Weight of Transformer with Coupling and Base-plate	nett .....about kg	230	315	355
	gross .....about kg	320	420	470

A Starting Rheostat is necessary for starting the transformer, and a Shunt Regulator for regulating the voltage.

*) In places where it is forbidden to connect up motors with squirrel-cage rotors and of the HP. efficiencies up to those mentioned in the table, a transformer should be selected from those listed further on, the 3-phase motors of which have rotors with slip rings.

Alternating-Direct Current Transformers for a high degree of Voltage-regulation (Figure on p. 139) for connecting up to 100—500 volts Alternating Current at 50 cycles per second: comprising an Alternating Current Motor with Squirrel-cage Rotor*) coupled to a Direct Current Shunt wound Dynamo for 5—65 volts pressure without change in speed or armature current; on one base plate.

List Number		50 656	50 657	50 658	50 659	50 660	50 661
Motor	Efficiency, HP.	0.5	1	2	3	4	6
	R. P. M.	1410	1420	1425	1435	1440	1450
Shunt Wound Dynamo	**Output, watts**	175	485	1000	1620	2400	3600
	Constant current at 65 volts, amperes	2.7	7.5	15.4	25	37	56
Prices of Transformers for Network Voltages to	**a) 120 volts** £	20.10.0	28.15.0	38. 0.0	46. 5.0	52.10.0	62.15.0
	b) 220 volts £	20.10.0	28.15.0	38. 0.0	46. 5.0	52.10.0	62.15.0
	c) 500 volts £	—	30. 0.0	39. 5.0	48. 0.0	54. 5.0	65. 0.0
d) Extra for 4 Slip Rings £		1.16.0	2.10.0	3.16.0	4.12.0	5. 5.0	6. 0.0
e) Packing for Land Transport £		0.11.0	0.15.0	1. 0.0	1. 4.0	1. 8.0	1.12.0
Prices of Accessories	**f) Phase Rheostat** and Reversing Switch £	2. 2.0	2. 2.0	2. 8.0	3. 0.0	3.12.0	5.10.0
	g) Shunt Regulator for Fine Regulation £	9.10.0	9.10.0	9.10.0	10.15.0	10.15.0	12. 0.0
Weight of Transformer with Coupling and Base-plate	nett . . . about kg	125	165	230	315	340	420
	gross . . . about kg	190	240	320	420	460	550

The speed at no-load is 1500 r. p. m., which drops to the values given in the table when the load is taken up. A Phase Rheostat with switch is necessary for starting, and a Shunt Regulator for regulating the D. C. voltage.

When ordering, kindly state the network voltage and frequency of the A. C. The transformers can also be supplied for 40—60 periods at the same prices. The efficiencies and speeds vary with the change in frequency. If the network voltage is higher than given under **a** and **b** in the table, the price for the next higher stage then holds. Please communicate with us if the voltage is above 500.

— The preceding, **Alternating Current Motor with Slip Ring Rotor.**

List Number		50 662	50 663	50 664	50 665	50 666
Motor	Efficiency, HP.	1	2	3	4	6
	R. P. M.	1420	1425	1435	1440	1450
Shunt Wound Dynamo	**Output, watts**	485	1000	1620	2400	3600
	Constant Current at 65 volts, amperes	7.5	15.4	25	37	56
Prices of Transformers for Network Voltages to	**a) 120 volts** £	33.10.0	42.15.0	52.10.0	59. 0.0	69. 0.0
	b) 220 volts £	33.10.0	42.15.0	52.10.0	59. 0.0	69. 0.0
	c) 500 volts £	34.10.0	43.15.0	54. 0.0	60.15.0	72. 5.0
d) Extra for 4 Slip Rings £		2.10.0	3.16.0	4.12.0	5. 5.0	6. 0.0
e) Packing for Land Transport £		0.18.0	1. 4.0	1. 8.0	1.12.0	1.15.0
Prices of Accessories	**f) Starter** with Choking Coil and Auxiliary Switch £	6.15.0	7. 5.0	8.10.0	8.15.0	10. 0.0
	g) Shunt Regulator for Fine Regulation £	9.10.0	9.10.0	10.15.0	10.15.0	12. 0.0
Weight of Transformer with Coupling and Base-plate	nett . . . about kg	175	240	325	350	435
	gross . . . about kg	250	335	445	460	560

A Starting Rheostat is required for starting the transformer, and a Shunt Regulator for regulating the voltage.

Alternating-Alternating Current Transformers.

Three Phase-Three Phase Transformers.

For transforming 3-phase and alternating current voltages, recourse should be had to the Static Transformers, catalogued in the List of Physical Apparatus, Section: Galvanic Electricity. This list containing the usual types of transformer for demonstration purposes, also folding models and those for taking off voltages of various grades by varying the transformation ratio. Prices for larger transformers on application.

*) In places where it is forbidden to connect up motors with squirrel-cage rotors and of the horse-powers up to those mentioned in the table, a transformer should be selected from those listed further on, the 3-phase motors of which have rotors with slip rings.

Direct-Direct Current Transformers.

These transformers are single-armature transformers and are employed in cases where a 220, 440 or 500 volt Direct Current network is available and where it is not wished to let the superfluous current in connection with the working of the projection lantern or for experimental purposes go to waste through the series resistances which must be used for reducing the current. With high tensions, particularly, the nullification of the current through series resistances gives rise to heavy working costs. In addition, the leads must in this case be dimensioned for the full current, while if a transformer is installed they can be dimensioned for a proportionately low current. The transformers yield a current of 65 volts Direct Current — sufficient for the projection lantern and for experimental purposes.

50 670.

An experimental switchboard, preferably of the A_1-type, is connected up with the secondary terminals of the dynamo. It is possible with the aid of this board to take off any desired current-strength as well as low potentials.

It is best to erect the transformer in the preparation room or any other room adjoining the class room so as to avoid any disturbance due to the noise of its running.

As suggested by Prof. Friedr. C. G. Müller (M. T., p. 248) the experimental plant can be arranged by connecting the experimental switchboard and projection lantern direct to the 220 volts network and providing a small transformer of about 100 watts output (5 amps. at 20 volts — see Nos. 50,677—50,680) for experiments with low tension currents, especially for charging a 6- or 8-cell battery.

Direct-Direct Current Transformers, Figure, for reducing the voltage of direct current at 220 volts to about 65 volts.

List Number*)	50 668	50 669	50 670	50 671	50 672	50 673	50 674	50 675	50 676
Consumption of energy, (about) watts	140	200	320	550	1100	1500	2000	2800	4350
Speed, r. p. m.	2000	1800	1600	1500	1300	1250	1250	1250	1100
Capacity as Generator, (about) watts	**70**	**120**	**200**	**400**	**800**	**1200**	**1600**	**2300**	**3700**
Current at 65 volts, (about) amperes	1.05	1.85	3.1	6.2	12.3	18.5	25	35	57
Efficiency as Motor, (about) HP. .	0.1	0.2	0.3	0.6	1.0	1.6	2.2	3.3	4.4
a) **Transformer,** without Belt Pulley £	**11.10.0**	**14.10.0**	**18. 0.0**	**19. 5.0**	**27.10.0**	**29. 0.0**	**32.10.0**	**40. 0.0**	**48.15.0**
b) **Packing** £	**0. 3.0**	**0. 4.0**	**0. 4.0**	**0. 6.0**	**0. 8.0**	**0. 9.0**	**0.10.0**	**0.13.0**	**0.16.0**
c) **Starting Rheostat** £	**0.16.0**	**0.16.0**	**1. 2.0**	**1. 5.0**	**1. 5.0**	**1. 5.0**	**1. 5.0**	**1.10.0**	**2.10.0**
d) **Starting and Regulating Rheostat** £	**0.16.0**	**1. 5.0**	**1.12.0**	**2.10.0**	**3.10.0**	**3.10.0**	**4.15.0**	**5.10.0**	**7. 0.0**
e) **Belt Pulley** £	**0. 7.6**	**0. 7.6**	**0.10.0**	**0.11.0**	**0.13.0**	**0.16.0**	**0.18.0**	**1. 3.0**	**1. 6.0**
Weight of the Transformer { nett (about) kg	25	30	47	67	115	130	160	180	240
Weight of the Transformer { gross (about) kg	45	58	80	115	170	190	215	240	320
Belt Pulley { Diameter mm	70	90	110	130	140	160	180	200	240
Belt Pulley { Width mm	40	50	65	65	70	80	90	100	100

*) When ordering, in addition to quoting the list number, kindly also mention the letters a, b, c, etc. placed in front of the price lines.

These single-armature transformers have a commutator on each of the two ends: one being used for taking the current from the network and the other for taking the transformed current from the machine for experimental purposes.

The operation of starting is as simple as in the ordinary direct current motor; thus it is only necessary to move the lever of the starting rheostat and the pressure of 65 volts or less is immediately available. A starting rheostat for starting the machine must be ordered with the transformer. The starting rheostats included in the table permit of the machine starting on half load. For regulating the voltage a Starting and Regulating Rheostat can be employed in lieu of the simple starting rheostat; in this case the speed at full load can be reduced to 50% of that given.

The Direct-Direct Current Transformers are connected up to the network in the same manner as ordinary shunt motors. The transformers require no transmission drive and are therefore as a rule supplied without belt pulley; they can also be used as 220 volt Direct Current Motors.

For this purpose a belt pulley is supplied at the prices given in the table, when this is required. The motor efficiencies are also stated in the table. If desired, these transformers are also supplied with lower secondary voltage (down to 2 volts) if it is not required to feed an arc lamp therefrom. Prices and outputs on application.

	£ s. d.
50,677. **Small Direct-Direct Current Transformer,** for transforming **220 volts** Direct Current into **20 volts** Direct Current (M. T., p. 248): output 80 watts	9. 0. 0
50,678. **Regulator-Starter** for previous transformer	1. 9. 0
50,679. **Small Direct-Direct Current Transformer,** as No. 50,677, larger: output 120 watts .	11.10. 0
50,680. **Regulator-Starter** for above	1.15. 0

Direct-Direct Current Transformers (cf. Fig. 50,670), for transforming **440** or **500 volts** Direct Current into **65 volts Direct Current.**

List Number *)	50 681	50 682	50 683	50 684	50 685	50 686	50 687	50 688	50 689
Energy-Consumption (about) watts	140	200	320	550	1100	1500	2000	2450	4150
R. P. M. (about)	2000	1800	1750	1650	1550	1500	1500	1500	1500
Efficiency as Generator (about) watts	**70**	**120**	**200**	**400**	**800**	**1200**	**1600**	**2000**	**3500**
Current at 65 volts (about) amperes	1.1	1.85	3.1	6.2	12.3	18.5	25	31	54
Efficiency as Motor (about) HP.	0.1	0.2	0.3	0.6	1.0	1.6	2.2	2.9	4.2
a) **Transformer,** without Belt Pulley £	12. 0.0	15. 0.0	18.15.0	20. 0.0	28.10.0	30. 0.0	33.15.0	43.15.0	50. 0.0
b) **Packing** £	0. 3.0	0. 4.0	0. 4.0	0. 6.0	0. 8.0	0. 9.0	0.10.0	0.13.0	0.16.0
c) **Starting Rheostat** £	0.16.0	0.16.0	1. 2.0	1. 5.0	1. 5.0	1. 5.0	1. 5.0	1.10.0	2.10.0
d) **Starting and Regulating Rheostat** £	0.16.0	1. 5.0	1.12.0	2.10.0	3.10.0	3.10.0	4.15.0	5.10.0	7. 0.0
e) **Belt Pulley** £	0. 7.6	0. 7.6	0.10.0	0.11.0	0.13.0	0.16.0	0.18.0	1. 3.0	1. 6.0
Weight of Transformer nett about kg	25	30	47	67	115	130	160	180	240
Weight of Transformer gross about kg	45	58	80	115	170	190	215	240	320
Belt Pulley Diameter mm	70	90	110	130	140	160	180	200	240
Belt Pulley Width mm	40	50	65	65	70	80	90	100	100

*) When ordering, kindly mention the Network Voltage; and the letters a, b, c, etc. placed before the price lines, in addition to the List Numbers.

Cf. the remarks regarding Transformers Nos. 50,668—50,676 for 220 volts.

Direct-Alternating Current Transformers for transforming **220 volts Direct Current** into **150 volts Alternating** and about **130 volts Three Phase Current.**

List Number *)	50 690	50 691	50 692	50 693	50 694	50 695	50 696	50 697	50 698	50 699
Energy-Consumption, watts (about)	200	350	500	950	1500	2450	3450	4650	5800	7350
R. P. M. (about)	1900	1800	1800	1650	1500	1500	1500	1500	1200	1000
Efficiency as Generator 3-Phase, watts (about)	**150**	**270**	**400**	**750**	**1300**	**2100**	**3000**	**4000**	**5200**	**6600**
Efficiency as Generator A. C., watts (abt.)	**135**	**250**	**360**	**675**	**1170**	**1900**	**2700**	**3600**	**4700**	**6000**
Efficiency as Motor, HP.	1/6	1/3	1/2	1	1 3/4	2 1/2	3 1/2	5	6 1/2	8.
a) **Transformer,** without Belt Pulley £	11.10.0	13.15.0	16.15.0	18.10.0	26. 5.0	28. 0.0	31. 5.0	38. 0.0	48. 0.0	53.15.0
b) **Packing** £	0. 3.0	0. 4.0	0. 4.0	0. 6.0	0. 8.0	0. 9.0	0.10.0	0.13.0	0.16.0	0.18.0
c) **Starting Rheostat** £	0.16.0	1. 2.0	1. 5.0	1. 5.0	1. 5.0	1.10.0	1.10.0	1.10.0	2.10.0	2.10.0
d) **Starting and Regulating Rheostat** £	1. 5.0	1.12.0	2.10.0	2.10.0	3.10.0	5.10.0	6. 0.0	8. 0.0	8.15.0	10. 0.0
e) **Belt Bulley** £	0. 7.6	0. 7.6	0.10.0	0.11.0	0.13.0	0.16.0	0.18.0	1. 3.0	1. 6.0	1. 9.0
Weight of Transformer nett, about kg	25	30	47	67	115	130	160	180	240	310
Weight of Transformer gross, about kg	45	58	80	115	170	190	215	240	320	410
Belt Pulley Diameter mm	70	90	110	130	140	160	180	200	240	260
Belt Pulley Width mm	40	50	65	65	70	80	90	100	100	100

*) When ordering, in addition to mentioning the List Numbers, kindly quote the letters a, b, c, etc. placed before the price lines.

These transformers are rotary converters; they have a commutator at one end of the armature and 4 slip rings at the other. The interlinked 3-phase current can be taken off three slip rings and the single-phase alternating current from two slip rings; it is also possible by using all four slip rings to obtain two-phase alternating current, this current being somewhat unsymmetrical of course.

These transformers are also supplied for connecting up to 110, 440 or 500 volts direct current, the outputs and prices for 110 volts being the same as for 220. For 440 and 500 volts the speed is 10% higher and price 5% higher.

These machines are started as easily as ordinary direct current motors; thus, it is only necessary to move the lever of the starting rheostat and the alternating or three phase current is available forthwith. A starting rheostat must be ordered with the transformer. The starting rheostats included in the table permit of the transformers

starting on half load. For regulating the voltage a combined Starting and Regulating Rheostat can be used in place of the simple starter; with these the speed of the transformers can be reduced by 50% at full load of that given in each case.

The transformers require no transmission drive and are therefore as a rule supplied without belt pulley; they are connected up to the direct current network in the same manner as ordinary shunt motors. These transformers can be employed as Direct Current Motors; for this purpose, and when desired, they are supplied with a belt pulley at the extra prices shown in the table. The outputs when used as motors are shown in the table. When constructed thus with belt pulleys the transformers can also be used as direct, alternating and three phase current Dynamos. If it be desired when using the transformers as dynamos to obtain the voltages given, they must be arranged to work in such manner that the speed is from 20% to 25% higher than that given. Shunt Regulators are necessary for regulating the dynamo voltage, the prices of these regulators being quoted on application.

The capacities given for the alternating and three phase current only hold for non-inductive load, i. e., taking cos φ = 1. With inductive load the wattage decreases with increase of phase-displacement between current and voltage. The periodicity of the alternating and three phase current is in the (two pole) transformers to 3000 volt-amperes equal to the number of revolutions divided by 60: this value being $^1/_{30}{}^{th}$ of the speed in the case of the larger (4-pole) machines.

Direct-Alternating-Three Phase-Direct Current Transformers, for transforming 220 volts Direct Current into (about) 150 volts Alternating, (about) 130 volts Three Phase and (about) 65 volts Direct Current.

List Number*)	50 700	50 701	50 702	50 703	50 704	50 705	50 706	50 707	50 708
Energy-Consumption (about) watts	140	200	320	550	1100	1500	2000	2800	4350
R. P. M. (approximately)	1900	1800	1700	1500	1400	1300	1250	1250	1100
Capacity as Generator — D. C., approx. watts	**70**	**120**	**200**	**400**	**800**	**1200**	**1600**	**2300**	**3700**
Capacity as Generator — Triphase, approx. voltamp.	**65**	**100**	**180**	**360**	**750**	**1100**	**1450**	**2150**	**3400**
Capacity as Generator — A. C., approx. voltamp.	**50**	**85**	**145**	**300**	**600**	**850**	**1000**	**1900**	**2700**
Efficiency as Motor (approx.) HP.	0.1	0.2	0.3	0.6	1	1.6	2.2	3.3	4.4
a) **Transformer,** without Belt Pulley £	**13.15.0**	**16.15.0**	**20. 0.0**	**23. 0.0**	**31. 5.0**	**33.15.0**	**40. 0.0**	**47.10.0**	**55. 0.0**
b) **Packing** £	**0. 3.0**	**0. 4.0**	**0. 4.0**	**0. 6.0**	**0. 8.0**	**0. 9.0**	**0.10.0**	**0.13.0**	**0.16.0**
c) **Starter** £	**0.16.0**	**0.16.0**	**0.16.0**	**1. 2.0**	**1. 5.0**	**1. 5.0**	**1. 5.0**	**1. 5.0**	**1.10.0**
d) **Starter-Regulator** £	**0.16.0**	**1. 5.0**	**1.12.0**	**2.10.0**	**3.10.0**	**3.10.0**	**4.15.0**	**5.10.0**	**7. 0.0**
e) **Belt Pulley** £	**0. 7.6**	**0. 7.6**	**0.10.0**	**0.11.0**	**0.13.0**	**0.16.0**	**0.18.0**	**1. 3.0**	**1. 6.0**
Weight of Transformer — nett about kg	28	35	52	75	130	145	175	200	270
Weight of Transformer — gross about kg	50	63	90	130	190	210	240	270	350
Belt Pulley — Diameter mm	70	90	100	130	140	160	180	200	220
Belt Pulley — Width mm	40	50	65	65	70	80	90	100	100

*) When ordering, in addition to quoting the List Number, kindly mention the letters a, b, c, etc. placed in front of the price lines.

These machines (constructed as rotary converters) combine a Direct-Direct Current Transformer with a Direct-Alternating-Three Phase Transformer. The transformers have on one end of the armature a commutator for leading in the network current, and 4 slip rings; the interlinked three phase current can be taken off by 3 slip rings and the single phase alternating current by 2 slip rings. It is also possible by using all four slip rings to take off a two-phase alternating current, this being of course somewhat unsymmetrical.

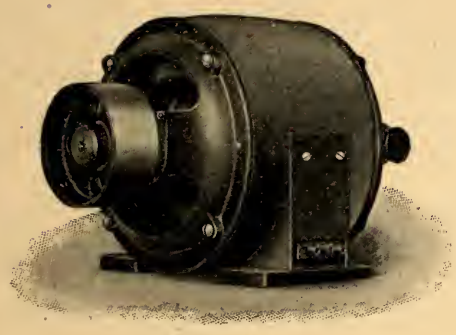
These transformers are also supplied for connection to 110, 440 or 500 volts, the prices and outputs being the same.

These machines are started as simply as an ordinary direct current motor; thus it is only necessary to move the lever of the starting rheostat and the low-tension alternating, three phase or direct current is available forthwith. A Starting Rheostat for starting the transformer must be ordered along with the latter. The starters given in the table permit of the transformer running on half load. For regulating the voltage, instead of a simple starter a combined Starting and Regulating Rheostat may be employed; with this it is possible to reduce the speed at full load by about 50 % of that mentioned.

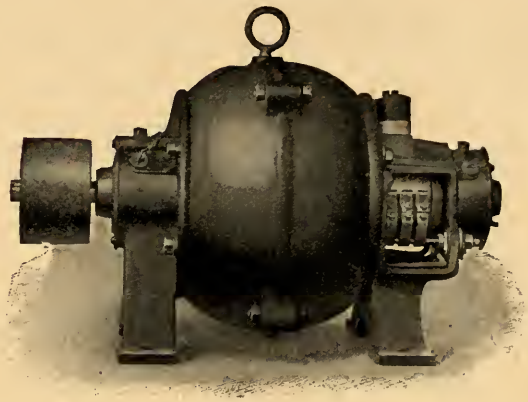
The transformers do not require any transmission drive, and are therefore as a rule supplied without belt pulley; they are connected to the network in the same manner as ordinary shunt motors. The transformers can also be used as Direct Current Motors; for this purpose, and when desired, they are supplied with belt pulleys at the prices given in the table. Their efficiencies as motors are stated in the table. When constructed with a belt pulley the transformers may also be used as Direct-Alternating and Three Phase Dynamos. If when used as dynamos it is desired to obtain the voltages given, they must be arranged to work in such manner that the speed is from 20 to 25 per cent. higher than that given. For regulating the dynamo voltage special Shunt Regulators are necessary, prices of which will be quoted on application.

The values given for the alternating and three phase current efficiencies only hold for non-inductive load — on the assumption that cos φ = 1. On inductive load the wattage decreases with increase of phase displacement between current and voltage. The frequency of the alternating and three phase current is in the case of the (two-pole) transformers up to 3000 watts equal to the speed divided by 60, and in the case of the larger (four-pole) it has the value of $^1/_{30}{}^{th}$ of the speed.

Direct Current Dynamos.



50713. 1:7.



50714. 1:10.

Direct Current Dynamos, Figures, for Belt Drive, Shunt Wound, for **65 volts** Direct Current.

List Number*)	50 709	50 710	50 711	50 712	50 713	50 714	50 715	50 716	50 717
Output, watts (approx.)	220	300	460	900	1300	2500	3500	4000	4850
Current at 65 volts, amperes (approx.)	3.4	4.6	7.1	13.85	20	38.5	54	62	75
R. P. M. (approximately)	2500	2500	2500	2500	2500	1800	1800	1700	1460
Power required, HP. (approx.)	0.5	0.65	1.0	1.6	2.3	4.2	5.5	6.2	7.7
a) **Dynamo** £	6. 5.0	6.15.0	8. 0.0	10.10.0	12.10.0	23.15.0	29.10.0	31.10.0	35. 0.0
b) **Packing** £	0. 4.6	0. 4.6	0. 5.6	0. 6.6	0. 8.0	0.11.6	0.13.6	0.14.0	0.14.6
c) **Slide Rails** £	0. 9.0	0. 9.0	0.13.0	0.13.0	0.13.0	1. 0.0	1. 0.0	1. 5.0	1. 5.0
d) **Regulating Resistance** £	1.15.0	1.15.0	1.15.0	2. 0.0	2. 5.0	2. 5.0	2. 5.0	2. 5.0	2.15.0
Weight of Dynamo nett about kg	17	15	25	32	40	124	161	190	235
Weight of Dynamo gross about kg	27	25	38	52	65	164	206	240	295
Belt Pulley Diameter mm	85	85	85	100	120	150	160	160	210
Belt Pulley Width mm	38	38	38	50	60	70	85	100	125

*) When ordering, in addition to mentioning the List Numbers, kindly quote the letters a, b, c, etc. placed in front of the price lines.

These dynamos are used for generating electric current for feeding the projection lantern and for experimental purposes. They have a belt pulley for driving, the belt from a gas engine, petrol motor or electric motor being connected up with this. In order to obtain the necessary speed mentioned in the table, the belt pulley diameter of the driving unit and of the dynamo must be in inverse ratio to the number of revolutions. If this is not so, a belt pulley of correspondingly different dimensions must be obtained having due regard to the ratios; an extra charge is made for this. The outputs mentioned are the maximum permissible outputs; the machines can be overloaded for short periods.

The medium and larger machines can, if desired, also be supplied for 115, 230, 460 or 550 volts.

If not specially requested, the Dynamos are supplied Shunt Wound. If constant voltage with varying load is required, Compound Wound machines can also be supplied without extra cost.

For Charging Accumulators which have to supply 65 volts themselves, the foregoing machines can only be used when their speed is proportionately increased about 10 %. If it is intended to use the machine thus, express mention should be made of this fact when ordering. If it should not be feasible to increase the speed, the dynamos catalogued in the following table should be selected, which can produce, without increasing the speed, the higher current necessary for charging accumulators.

If desired, dynamos with 4 slip rings are supplied; with these it is possible to take from three slip rings interlinked three phase current of 44 volts pressure, and from two slip rings 38 volt single phase alternating current. It is also possible by using all four slip rings to get two phase current, though this is somewhat unsymmetrical. Outputs and prices on application.

The dynamos can also be employed as Electric Motors in conjunction with 65 volt Direct Current; in this case, however, a special Starting Rheostat is necessary in order to obviate too rapid putting into circuit and danger of burning out the field winding when switching out.

It is advisable to place the dynamos on a marble base, or at least on a firmly anchored wood frame.

We also supply the following at the same time, if desired: Working Switchboards for the dynamos and batteries pertaining thereto with fuses, main switches and single switches, metering instruments, terminals and

For Small Hand-driven Dynamos and Dynamos for demonstration purposes, see Section "Electricity".

the like for different circuits, e. g., the projection lantern and the lecture table. Estimates will gladly be submitted. Experimental Switchboards are supplied on the terms mentioned in an earlier section of this list. For 65 volt dynamos the Type A_1 switchboard with 1 circuit, or Switchboard D_1 with two circuits is probably the most suitable.

Direct Current Dynamos for obtaining extra Voltage, for charging Accumulators (Figs. 50,713 and 50,714), for Belt Drive: Pressure **65—90 volts** Direct Current.

List Number*)	50 718	50 719	50 720	50 721	50 722	50 723	50 724	50 725	50 726	50 727
Output, watts (approx.)	150	140	310	710	900	1500	2500	3000	3750	4850
Current at 65 v., amps. (approx.)	2.3	2.16	4.76	10.9	13.85	23	38.5	46	57	74.5
Current at 90 v., amps. (approx.)	1.67	1.56	3.45	7.9	10	16.7	28	33.4	41.6	54
R. P. M. (approximately)	1870	1430	1980	2090	1980	1650	1980	1540	1540	1610
Power required, HP. (approx.)	0.33	0.32	0.61	1.22	1.53	2.45	3.9	4.7	5.76	7.7
a) **Dynamo** £	6. 5.0	6.15.0	8. 0.0	10.10.0	12.10.0	20. 0.0	23.15.0	29.10.0	31.10.0	35. 0.0
b) **Packing** £	0. 5.0	0. 5.0	0. 6.0	0. 7.0	0. 8.0	0.11.6	0.11.6	0.13.6	0.14.0	0.14.6
c) **Slide Rails** £	0. 9.0	0. 9.0	0.13.0	0.13.0	0.13.0	0.15.0	1. 0.0	1. 0.0	1. 5.0	1. 5.0
d) **Regulating Resistance** £	2.10.0	2.10.0	2.10.0	2.15.0	3. 0.0	3. 0.0	3. 0.0	3. 0.0	3. 0.0	3. 5.0
Weight of Dynamo nett about kg	17	15	25	32	40	100	124	161	190	235
Weight of Dynamo gross about kg	27	25	38	52	65	130	164	206	240	295
Belt Pulley Diameter mm	85	85	85	100	120	150	150	160	160	210
Belt Pulley Width mm	38	38	38	50	60	60	70	85	100	125

*) When ordering, in addition to quoting the list numbers, kindly mention the letters a, b, c, etc., placed before the price lines.

These dynamos, the voltage of which can be increased, can only be used as shunt machines. The speed does not need to be increased to obtain the higher voltage. The output (volts × amperes) should not exceed the value in watts given in the table.

See also the remarks re 65 volt Dynamos Nos. 50,709—50,717.

Projection Apparatus and Accessories.

General.

When installing a projection lantern for the purpose of teaching physics, it is of importance to apply to a firm manufacturing physical apparatus in general. A great many points enter into consideration in the proper arrangement of an apparatus employed for projection in connection with scientific subjects which only the manufacturer of apparatus for teaching physics thoroughly understands. The projection lanterns constructed by us fulfil every conceivable requirement; they are constructed in such manner as to permit not only of the projection of lantern slides, but of the projection of horizontally placed transparent objects, of opaque objects (e. g., illustrations from magazines, drawings, photographs, flat objects); also the projection of microscopical preparations. In addition it is possible to obtain animated pictures with the cinematograph; and, in conjunction with an optical bench, polarisation apparatus, etc. it is possible to demonstrate many experiments in connection with the teaching of light, spectrum experiments, polarisation, interference, and diffraction phenomena, etc. Moreover, the projection lanterns are arranged that it is only necessary to place in front of the lantern the apparatus dealing with the various branches of physics which it is intended should be projected; in this connection mention may be made of Plateau's apparatus for showing the oblateness of a rotating spheroid of oil; the apparatus for showing total reflexion in a water jet, the apparatus for demonstrating that a jet of water is composed of drops, demonstration of electrolytic decomposition, Kolbe's electrometer, etc. It is this latter method of using the lantern which renders it of such value for teaching. The apparatus necessary for the individual experiments, together with some instructions, are included later on in the list, and we refer our customers to these and to the large selection of apparatus which are listed in the main catalogue. The projection apparatus which are intended solely for the projection of diapositives are specially indicated.

Source of Illumination.

Selection. Without a doubt the electric arc light is the most suitable for projection purposes, possessing a large number of advantages over the other kinds of illumination considered. The Nernst lamp has found its way into use in recent times along with the arc lamp. In view of the present state and continued rapid development of things electrotechnical, it is advisable either to use a Projection Lantern having an electric arc lamp or else one which in addition to being lighted by electricity, can also, if desired, be supplied with some other source of light. The first case will occur most often, for at the present time most schools in small towns have electricity available by being connected with a Municipal or private generating station. Even in places where this source of supply is not at hand at present it might certainly be well to have at the commencement a lantern which can be adapted to electric light. As electric generating stations are rapidly springing up in every direction, it may be taken as a certainty that electricity will within a short time be available for supplying the lantern. As a matter of fact a great many small townships possesses to-day electricity stations which were thought quite impossible a few years back. If no source of electricity is available, the following principal sources of light must be considered: Lime Light, Thorium Light, Spirit, Petrol, Paraffin and Incandescent Gas, and also Acetylene light.

Electric Arc Light. The following principal advantages may be set forth in favour of this method of illumination: — It is simple to attend to; the carbons burn for a number of hours so that renewal is not often necessary. The lantern is connected up to the supply by a flexible cord, the current being switched on and off by a switch. Cleanliness is another strong point, as no substances are used which cause soot, or which corrode, cause the formation of grease, or which produce a strong smell. The safety in working is great; materials which may cause fire or explode are done away with; and all risk both to operator and experiments is obviated. In view of the high illuminating power of the arc lamp (employing direct current this is about 1500 Hefner candles with 15 amps., 2200 H. C. with 20 amps.; 3000 H. C. with 25 amps.; and employing alternating current, about 450 H. C. at 15 amps.; 700 H. C. with 20 amps.; and 800 H. C. with 25 amps.) the scope of lanterns with arc light is very considerable; a number of experiments can be carried out at high powers of magnification as well as projections with

the screen some considerable distance away from the lantern, and especially spectrum experiments: it being possible to do this work only by employing an arc lamp or a Nernst lamp.

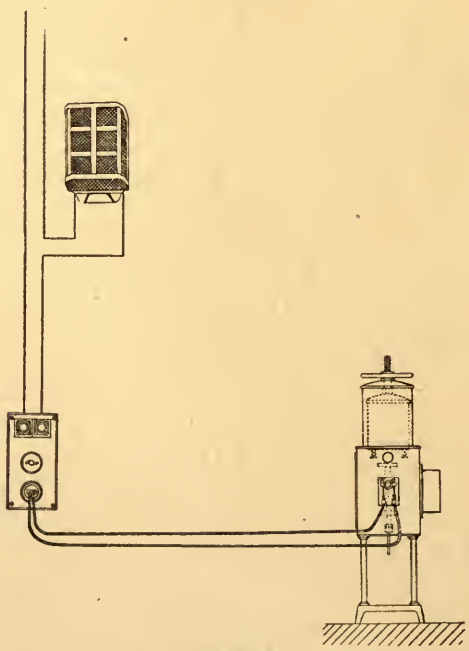
The arc lamps are either supplied for regulating automatically or by hand. In the auto regulating type the distance apart of the carbons while burning is automatically adjusted by an electromagnetic regulator, rendering these lamps very convenient in use. The lanterns with hand-regulated arc lamp only need to have the carbons regulated by hand very seldom; and they can be recommended for this reason, viz. because they can be burned with currents of varying strength, and the maximum brilliancy can be attained at the desired moment by regulating. The hand-regulated lamps can be burned either on direct or alternating current.

A current at a pressure of at least 65 volts must be available from the network, since the contact resistance of the lamps has to be in series. The voltage supplied by electricity works is in most cases higher than this, being usually 110 or 220 volts. In such cases a series resistance suitable for the purpose must be employed. For rectifying 65 volts alternating into direct current of the same voltage a Cooper-Hewitt rectifier is very well adapted (see No. 50,882).

The most satisfactory kind of current to employ for the projector (as for experimental purposes) is **Direct Current,** since when using D. C. the crater of the positive carbon renders good light distribution possible, as it is possible to turn this crater towards the condenser by sloping one or both carbons without the tapered negative carbon casting a shadow. Complete information as to adjusting the carbons is given later.

The lamp is connected to the network by a double flexible lead which is connected to the lamp terminals, the free end being provided with a plug contact. To establish the connection the latter is inserted into a plug box placed at a convenient height on the wall or suspended from the ceiling. The series resistance just mentioned (which must be adapted to the network voltage and the lamp current) and also a 2-pole fuse must, when direct current is being used, be inserted in the lead coming from the network to the plug box. To render the plug box devoid of current when not in use, it is prescribed that a double pole switch be inserted in the circuit before the plug box. These pieces of apparatus (fuse, switch and plug box) are mounted together on a small marble slab (No. 50,878, p. 169; see also Fig. 50,728 A). The switchboard is arranged for connecting up the lamp from the wall. When connection is made from the ceiling, the plug box is omitted from the switchboard (see No. 50,879, p. 169) and is given in separately, being of a special type. When ordering, kindly state the length of lead desired so that this may be supplied ready connected up.

The Series Resistance is used for reducing the network voltage (which is usually either 110, 120 or 220 volts) down to 40—47 volts, i. e., the voltage necessary for working the arc lamp, by dissipating the excess voltage. It serves at the same time as a steadying resistance and ensures the lamp burning steadily; it is not recommended that the lamp be connected to, say, 50 volts, without any series resistance at all. The resistance is adjusted once and for all to that current and voltage on which the lamp has to burn, and for which it is regulated.



50 728 A.
Switchboard for the electric projection lamp (direct current).

In connecting up a D. C. lamp care should be taken that the upper carbon is joined up to the positive pole of the lead, and that the plug is inserted with due regard to the + and — signs to be found on it.

In the case of **Alternating Current Arc Lamps** used in conjunction with alternating or three phase stations, it is advisable to employ a Static Transformer in lieu of the series resistance, this transformer stepping the network voltage down to that which has to be employed, which is about 30 volts. A considerable saving in working costs is effected by this arrangement. The A. C. lamps are only used arranged vertically; both carbons used are of the cored type, and both are of the same thickness, or the lower is slightly thicker than the upper.

Special care should be paid to the correct arrangement of the electric leads. For the D. C. lamp, 15, 20 or 25 amperes current should be reckoned, while the 20 or 25 ampere alternating current arc lamp at 120 volts network voltage, and employing a transformer, takes 7—8 amps. from the network. It is advisable to branch the arc lamp lead from a main lead independently of the lead for lighting and for the experimental

switchboard, as in this case the cross section of the wire has to be made to suit only the lamp, and the loss of voltage (especially when installing direct current arc lamps) need not be taken into consideration; accordingly, a cross-sectional area of 2.5 sq. mm at 15 amps. 4 sq. mm at 20 amps. and 6 sq. mm at 25 amps. is sufficient. If, however, this lead is only branched off in the lecture room, the common lead must be of such thickness as to prevent any too large voltage fluctuations occuring from the point of introduction to the point where the cable branches off. The first method is more advantageous and cheaper.

It is possible, where means are limited to connect the projection lamp up to the lecture table, but in this case the switchboard must not be used at the same time for other purposes such as is necessary for the apparatus for lines of force.

Nernst Light. The Nernst lamp method of illumination is specially convenient since it is seldom necessary to replace the heater and the attention required is reduced to a minimum. The Nernst lamp used for the projector necessitates a network voltage of at least 100; it is constructed for direct or alternating current in voltages up to 260. Its candle-power at 110 volts is about 500, and at 220 volts, 1000 Hefner Candles (Fig. 50,923 on p. 171 shows a triple Nernst lamp constructed in the manner suggested by Prof. Greil, and as inserted in the projection lantern). The burner must be heated with a gas or spirit flame before use. The price list contains a self-igniting type also.

Limelight and Thorium Light. These two well-tried types of glow light (of which the thorium light is more efficient in its action) are simplest connected to the gas lead and the flame necessary for heating the cylindrical or flat-shaped glower is generated by the aid of oxygen. The oxygen for this purpose can be made in an oxygen generator; it is much cheaper, however, to use oxygen bombs (steel flasks containing compressed oxygen), which are always ready for use and which are of the highest value for projection purposes as well as for physical and chemical experiments. The flasks are sent to the factory for re-filling. Fig. 50,954 (p. 173) shows an oxygen flask in which a capacity indicator is inserted, so that the bombs can be recharged with oxygen at the proper time before the supply runs completely out. In addition to the indicator mentioned, however, it is advisable to provide a pressure-reducing valve with special pressure gauge for the reduced pressure. Fig. 50,953.

Two gas leads are used for conveying the illuminating gas and the oxygen respectively, in the case of the thorium and limelight burners. The igniting flame is put into contact with a part of the thorium or lime slab which it renders incandescent. When the candle-power goes down, the glower is rotated thus rendering a fresh part of the same incandescent; after it is used up, the glower is replaced. The limelight burners with cylindrical glowers are arranged in the same manner. The thorium discs need to be renewed but seldom.

If illuminating gas is not available, hydrogen can be employed instead, taken either from a hydrogen generator or from a steel flask filled with compressed hydrogen. If a supply of illuminating gas is wanting, recourse may also be had to limelight burners for ether and oxygen (Fig. 50,944, p. 172).

Fig. 50,955, p. 173, shows a limelight burner burning with gasoline and oxygen, contained, together with all accessories in a trunk-shaped box. This lighting arrangement comprises: 1 small oxygen flask, 1 pressure-reducing valve with pressure gauge, consumption indicator and key, 1 limelight burner with gasoline receiver and the necessary flexible tubing, also lime disc or cylinder. This arrangement is very convenient for travelling purposes.

Spirit and Petrol Incandescent Light. The lamp for spirit incandescent light shown in Fig. 50,964, p. 174, gives a very bright light only slightly inferior to limelight; and with its aid well-lighted images up to 4 m length of side can be obtained. The lamp is provided with reflector and double incandescent mantle. The initial pressure is produced with a small pressure pump which is given in, and the pressure prevailing at any moment can be read off on a gauge.

Size of Condenser and Distance between Projection Lantern and Screen.

The size of the condenser is determined (1) by the size of the photo to be projected, (2) by the distance at which the projection apparatus has to be from the screen. The diapositives usually sold have a free aperture of image of about 7×7 cm; for this size the 102 mm condenser is sufficient.

For many cases, more especially the projection of apparatus, it is advisable to use a larger condenser.

For Diapositives 7×7 cm free aperture a condenser 102 mm diameter is necessary
„ „ 8.5×10 „ „ „ „ „ 122 „ „ „ „
„ „ 9×12 „ „ „ „ „ 152 „ „ „ „

The following distances between Projector and Screen are recommended assuming a magnification of from × 30 to × 40:

With 102 mm Condenser; distance about 4—6 m
„ 122 „ „ „ „ 6—8 „
„ 152 „ „ „ „ 8—11 „

The sizes of image given in the Table are obtained at the distances of objective from screen given with the various sizes of condensers and objectives, and with free aperture of diapositive 7×7 cm.

For Lanterns . . . . . Nos.	50730—50734 50768—50772 50783—50788 50801, 50802, 50807, 50833—50842	50735—50739 50773—50777 50789—50794 50803, 50804 50808, 50844—50853	50740—50744 50778—50782 50795—50800 50805, 50806 50809
Diameter of Condenser . . . mm	102	122	152
„ „ Objective . . . mm	42	54	60
Distance of Objective from Screen			
With image 1.5 × 1.5 m	3 m	4 m	5.5 m
„ „ 2 × 2 „	4 „	5.5 „	7.5 „
„ „ 2.5 × 2.5 „	5 „	7 „	9 „
„ „ 3 × 3 „	6 „	8 „	11 „
„ „ 3.5 × 3.5 „	7 „	9 „	13 „

For larger photographs the distances between objective and screen should be proportionately less if the resultant image on the screen is to be of the same size. The larger condensers necessitate a higher candle-power. For lanterns having larger condensers, therefore, arc lamps for higher currents should be selected.

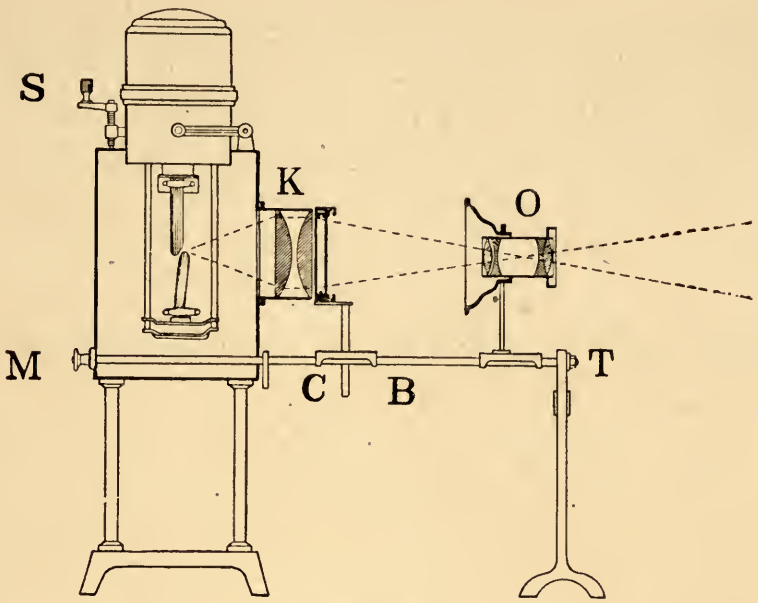
Instead of employing the simple achromatic projection objective usually supplied with the projectors, a Projection Anastigmat, a Steinheil Group Antiplanet, or a Voigtländer Heliar should be selected if it be desired that the resultant images should be equally as brilliant at the edges as in the centre. If the experimenter has at his disposal a source of light of considerable brilliancy, obtained from the arc lamp, thereby rendering a considerable degree of magnification possible, the magnification should not be carried too far, as the result is too weakly illuminated and blunt images. A magnification of 30—40 times is most suitable.

Construction and Selection of Projection Lanterns.

General. The illustration appended shows a section through a projection lantern with arc lamp corresponding to our Model B type, with aluminium housing and with auto regulating arc lamp suspended vertically. The light pencil from the arc lamp is collected on the condenser K and rendered convergent. The diapositives or apparatus, of which certain parts are to be observed in an objective manner, are placed or erected in front of the condenser, by which they are thoroughly and brilliantly illuminated, and the light transmitted is projected from the objective O on to the screen with proportionate magnification. The lantern can be used for the most diverse purposes of illumination without the optical bench B (which can easily be detached by removing two nuts M) and without the objective O; in this case it replaces the heliostat, excepting in experiments with the solar spectrum. C shows a slider containing the diapositive change frame.

The projection apparatus constructed by us are the following types:

1. **Model A, School Type Projector,** simply but reliably constructed, having optical bench and being arranged so as to work with any method of illumination, and capable of being employed for all kinds of projection by using the corresponding auxiliary apparatus. Fig. 50,735.



50 728 B.

2. **Model B,** constructed with **aluminium housing,** for institutions having liberal means at their disposal; otherwise as Model A. This type of projector, which we have constructed now for some years, has met with approval everywhere. It is constructed with automatic regulating Direct or Alternating Current arc lamp, with arc light hand regulator and in a form suitable for all kinds of illumination, Fig. 50,728 B.

3. Projection Apparatus of the **Schuckert form,** with tilted arc lamp for the purpose of obtaining greater light-distribution; it can only be used with advantage on direct current. This type is constructed in a form suitable for all kinds of projection in connection with an optical bench, in addition to a form adapted for the continuous projection of diapositives, this last pattern resting on short legs and having a cooling chamber but no optical bench.

4. The **Epidiascope** — a large projector for reflected and transmitted light, where the demands on it are great; it does not, however, possess the many-sided adaptabilities of our A and B types, as it has not an optical bench.

5. The **Megadiascope** — a Universal Projection Apparatus, which satisfies every demand peculiar to teaching, and this in the most thorough manner. It permits of all kinds of projections being carried out and possesses an excellent source of light in its 25, 30 or 50 ampere arc lamp. A complete description appears at the end of this list.

6. A few special types of scioptica suitable for the projection of photos and apparatus by transmitted light; the Kolbe projector and the apparatus for the permanent projection of animated pictures, which can also be used for photos.

The Projectors with Optical Bench can be put to the maximum variety of uses as the apparatus are set up on the optical bench in the open between the condenser and the objective. Also, by removing the objective it is possible to place on the optical bench all those auxiliary apparatus which will be described later on in this list, for the purpose, e. g. of the episcopic projection of opaque objects, projection of horizontally-placed objects, microscopic projection, in addition to other experiments in connection with optics and heat.

It is of advantage to order a lantern resting on tall legs. This arrangement has for its primary object the fact that the images, when the lantern is stood upon a table of the ordinary height, can be projected over the heads of the audience; while on the other hand independent apparatus can be set up in front of the lantern on taking away the optical bench. For many pieces of apparatus, e. g., Andrews' press for the compression and liquefaction of carbonic acid, for burettes and thermometers, as well as for experiments in connection with which burners must be placed under the optical bench, a projector of corresponding height is necessary. In addition, the projector is easier to handle when above the table top, as in this case it is possible to carry out any operation in connection with it, such as regulating the lamp, focussing the picture, changing the diapositives, etc., etc., without any stooping on the part of the operator. The low type of lantern is specially suited for travelling lectures, as it takes up little space.

The optieal beneh ean easily be removed by loosening two nuts, and it is therefore possible when necessary to set up independent instruments, ete. in front of the lantern.

The eooling ehamber listed on the table of priees on p. 161 (see also Fig. No. 50,796/50,767, p. 163) is filled with water, or, better still, with a solution of ferrous ammonium oxide, whieh absorbs the heat well. For protraeted working of the projector a eooling ehamber (Nos. 50,976 or 50,977) is suitable, this being plaeed on the optical beneh in front of the eondenser.

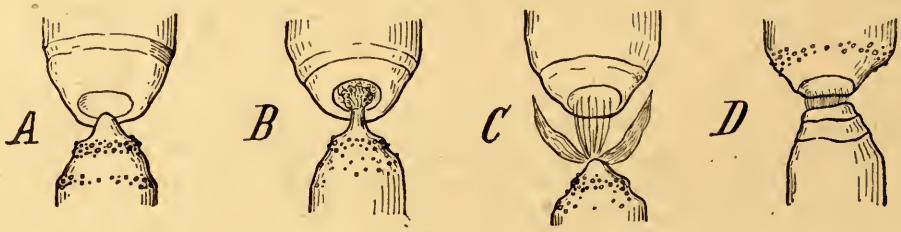
With regard to the individual outfits and optieal installations of various prices, referenee should be made to the price list.

Directions to be observed for the Attention of the Lamps.

Attention of Arc Lamps. An important condition to be observed if a light of the maximum brilliancy is to be derived, is the eorreet adjustment of the earbons. Before inserting fresh carbons, the carbon holders should be separated to such extent that the new earbons when fitted are a few millimetres apart; the thieker — the eored earbon — is plaeed in the upper earbon holder in the ease of Direet Current lamps. The freshly inserted earbons should be of equal length. In the vertically arranged lamp of the Type B projeetor the lower earbon should be so adjusted that it inelines slightly towards the eondenser, as shown in Fig, 50,728 C. The most favourable degree of brilliancy in proportion to the eurrent eonsumed will then be attained. The aetion is secured in that with this arrangement a lateral crater of light forms in the upper carbon, emitting its brilliant rays in the direetion of projection. In the ease of the other are light regulators ineluded in the list the same aetion is produeed to a lesser or greater degree by tilting the carbons in various ways (cf. the Price List). The point of illumination must be in the optieal axis of the lantern, this being seeured by raising and lowering the lamp.

50 728 C.

An eye must be kept upon the eorreet distanee and adjustment of the carbons, and eare taken to see that they burn eorreetly. The distanee apart of the carbons must not be too small, not under 2 mm, so as not to eause too great an inerease of current, whieh may eause the fuses to blow or set up heating in the conductors. The illustration (Fig. 50,729 A) shows the eorrect formation of the erater for the earbons of the direet eurrent are lamp. Fig. 50,729 B shows an arboreous formation whieh makes its appearanee on the negative earbon when the earbons are too close together, and whieh easily gives

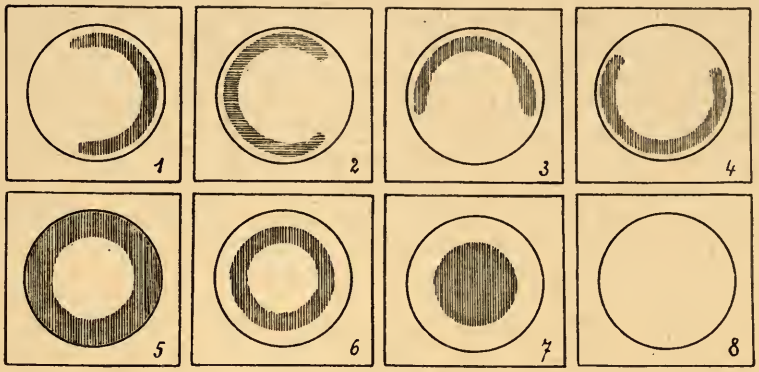


50 729.

rise to faults in working; this defeet should be remedied as soon as it observed. Fig. 50 729 C shows the shape of the arc when the earbons are too far apart, while Fig. 50,729 D shows the shape assumed by the tips of the earbons when the lamps are burning with the current reversed. In the latter case the leads should be ehanged round. The illustrations here reprodueed are taken from Hassaek and Rosenberg's work entitled „Die Projektionsapparate", Vienna and Leipzig, 1907.

In the ease of those lanterns in whieh the distanee of the arc lamp from the eondenser is invariable (Model B, Sehuekert type) the eorreet relative distance between these two portions of the projector are given to the apparatus in the manufaeture in order that clear images may result. When the arc lamp is made adjustable, the following operation should be observed: An image should be plaeed in front of the eondenser and sharply foeussed on to the sereen by sliding the objeetive. The picture should then be removed and the arc lamp moved until the whole projection surface is evenly lighted and surrounded by a sharp border. After replaeing the pieture in front of the eondenser, it should again be sharply foeussed.

The eorreet position of the souree of illumination in relation to the condenser ean be determined by projeeting the eircle of light on to the sereen before introdueing the objeet whieh it is desired to projeet. From the nature of this light image (aeeording as it is equally bright or partly elouded) it is possible to deeide as to the position of the eentre of illumination. The sketch (Fig. 50,729 E) appended shows the influenee of the relative positions of condenser and souree of light on the light-image.



50 729 E.

Phenomenon No. 1 indicates: Source of light too far to the right;
„ No. 2 „ „ „ „ „ „ „ „ left;
„ No. 3 „ „ „ „ „ „ high;
„ No. 4 „ „ „ „ „ „ low;
„ No. 5 „ „ „ „ „ „ far from condenser;
„ No. 6 „ „ „ „ „ „ close to condenser;
„ No. 7 „ „ „ „ „ „ „ „ „
„ No. 8 „ the Source of light is correct.

In the projector lanterns with arc lamp suspended vertically, the latter is so arranged that mostly only Nos. 3 and 4 of the above phenomena are likely to occur. The arc lamp is so adjusted in its position that it always casts its light on to the condenser in the correct manner. The height of the lamp cannot therefore be adjusted once and for all at the commencement, as (see Fig. 50,728 C) exactly the same angle is not always encountered when the carbons are being adjusted and, therefore, the light pencil may on one occasion be cast higher than on another. This necessary slight adjustment is completed easily and quickly in the Model B projectors by the aid of the handle and screw, S (Fig. 50,728 B) placed on top of the lantern.

Attention required with other Sources of Light. When employing limelight the lime cylinder or disc should be first heated by house gas at the ordinary pressure, and when this part of the burner is sufficiently hot, the stopcock of the oxygen cylinder should be opened and the pressure regulated by means of the pressure-reduction valve until the maximum brilliancy is obtained, after which the apparatus should be allowed to continue burning.

The same adjustment when using the apparatus is necessary in the case of thorium discs, which are now used instead of zirconium on account of the much better light they give and their greater durability.

The adjustment of other systems of illumination is also provided for at the commencement, so that scarcely any alterations whatever are necessary to the original arrangement. As regards the attention necessary to the individual lamps, we supply, in such cases where it appears necessary, special instructions when supplying the lamps. When inserting lamps in projection lanterns not built up by us, the directions, given in the case of the electric lanterns should be observed. It is advisable in such cases, however, to send lantern and lamp to our works in order that they may be made to fit properly.

The Projection Screen.

The projection screen is in the generality of cases fixed to the ceiling in front of the students, on the blackboard wall, and in front of the blackboard. For preventing it from becoming dusty it is kept rolled up. It is specially advantageous to place the screen on the blackboard wall in cases in which the lantern is erected in front of the students or in their midst, as the apparatus set up on the lamp can be seen well from the individual places. In this respect, however, it is also of value to arrange the screen on one of the lateral walls of the class room, opposite the window wall and the heliostat in the prolongation of the lecture table, as the projector screen can then also be used for the experiments with the heliostat.

The height at which the screen should be hung is determined by carefully considering the place where the lantern is set up and the correct position of the same from the screen and seeing that no shadows of either forms or scholars appear on the lower part of the screen. In many instances, when the

lantern is arranged horizontally, the image will fall too low on the screen since the lantern cannot well be placed higher than is convenient for purposes of manipulation. In all these cases it is necessary to have the lantern arranged tilted, so that the image is proportionately higher and falls on the centre of the screen. For tilting, either a table top which can be sloped (No. 50,993) is used, this being simply laid on the top of the lecture table; or recourse should be had to a stand (Nos. 50,995 et seq.) with top which can be tilted, the projection lantern being placed thereon. The projection screen must be correspondingly inclined so as to obviate any distortion of the images. The screen can be very simply tilted by having two weights at the right and left of the screen and a little behind the same. Two cords should be carried from the weights to the weighting bar of the screen, and the screen itself can thus be regulated so as to assume the correct angle of inclination.

The screen itself should best be made of an opaque dull white material; the most suitable size being in most cases 3×3 metres. Transparent screens need only be considered where the lantern must be installed in a room behind the screen. For a few interference, polarisation and diffraction experiments it is of value to have a special small and handy transparent screen which can be set up near the lantern. The phenomena are then strongly illuminated and the scholars can pass by behind the screen in rapid succession.

For rolling the screen up and down a draw cord device is used, or a rolling device, driven by electric motor, may be employed. This latter arrangement can be set into motion from any point in the room simply by putting the motor into circuit by the aid of a hand reversing switch, which, along with the fuses necessary, is fixed to a marble slab on the wall. The motor is automatically put out of gear as soon as the screen is completely rolled up or down.

The room is best darkened by means of light-tight blinds which can be rolled up or down; this arrangement can be worked either by hand or by motor. PP. 5 and 29—32 contain all particulars as to these devices. When asking for prices for darkening arrangements, kindly always forward accurately dimensioned sketches — if possible, send constructional plans, as the prices depend essentially on the size, number and arrangement of the windows.

Uses of the Projection Lanterns.

Projection of Diapositives.

The projection of diapositives is utilised as an important addition to instruction in botany, zoology and mineralogy, physical geography, geology, cosmology; but more particularly for nearly all branches of physics and chemistry; in addition the art of projecting plays a part in the teaching of history, the history of art, and religion. The advantages of the projection lantern therefore come specially into play when they are ready installed for use on the spot, and when the class room can be rapidly darkened, this being rendered possible the most advantageously with electric projectors and suitable darkening devices. It is also advisable to have the room lighted by incandescent lamps. The diapositives are laid in the change frame, the objective being then adjusted first in a coarse manner and subsequently in a fine manner until the image is focussed sharply on the screen; after this it is possible to go on changing the pictures in regular order.

As a rule the projection lanterns are supplied ready complete for the projection of diapositives; it remains for the photographs themselves to be provided. We usually supply these in size 9×10.5 cm. If it is required to project different sized pictures, as 8.5×10 cm or 9×12 cm, special change frames are provided for the purpose, these being supplied, at the same time as the lantern, for the 3 sizes named. A diapositive holder with change frames for plates 13×18 cm (No. 50,973) can be used with all lanterns; it must, however, be borne in mind that, especially with small condensers, only a small portion of a picture 13×18 cm can be cast on to the screen. This holder with change frame for 13×18 cm photographs must be specially ordered when required, and is charged for as an extra.

Projection of Translucent Physical Apparatus.

Many physical phenomena occur in so minute a form as to make it impossible to follow them at all with the naked eye, and others can be observed by only one person. In these cases, when a projection microscope is not available, the lantern is the only means of rendering the phenomena simultaneously visible to a large audience. Only a few of the experiments will be mentioned here:

The decomposition of a jet of water into drops by means of a stroboscopic disc; capillary phenomena; wave-projection machine; Newton's transparent colour discs; sectional model of a

steam cylinder; Andrews' press; the action of capillary tubes; density-maximum of water, and many others.

The apparatus in question are placed upon a stage set up between the condenser and objective, or direct on the optical bench. This does not necessitate any alterations to the lantern. A complete list of apparatus suitable for projection is contained in the Price List. The audience soon gets used to seeing the images appear on the screen upside down; if it is required that the pictures should appear upright, a reflecting prism (Nos. 51,040—51,043) is used.

Horizontal Projection.

The term horizontal projection may be taken to mean the projection of transparent objects placed in a horizontal position. This mode of projection is chiefly employed in connection with experiments made in flat dishes (especially with liquids), in chemical experiments and crystallisation, many of these being carried out in watch glasses; also for demonstrating the use of Berghoff's apparatus for explaining the theory of lines of force; for demonstrating the galvanometer, etc. A special **Horizontal Projection Apparatus** (Nos. 51,032—51,039) is required for these experiments; in this apparatus the light pencil issuing from the condenser horizontally is directed vertically, conducted through the apparatus, and subsequently redirected horizontally towards the screen. When using these apparatus, special attention should be paid to the notices included under the various numbers, regarding the removal of the front condenser lens and the entire condenser; a separate objective is unnecessary when using the horizontal projector.

The Projection Lantern as Source of Light for Optical Experiments.

Many-sided are the uses of the projection lantern as a source of light for optical experiments. The lantern very often replaces the heliostat, which in numerous instances it is impossible to use owing to the lack of sun. For such purposes the lantern is usually employed with the optical bench but without the objective. It seems superfluous to mention all the different optical demonstration apparatus for showing the propagation of light, the reflexion and refraction on plane and curved surfaces, the dissemination of colour, sensations of vision also for demonstrating optical instruments, interference, diffraction, polarisation and double refraction, etc., which require a special source of light, and which of course show all the phenomena more plainly the stronger the source of light. We carry a large selection of such apparatus and in this connection we would make reference to the Optics section of our list. In the present section dealing with Projectors and accessories, we have only included these optical apparatus which are specially intended and arranged to be used with the lanterns and which cannot be employed with any source of light.

Converging Light is available in connection with the lanterns in the path of rays immediately behind the condenser lens. **Parallel Light** is produced with the aid of the bi-concave lens No. 50,979 to 50,981. The holder for this lens is inserted in the stand, after removing the table or the change frame, the holder being brought near to the condenser in the converging rays, until the rays are parallel. **Diverging Light** is secured by using the condenser alone, but at a greater distance from the same. It is better, however, to utilise the diverging light emanating from the objective after the latter has been placed on the optical bench. For producing a pencil of light of smaller or greater diameter, e. g., for tuning fork apparatus, etc., a diaphragmic disc No. 50,983 should be used, the individual diaphragms of which can be changed by rotating. The disc is fixed to a haft by means of which it can be inserted in the sliders of the optical bench.

For the other experiments of an optical character it is necessary to have a corresponding number of sliders having stands (Nos. 50,974 and 50,975) for setting up nicols, lenses, etc.; for all cases it will be sufficient to have 5 Sliders with stands (No. 50,974) and 1 Slider with stand and being movable laterally by a screw motion (No. 50,975). A water trough (No. 50,976 to 50,977) is recommended for all experiments if the lantern used is not fitted with a cooling chamber between the lenses of the condenser. A cooling vessel is absolutely necessary for polarisation experiments and the introduction of microscopic preparations.

Spectrum Phenomena. Projecting a Spectrum. An adjustable Slit with micrometer screw No. 50,986, adjusted to an aperture of about $^1/_2$ mm is placed in front of the condenser. For this purpose the Slit fitted with Iris Diaphragm (No. 50,988), which can be vertically or horizontally adjusted at will, and which permits of varying the length of the slit, is also very good.

By the aid of a Collimator Lens (No. 50,982) a sharp image of the slit is projected on the screen. A prism — preferably a direct vision prism — is placed on the Prism Stage, the latter being brought into the narrowest part of the light pencil issuing from the collimator lens, the result being a sharply defined spectrum on the screen. The direct vision prisms have the advantage over the prisms with deflecting ray, for projection purposes, as they obviate the tilting and lateral adjustment of the lantern. In addition, Wernicke and Königsberger liquid prisms may well be considered. These prisms give specially great brightness of image; the liquid may be kept in the prisms. For determining and comparing the refractive capacity and the different dispersion of liquids, use is made of the carbon disulphide prisms and also of the hollow prisms, these being catalogued in a large variety in the section of this list dealing with Optics. Opportunity offers here for mentioning also the reproduction of the solar spectrum by using the transparent solar spectrum. The fact that a spectral colour can be no further split up by a prism can be confirmed by placing a slit behind the prism, whose aperture is then illuminated with the desired colour, after which a further prism is placed in the light pencil. For this experiment an adjustable Slit, on stand, as well as a small stand containing a special prism, can be employed. The second slit is left fairly wide (up to 5 mm or thereabouts) and is set up at not too great a distance from the projection screen.

The resolution of the colours of the spectrum into white can be shown by the aid of the apparatus listed in the optical section of our list; in this apparatus the individual colours of the spectrum projected on to a number of mirrors are projected from these on to a separate small screen or a white pasteboard slab (placed at right angles to the large screen) by focussing the mirrors on one point: a white spot resulting from the mixing of all the colours. This experiment is especially instructive because the mixing of the colours can be carried out in full view of the students, and the mixing of the individual complementary colours and other colours can be conveniently effected before or afterwards. In setting up the apparatus with 5 or 7 mirrors in front of the lantern, these mirrors should be at an angle of 45° to the optical axis, but care should be taken that those mirrors encountered by the feebler part of the spectrum are nearest the lantern so that they take up a larger angle of rays than the others. An Oscillating Prism is used to demonstrate the theory that the actual colours of the spectrum appearing on the same spot in rapid succession appear white; we supply this prism to suit the whirling table. The prism, together with the driving device, is set up in front of the lantern in such manner that the prism itself is arranged as an ordinary prism while the spectrum is being projected, being afterwards set in motion. Even imitated spectrum tints give white when reproduced additively. This experiment can be made in conjunction with the previous ones by employing the transparent colour discs. Another method for re-uniting the colours of the spectrum consists in inserting an achromatic (spherical) lens in the path of the rays behind the prism; a cylindrical lens may even be used for the purpose.

Various emission spectra can be projected with the lantern in rapid succession, by the aid of carbons filled with the salts of various metals. For rapidly changing the carbons a revolving arrangement is most advantageous. In these experiments the current must be passed through the lantern in the reverse direction to that which is usual, i. e., it must be led in at the lower carbon and out at the upper. The experiment with sodium salt must always be made last, or the spurting of the sodium will cause the other spectra of the sodium line to show.

A small bench is arranged on the adjustable slit on which may be placed an absorption trough, e. g., for liquids or gases, for the purpose of carrying out absorption experiments; this little bench can also take a colour slab or the like. The liquid specially adapted for absorption experiments is a diluted solution of potassium permanganate. The slit with iris diaphragm (No. 50,988) mentioned above contains special springs for clamping the slabs or coloured glasses or other preparations. For reversing the sodium line the apparatus suggested by Frankland is used. This is placed between the slit and the collimator lens in such manner that the pencil of light must pass the flame, a pure spectrum being projected on the polarisation screen. If a small piece of sodium the size of a pea be now put into the small platinum spoon of the apparatus, thus colouring the flame an intense yellow, the sodium line shows black on the projection screen.

For other spectrum experiments the prisms constructed of various sorts of glass, liquid prisms, compound and crossed prisms, included under Optics, are employed.

Interference and Diffraction. The type of screen used is the small transparent screen No. 51,003, as the phenomena are somewhat weakly illuminated and it is necessary that the scholars should view them individually. By employing this screen the scholars can pass by behind the screen without disturbing the rest of the class.

The interference prism is set up in front of the optical bench, and the bi-concave lens and the adjustable slit on the bench itself, and the small projection screen is brought up to the lantern until the interference bands are sharply focussed on the screen, which may subsequently be removed. For demonstrating the diffraction phenomena the slit No. 50,985, adjusted to a width of slit of 2 mm, is placed in front of the condenser and a second slit, say, adjustable slit No. 50,986, is placed on the op-

tical bench as far away from the condenser as possible. If the last-named slit be gradually narrowed the coloured diffraction bands will result.

Polarisation. The phenomena attending the polarisation of light can be shown with the Polarisation Apparatus No. 51,074, this apparatus being specially adapted for the purpose. A fuller description is contained on p. 1212 (see end of present Section).

Double Refraction. The two spectra appearing simultaneously are projected with the aid of a calc-spar prism (the refracting edge of which is parallel to the principal crystallographic axis) in exactly the same manner as described for a spectrum in the spectrum phenomena. The Polarisation Apparatus (No. 51,074) previously mentioned is also suitable for carrying out further experiments with rapidly annealed glasses, calc-spar lamellae, preparations of gypsum and mica, etc., as this apparatus is set up ready for use in front of the lantern as the preparations have only to be inserted and rotated in their plane.

Microscopical Preparations.

The projection microscope No. 51,047 is screwed into the objective holder (or No. 51,048 is inserted on the slider of the optical bench) and it is introduced into the path of the converging rays issuing from the condenser in such manner that their point of union strikes the microscopical preparation. A water trough No. 50,976 or 50,977 is used for preventing the preparation from becoming heated.

The microscopical preparations are fixed under the spring clamps of the object stage. The sharpness and brilliancy of the images are then secured by turning the knob. For finer focussing, which is necessary at very great magnification, a special screw knob with micrometer screw, to be found in the case of the Projection Microscope No. 51,048 underneath the object stage, is provided. The apparatus is arranged for projecting without an ocular, as in most cases a moderate degree of magnification, say 500 times, is sufficient. One of the objectives Nos. 51,049—51,053 is required in addition to the microscope, those used being chiefly the ones numbered 2, 3 and 5. If a number of objectives are available, it is advisable to use a revolving nose piece (Nos. 51,054 or 51,055) for changing the objectives, so as to render it possible to pass from one magnification to another with expedition.

Opaque Objects.

For presenting and magnifying illustrations, especially wood cuts from text books, one of the **Megascopes** Nos. 51,045 or 51,046 is used. When using this either the whole or a part of the condenser should be removed in accordance with the instructions in the price list.

The Projection Lantern as a Source of Heat.

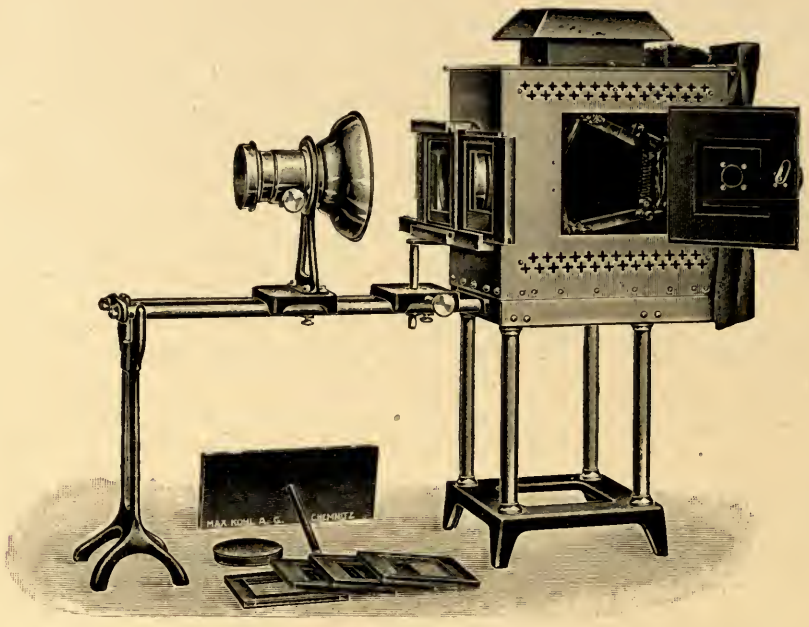
In addition to being employed as a source of light the projection lantern can in a number of cases be specially used as a source of radiant heat, e. g., for absorption experiments with coloured glasses.

Miscellaneous Applications.

It may be well to mention here that the experiments just described do not by any means exhaust the experiments which it is possible to carry out with the projection lantern. There are still a number of experiments, especially relating to light, which may be carried out by the aid of the projection lantern; but these are not given here, since the Projection Lanterns are only used as the source of light for these and special provision for the same does not need to made in the lantern. As regards the conduct of these experiments, therefore, reference must be made to the literature mentioned in the list and to the instructions for use which we append to the apparatus when supplying.

Mention may, however, be made of the use of the lantern for photographic enlargements, for copying with high-speed sensitised papers; also for the projection of cinematographic pictures, projection of pictures in their natural tints by subtractive colour reproduction with the Projection Chromoscope as suggested by Ives, or by additive reproduction with the Diffraction Chromoscope.

Further fields for the utilisation of projectors are given in the work of Drs. Hassack and Rosenberg entitled „Die Projektionsapparate“, Vienna and Leipzig, 1907, A. Pichlers Witwe & Sohn. All the apparatus mentioned in this work are supplied by us, and many other pieces of apparatus in addition in accordance with the best known and most used text books are included in our price list.



50 735. 1 : 10.

Prices of Projection Apparatus.

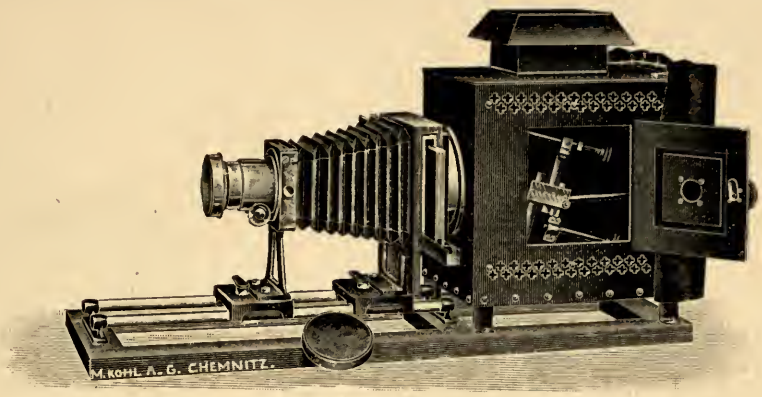
School Projection Apparatus, Model A, Figure 50,735, for projecting apparatus and photographs; with Condenser, Achromatic Objective, Optical Bench, Change Frame with smaller frame inserted for taking diapositives 9×10.5 cm, 8.5×10 cm and 9×12 cm; 1 stage and one movable slider with stand in which to insert the change frame, the stage or other objects; on tall legs.

With Achromatic Projection Objective	Condenser Diameter . . . . . mm	102	122	152
	Objective Diameter . . . . . mm	43	55	65
	Focal length of Objective . . . . . mm	150	180	250
With Arc Lamp for hand regulation, No. 50 890	List No.	**50 730**	**50 735**	**50 740**
	£	**11. 10. 0**	**12. 10. 0**	**14. 0. 0**
With auto-regulating Direct Current Arc Lamp, No. 50 898 . . .	List No.	**50 731**	**50 736**	**50 741**
	£	**12. 0. 0**	**13. 0. 0**	**14. 10. 0**
With Direct Current Nernst Projector Lamp, No. 50 923	List No.	**50 732**	**50 737**	**50 742**
	£	**10. 10. 0**	**11. 10. 0**	**13. 0. 0**
With Limelight Burner for House gas and Oxygen, No. 50 936 . .	List No.	**50 733**	**50 738**	**50 743**
	£	**10. 0. 0**	**11. 0. 0**	**12. 10. 0**
With Incandescent Spirit Burner, No. 50 964	List No.	**50 734**	**50 739**	**50 744**
	£	**11. 0. 0**	**12. 0. 0**	**13. 10. 0**

Switchboards see page 169, **Regulating Resistances** for the apparatus with electric arc lamps — see pp. 1226—1228. **Fixed Series Resistances,** Transformers and **flexible triple leads** — see pp. 168 and 169. Better **Optical** and **other Outfits** — see Nos. 50,750—50,767, p. 161.

The housing is of black iron; it has a door, in the side wall, having dark glass peep holes, and a further observation window on the opposite side. The lamp is manipulated from behind. For this purpose the back is fitted with a sliding door which can be completely removed. The disturbing light radiated from behind is prevented from issuing from the lantern by black curtains, the housing being well ventilated. The condenser is fitted to the front wall, the optical bench being placed in front of the latter, and carrying two sliders: one of those shown in the illustration carries the diapositive holder with change frame, while the other carries the objective-holder together with the objective.

As regards the various systems of lamps, the lantern of this apparatus is arranged so that all the lamps included in the table of prices can be inserted — e. g., instead of the hand-regulated lamp, a lamp with auto-regulation, or a Nernst lamp or focus glow lamp, when the candle-power demands are not too great or if a saving in current has to be effected. Gas and spirit incandescent lamps will also fit the lanterns so that they can be



50 778. 1 : 11.

employed for other kinds of illumination by schools in which electricity is not available for the purpose. When arranging for installing electricity it is only necessary therefore to order an electric arc lamp for the lantern afterwards.

The lantern is also supplied resting on short legs, in accordance with Fig. 50,778 and the following table. When constructed thus it has an extending bellow, rendering it peculiarly adapted for the projection of diapositives. The bellows can, however, easily be removed, and the lantern then be used for all other modes of projection.

Other Optical Fittings and Accessories.

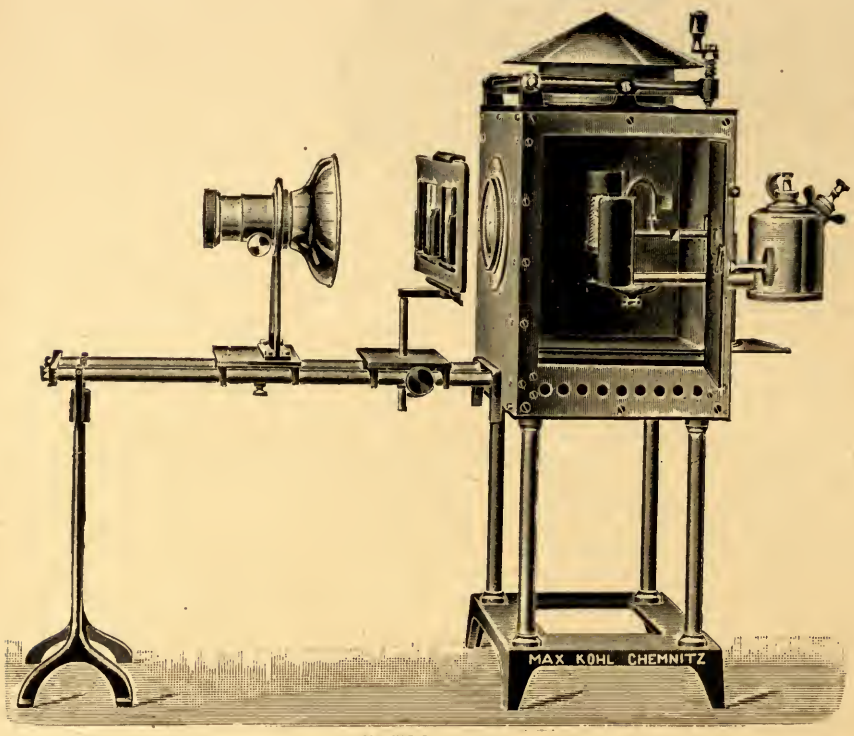
For Condensers of Diameter . . . . . mm		102	122	152
With Projection Anastigmat	List Number	**50 750**	**50 756**	**50 762**
	Diameter mm	40	50	60
	Focal Length mm	150	190	230
	Extra Price £	**3. 0. 0**	**2. 10. 0**	**2. 0. 0**
With Steinheil Group Antiplanet	List Number	**50 751**	**50 757**	**50 763**
	Diameter mm	29	33	43
	Focal Length mm	160	180	240
	Extra Price £	**2. 15. 0**	**2. 5. 0**	**2. 10. 0**
With Voigtländer Heliar	List Number	**50 752**	**50 758**	**50 764**
	Diameter mm	36	40	54
	Focal Length mm	160	180	240
	Extra Price £	**7. 0. 0**	**7. 10. 0**	**12. 0. 0**
Tilting Device	List Number	**50 753**	**50 759**	**50 765**
	Extra Price £	**0. 10. 0**	**0. 10. 0**	**0. 10. 0**
Lengthened Optical Bench	List Number	**50 754**	**50 760**	**50 766**
	Extra Price £	**0. 10. 0**	**0. 10. 0**	**0. 10. 0**
Cooling Chamber between the Condenser Lenses . . . . . (cf. Figs. 50796 and 50767, page 163)	List Number	**50 755**	**50 761**	**50 767**
	Extra Price £	**2. 10. 0**	**3. 0. 0**	**3. 10. 0**

When one of the better objectives listed in the above table is ordered at the extra price given, the Projection Objective is, of course, omitted.

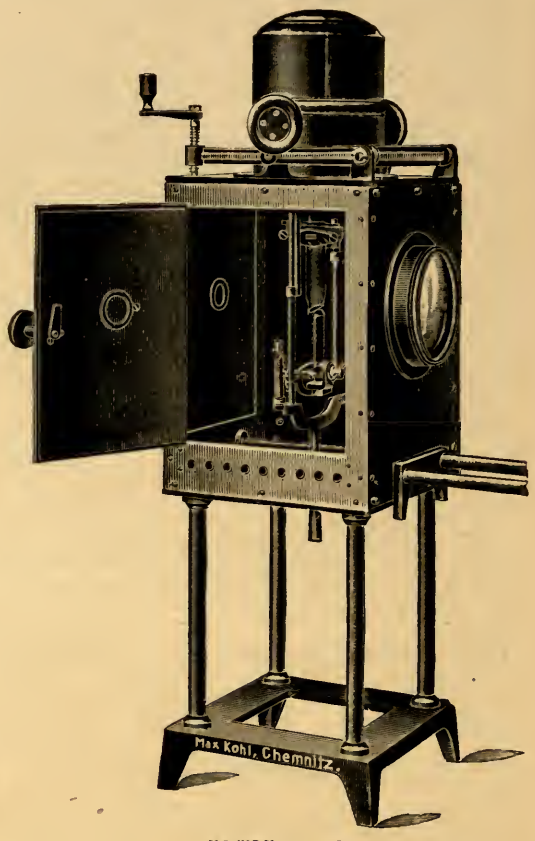
School Projection Apparatus, Model A, low Type (Fig. 50,778), with detachable extending bellows, achromatic Objective, Optical Bench, change frame with small frame for taking diapositives 9×10.5 cm, 8.5×10 cm, and 9×12 cm; 1 Stage and 1 Slider with stand for inserting the change frame, the stage or other objects.

With Achromatic Projection Objective				
	Diameter of Condenser . . . . . mm	102	122	152
	Diameter of Objective . . . . . mm	43	55	60
	Focal Length of Objective . . . . . mm	150	180	250
With hand-regulating Arc Lamp, No. 50 890	List Number	**50 768**	**50 773**	**50 778**
	Price £	**12. 0. 0**	**13. 0. 0**	**14. 10. 0**
With auto-regulating Direct Current Arc Lamp, No. 50 898 .	List Number	**50 769**	**50 774**	**50 779**
	Price £	**12. 10. 0**	**13. 10. 0**	**15. 0. 0**
With Direct Current Nernst Projection Lamp, No. 50 929 . .	List Number	**50 770**	**50 775**	**50 780**
	Price £	**11. 0. 0**	**12. 0. 0**	**13. 10. 0**
With Limelight Burner for House Gas and Oxygen, No. 50 936	List Number	**50 771**	**50 776**	**50 781**
	Price £	**10. 10. 0**	**11. 10. 0**	**13. 0. 0**
With Spirit Incandescent Burner, No. 50 964	List Number	**50 772**	**50 777**	**50 782**
	Price £	**11. 10. 0**	**12. 10. 0**	**14. 0. 0**

Re the **Construction** of this lantern, kindly note the description of the preceding model; for better optical and other fittings, see above, Nos. 50,750—50,767.



50 794. 1: 9.



50 795. 1: 8.

Projection Apparatus, Model B, with Aluminium House (Figs. 50,794, 50,795, 50,796, for projecting apparatus and photographs; with Condenser, Achromatic Objective, Optical Bench, Change Frame with small frame for taking photographs 9×10.5 cm, 8.5×10 cm, and 9×12 cm plate-size; 1 Stage and 1 Slider with stand for holding the change frame, the stage, or other objects, on tall legs.

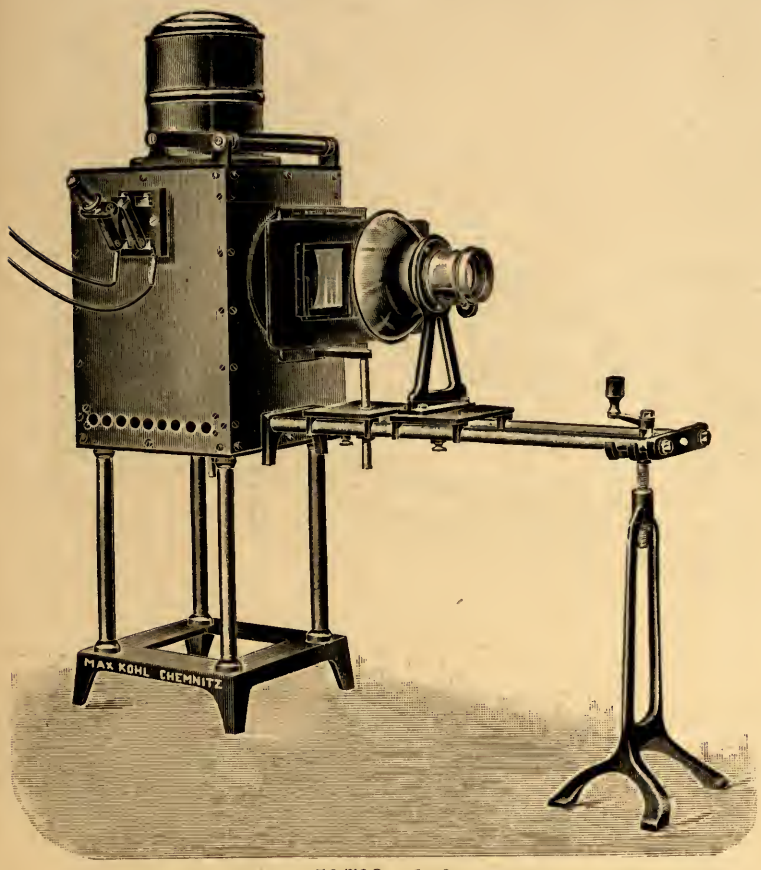
With Achromatic Projection Objective	Diameter of Condenser . . . . . mm	102	122	152
	Diameter of Objective . . . . . mm	43	55	60
	Focal Length of Objective . . . . . mm	150	180	250
With Arc Light Hand Regulator, Fig. 50 795	List Number	**50 783**	**50 789**	**50 795**
	Current, amps.	15—25	15—25	20—25
	Price £	**17. 10. 0**	**18. 10. 0**	**20. 0. 0**
With auto-regulating Direct Current Arc Lamp, Fig. 50 796	List Number	**50 784**	**50 790**	**50 796**
	Current, amps.	15	15	20
	Price £	**15. 10. 0**	**16. 10. 0**	**18. 0. 0**
With auto-regulating A. C. Arc Lamp, Fig. 50 796 . . .	List Number	**50 785**	**50 791**	**50 797**
	Current, amps.	20	20	25
	Price £	**16. 0. 0**	**17. 0. 0**	**18. 10. 0**
With Nernst Projection Lamp (D. C.), No. 50 923	List Number	**50 786**	**50 792**	**50 798**
	Price £	**15. 0. 0**	**16. 0. 0**	**17. 10. 0**
With Limelight Burner for House Gas and Oxygen, No. 50 936	List Number	**50 787**	**50 793**	**50 799**
	Price £	**14. 10. 0**	**15. 10. 0**	**17. 0. 0**
With Spirit Incandescent Burner, No. 50 964, Fig. 50 794 . .	List Number	**50 788**	**50 794**	**50 800**
	Price £	**15. 10. 0**	**16. 10. 0**	**18. 0. 0**

For Series Resistances, Transformers and Twin Flexible Cable, see p. 168. For better optical and other fittings see Nos. 50,750—50,767, p. 161.

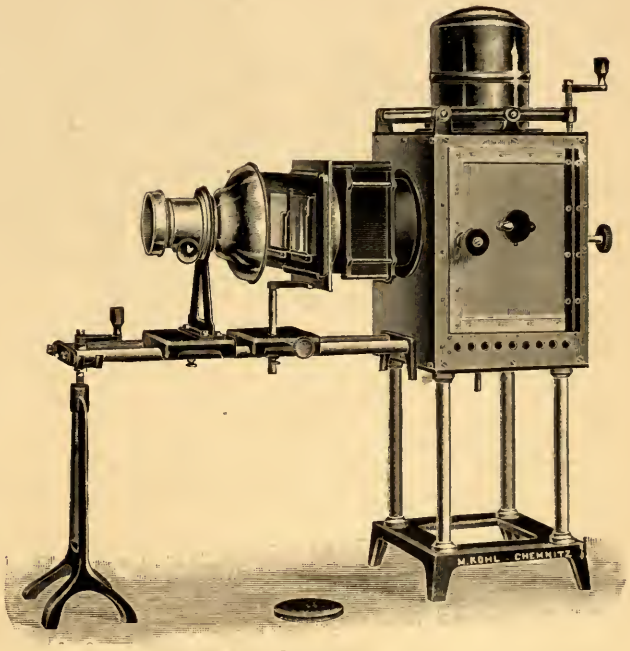
This projector is somewhat more richly fitted out than Model A. The lamp housing is composed of aluminium walls, is well ventilated and has two doors with dark glass peep holes. The provision of the doors (one in the side wall and the other in the back wall) renders it convenient to insert the carbons. The arc lamp can be raised and lowered by a handle and screw so as to get the centre of light quickly and accurately in the optical axis. One of the side walls of the housing carries a switch for the arc lamp (where the lanterns are fitted with arc lamps); the switch is thoroughly enclosed thus obviating any contact being made in the dark with parts under current.

The hand regulator fitted in the case of Nos. 50,783, 50,789 and 50,795 is manipulated by simply turning the hand wheel fitted above it; this form of regulation is very convenient.

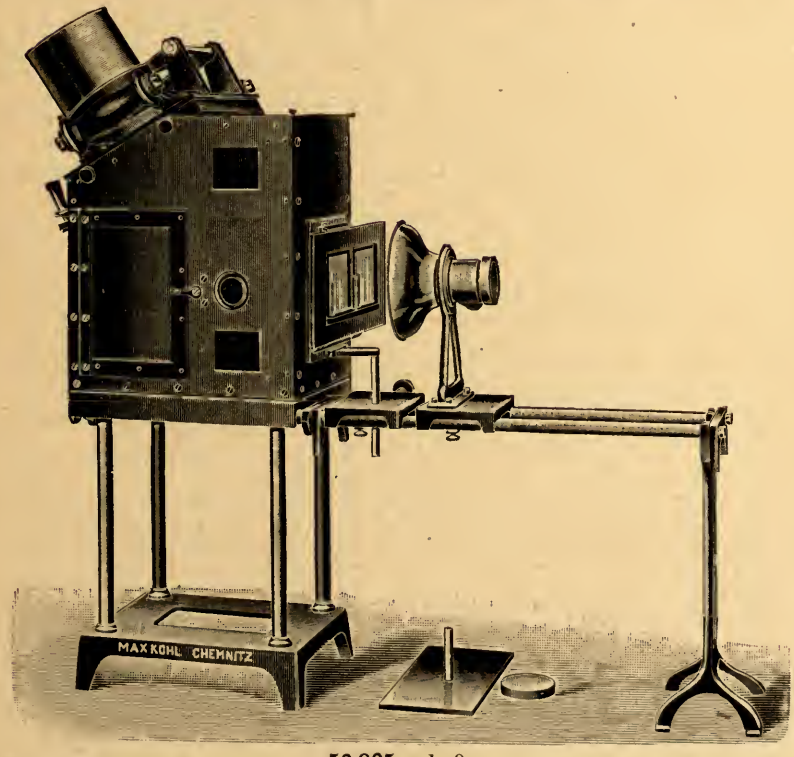
For localities not yet supplied with electric current, but where this supply is contemplated, the lantern



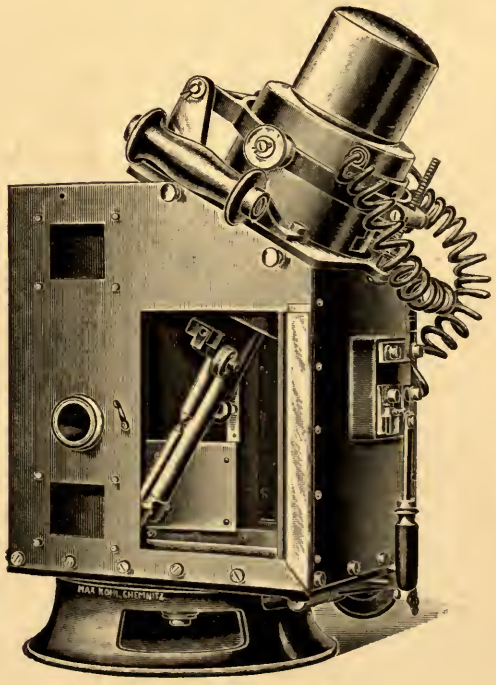
50 796. 1 : 9.



50 796 und **50 767.** 1 : 12.



50 805. 1 : 9.

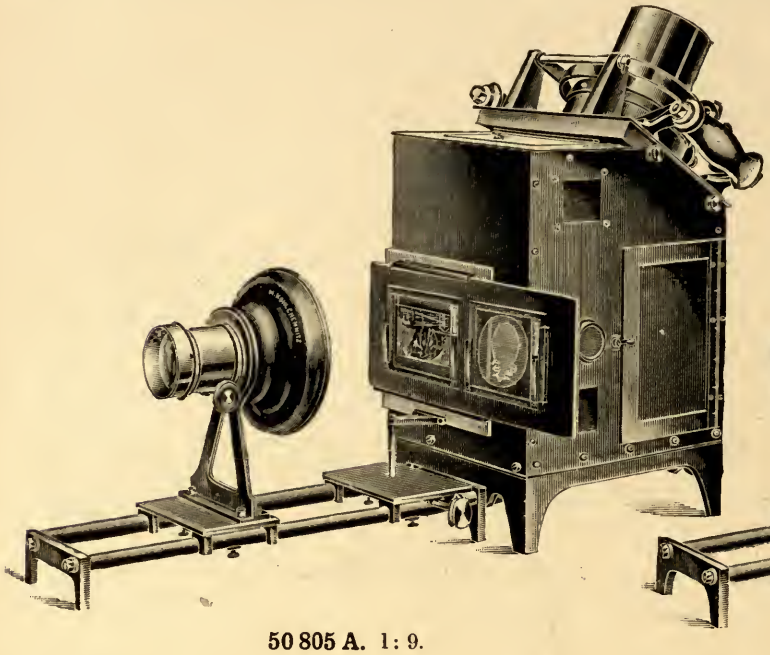


50 805 C. 1 : 6.

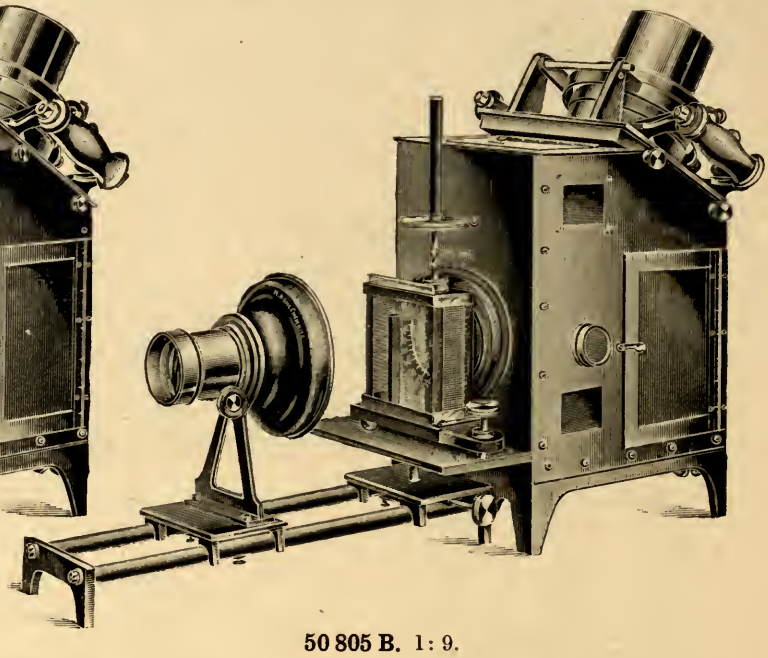
is constructed exactly as shown in Fig. 50,794; in addition, however, it is arranged that a thorium burner, incandescent burner or the like may be used initially, being replaced later by the arc lamp.

The projectors fitted with auto-regulating arc lamp usually have lamps for the currents given in the table. Auto-regulating lamps for higher currents (to 25 amps.) are supplied without extra price, if desired.

Projection Lanterns with tilted Lamp (Schuekert system), Fig. 50,805, for projecting apparatus and photographs; with Condenser, Achromatic Objective, Optical Bench; Change Frame with smaller



50 805 A. 1: 9.



50 805 B. 1: 9.

frame for taking photographs of 9×10.5 cm, 8.5×10 cm and 9×12 cm plate-size; 1 Stage and 1 Slider with stand for taking the change frame, the stage or other objects.

With Achromatic Projection Objective	Diameter of Condenser . . . . . mm	102	122	152
	Diameter of Objective . . . . . mm	43	55	60
	Focal Length of Objective . . . . . mm	150	180	250
With auto-regulating D. C. Arc Lamp, Fig. 50 805	List Number	**50 801**	**50 803**	**50 805**
	Price £	**17. 10. 0**	**18. 10. 0**	**20. 0. 0**
With auto-regulating A. C. Arc Lamp, Fig. 50 805	List Number	**50 802**	**50 804**	**50 806**
	Price £	**19. 10. 0**	**20. 10. 0**	**22. 0. 0**
Construction resting on short legs, Figs. 50 805 A and 50 805 B . . . . **Less** £		**0. 10. 0**	**0. 10. 0**	**0. 10. 0**
Construction on Rotatory Base with fine and coarse adjustment, Fig. 50 805 C, page 163 . . . . . **Extra** £		**2. 0. 0**	**2. 0. 0**	**2. 0. 0**

For Switchboards, Regulating Resistances, see pp. 1226—1228. For Transformers and Twin Flexible Cables, see p. 169.

Better optical and other Fittings, see Nos. 50,750—50,767 on p. 161.

The housing is of blacked sheet brass and has a door and an observation window on each of the two sides. The distribution of light is somewhat enhanced by the oblique arrangement of the lamp. The arc lamp can also be brought into a vertical position for carrying out spectrum experiments. The tilted type of lamp is not practicable for alternating current.

The illustration Fig. 50,805 A shows the apparatus as employed for projecting photographs, and Fig. 50,805 B as used for projecting apparatus.

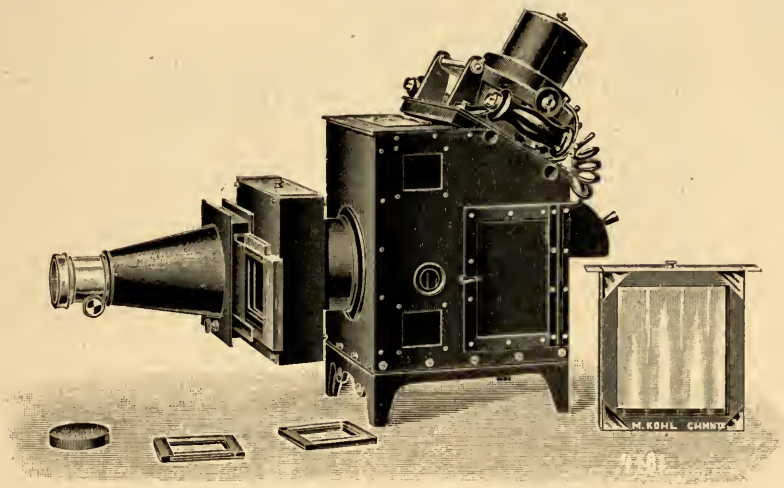
Projection Lantern with tilted Lamp (Schuckert system), Fig. 50,808, with auto-regulating Direct Current Arc Lamp for 20 amps., for projecting Photographs; with Condenser and Projection Objective, and with 2 interchangeable water troughs; Change Frame with small frame inserted for 8.5×10, 9×10.5 and 9×12 cm.

List Number	**50 807**	**50 808**	**50 809**
Diameter of Condenser . . . . . mm	102	122	152
Lamp Current . . . . . amperes	15	15	20
On 4 Legs . . . . . £	**20. 10. 0**	**22. 10. 0**	**25. 0. 0**
Mounted on Rotatory Base (cf. Fig. 50 805 C, page 163) . . **Extra** £	**2. 10. 0**	**2. 10. 0**	**2. 10. 0**

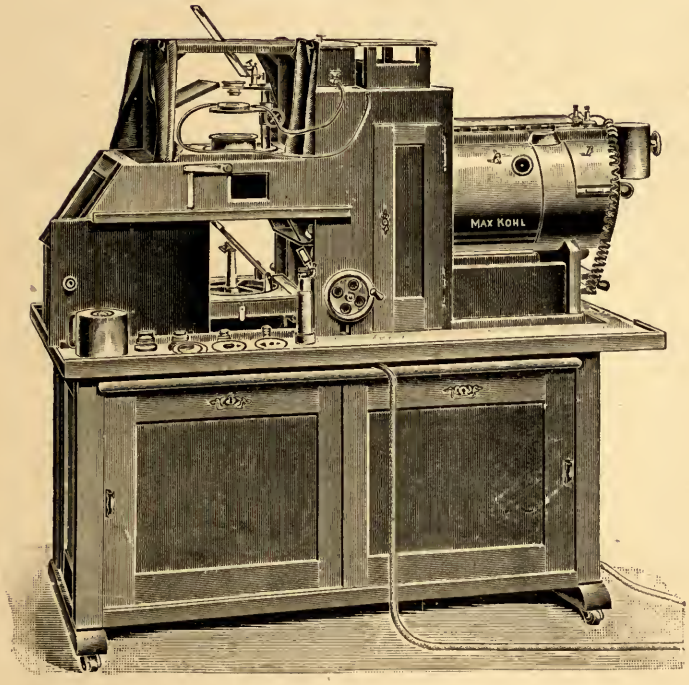
We also supply these projectors with 1 trough constructed entirely of glass for filling with a solution of ferrous ammonium oxide, which absorbs the heat excellently, in lieu of the two water troughs. The price is the same.

One of the regulating resistances Nos. 9645—9648, p. 1228, is necessary for working the lantern and should be ordered at the same time. In addition to this, it is advisable to have the switchboard No. 9621.

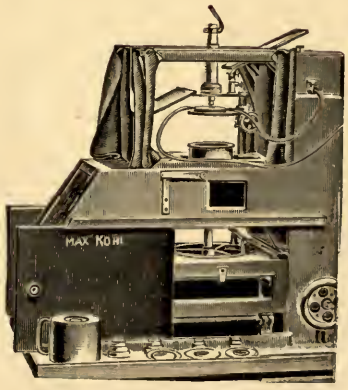
The foregoing lanterns if fitted with an alternating instead of direct current lamp are increased in price by £ 1. 15. 0. The A. C. lamps can only be used in the vertical position.



50 808. 1 : 10.

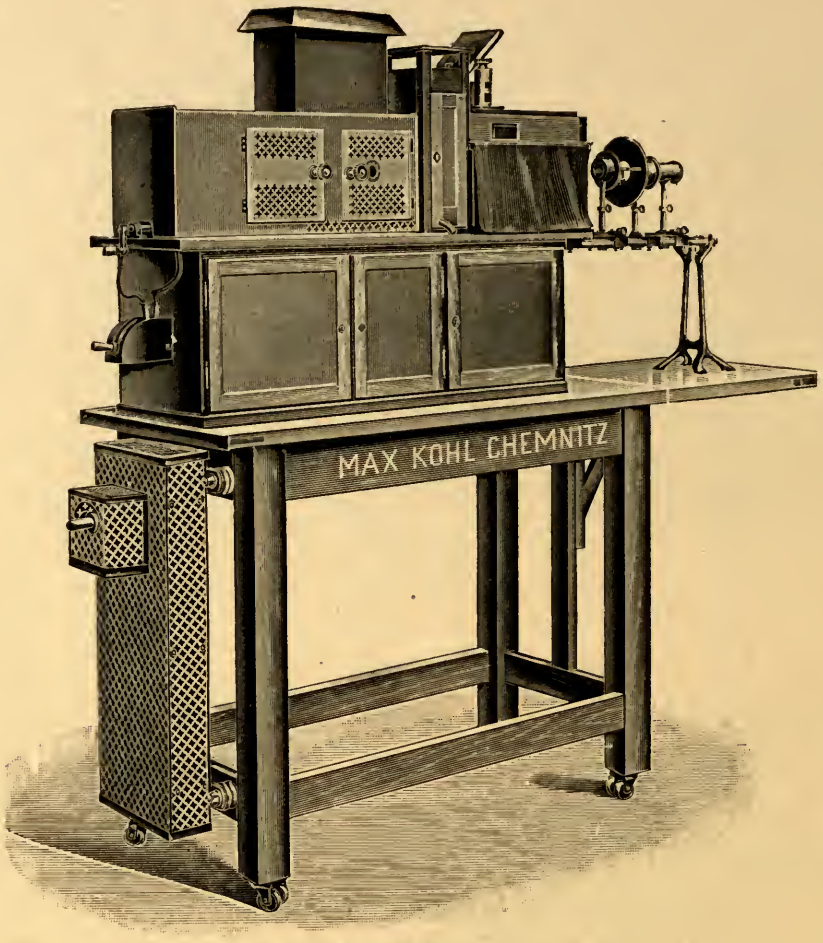


50 810, 50 817. 1 : 18.



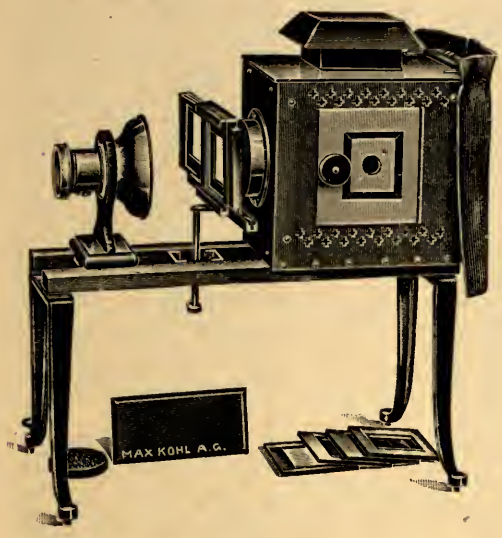
50 810, 50 817, 50 826. 1 : 18.

	£ s. d.
50,810. **Epidiascope** (Zeiss') for projecting with reflected and transmitted light, Figure, with 30 amp. Direct Current Projector and fine adjustment for the projection system, with erecting mirror (which can be tilted), without regulating resistance or objective, Figures	62. 0. 0
50,811. — do., with 50 amp. Direct Current Projector and erecting mirror (can be tilted); without regulating resistance or objective	67. 0. 0
50,812. **Zeiss Tessar,** Series 1 c, No. 17, focal length 250 mm, for Diapositives to 13×21 cm	16. 0. 0
50,815. **Change Slider,** for introducing the pictures from one side of the apparatus; without rotatory insertion disc	4.19. 0
50,816. **Rotatory Disc** for laying the pictures in the change slider No. 50,815, Size 8.5×8.5, 8.5×10, 9×12, 13×18 cm . . . . . **Each**	0. 9. 0

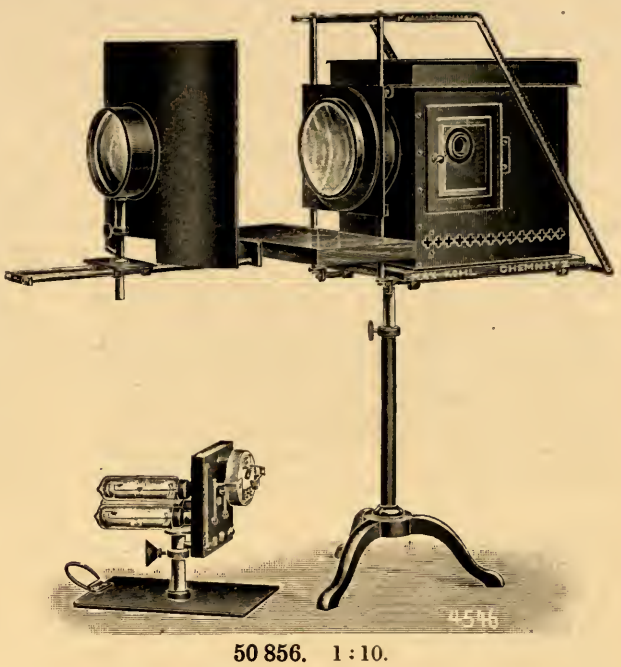


9515, 9530, 9646. 1:20.

	£ s. d.
50,817. **Microprojection Outfit** (Figure on p. 165), with large erecting mirror for projecting horizontally and upwards on the slope; without objective	17. 2. 0
The outfit comprises a Microscope Stand (£ 6. 1. 0) with illuminating Mirror (£ 1. 13. 0); 2 Illuminating Lenses (£ 1. 19. 8), 4 Diaphragms with different sized apertures for inserting in the aperture of the table (£ 0. 7. 10), 4 Distance Rings for the objectives (£ 0. 7. 10), large Erecting Mirror for projection in a horizontal and sloping direction (£ 2. 9. 6), a Cooler (£ 0. 13. 3) with water vessel (£ 0. 9. 5), a Screening Device (£ 1. 7. 6), Iris Diaphragm for inserting between base and screening device (£ 1. 13. 0). There is a box for the stand.	
50,818. — do., with small erecting mirror, for projecting only in a horizontal direction .	16. 7. 9
This outfit is only suitable for projecting in a horizontal direction. The small erecting mirror costs, separately, £ 1. 15. 3.	
50,819. **Achromatic Objective** (Zeiss'), type aa, 26 mm focus	1. 9. 9
50,820. — do., AA, 17 mm focus	1.13. 0
50,821. — do., C, 7 mm focus.	1.13. 0
50,822. **Projection System** (Zeiss'), 35 mm focus	1.18. 6
50,823. — do., 40 mm focus	2. 4. 0
50,824. **Micro-Planar** (Zeiss'), 50 mm focus	5.10. 0
50,825. — do., 100 mm focus	6.12. 0
50,826. **Ocular Tube** with erecting mirror (cf. Figure, p. 165), for projecting in connection with an ocular. Price without ocular	1. 0. 0
50,827. **Projection Ocular** (Zeiss'), No. 2, focus 90 mm	2. 4. 0
50,828. — do., No. 4, focus 45 mm	2. 4. 0
50,829. **Compensating Ocular** (Zeiss'), No. 4, 45 mm focus	1. 2. 0
50,830. — do., No. 8, 22.5 mm focus	1.13. 0
50,831. — do., No. 12, 15 mm focus	1.13. 0
50,832. — do., No. 18, 10 mm focus	1. 7. 0
For Switchboards, Regulating Resistances, etc., see pp. 1226—1228 (sewn in at the end of this section); for Flexible Double Conducting Cables, see p. 169.	



50 842. 1: 12.



50 856. 1 : 10.

Kohl's Megadiascope. Detailed description and prices of this universal projector (which can be adapted to all kinds of projection in use — for photographs and apparatus; also for microscopic, megascopic and horizontal projection; for use in conjunction with Paalzow's optical bench, and for optical experiments, etc.) are given on pp. 1201—1232 (bound up at the end of this section), Fig. 9515.

Skiopticon, with Optical Bench and Achromatic Objective, Fig. 50,842.

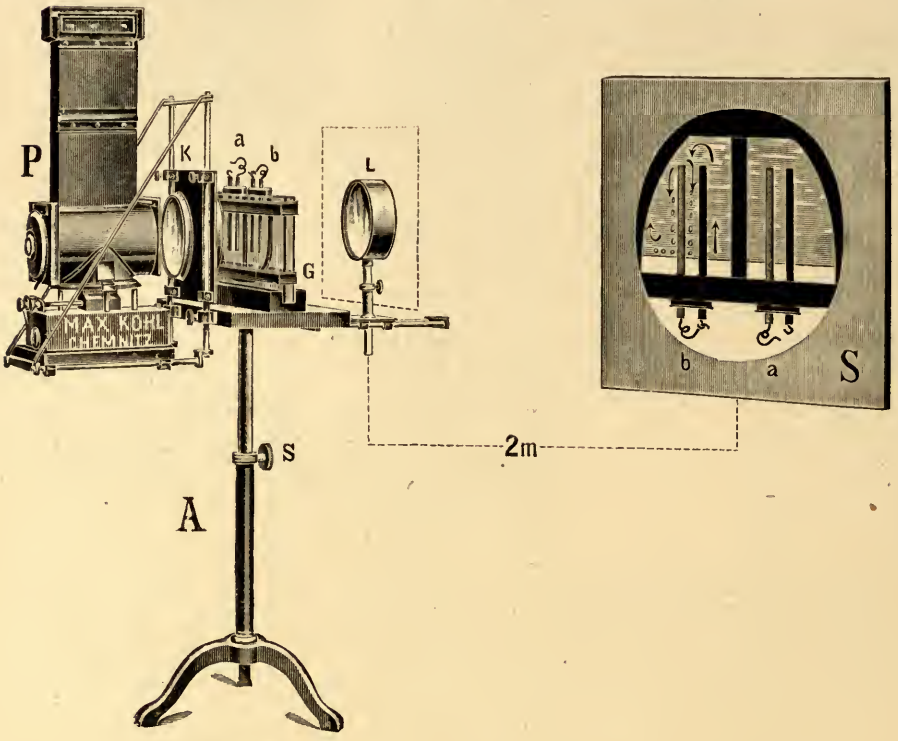
Diameter of Condenser . . . . . mm		102	122
Diameter of Objective . . . . . mm		43	55
Focal Length of Objective . . . . . mm		150	180
With Arc Lamp for Hand Regulation, No. 50 890	List Number	**50 833**	**50 844**
	£	**7. 0. 0**	**8. 0. 0**
With auto-regulating D. C. Arc Lamp, No. 50 898	List Number	**50 834**	**50 845**
	Current, amps.	15	15
	£	**8. 10. 0**	**9. 10. 0**
With D. C. Nernst Projection Lamp, 4 amps., No. 50 923	List Number	**50 835**	**50 846**
	£	**6. 10. 0**	**7. 10. 0**
With Burner for Thorium Light, No. 50 933	List Number	**50 836**	**50 847**
	£	**7. 5. 0**	**8. 5. 0**
With Limelight Burner for House Gas and Oxygen, No. 50 936. . .	List Number	**50 837**	**50 848**
	£	**6. 10. 0**	**7. 10. 0**
— **idem, for Ether and Oxygen,** No. 50 944	List Number	**50 838**	**50 849**
	£	**8. 5. 0**	**9. 5. 0**
With Incandescent Gas Burner, No. 50 962	List Number	**50 839**	**50 850**
	£	**5. 15. 0**	**6. 15. 0**
With Incandescent Spirit Burner, No. 50 964	List Number	**50 840**	**50 851**
	£	**7. 10. 0**	**8. 10. 0**
With Acetylene Lamp, No. 50 967	List Number	**50 841**	**50 852**
	£	**6. 5. 0**	**7. 5. 0**
With triple-burner Paraffin Lamp	List Number	**50 842**	**50 853**
	£	**6. 5. 0**	**7. 5. 0**

The house is constructed of sheet iron and has 2 doors; it has double walls and is well ventilated. The doors are provided with peep holes.

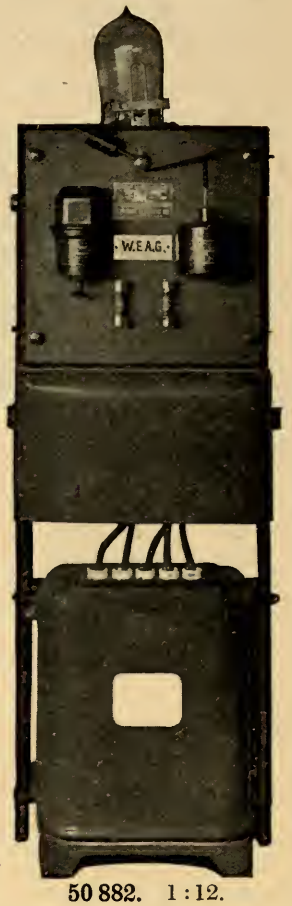
Switchboards, Series Resistances for D. C. Arc Lamps, and **Transformers** for A. C. also **Flexible** Double Cable, see pp. 168 and 169.

	£ s. d.
50,855. **Projection Apparatus on Stand** (Kolbe type), cf. Fig. 50,856 (Kolbe, Einführung in die Elektrizitätslehre, 2nd Edition, Vol. II, 1905, Fig. 13 and p. 186. — Kolbe-Skellon, Introduction into Electricity, Fig. 88), with arc lamp No. 50,892 for hand regulation; in simple house	7. 0. 0
50,856. — do., with triple **Nernst Lamp** No. 50,923, Figure	7. 0. 0

When ordering, kindly quote the type of current and the voltage.



50 858. 1 : 13.



50 882. 1 : 12.

	£ s. d.
50,857. **Projection Apparatus on Stand,** as No. 50,855, with 100-candle Focus Glow Lamp No. 50,932	6. 0. 0
50,858. — do., with triple flame paraffin lamp, Figure, without double projection element	5. 0. 0
50,859. **Projection Apparatus** (Kolbe's), cf. Fig. 50,862, p. 169, new construction of our own type, with hand-regulated arc lamp No. 50,892, Condenser 102 mm and Objective 43 mm diameter, on massive table, with simple housing (cf. Kolbe, Einführung i. d. Elektr.-Lehre, 2nd Edition, Vol. II, Fig. 82. — Kolbe-Skellon, Introduction into Electricity, Fig. 158)	6.10. 0
50,860. — do., with Nernst Projection Lamp No. 50,923	6.10. 0
50,861. — do., with 100-candle Focus Glow Lamp No. 50,932	5.10. 0
50,862. — do., with triple-burner Paraffin Lamp, Figure	4.10. 0
50,863. — Preceding, **larger,** with hand-regulated arc lamp No. 50,892; fitted with Condenser 122 mm and Objective 55 mm diameter	7.10. 0
50,864. — do., with Nernst Projection Lamp No. 50,923	7.10. 0
50,865. — do., with 100-candle Focus Glow Lamp No. 50,932	6.10. 0
50,866. — do., with five-jet Paraffin Lamp	5.10. 0
50,867. **Complete Projection Apparatus for cinematographic and ordinary photographic Projection,** Figure 1 collapsible table stand with top for erecting, projection lantern with hand-regulated arc lamp No. 50,893, 1 cinematograph, 1 stand with trough and central closing arrangement, 1 automatic winding device for the films, 6 film spools, 1 film press, 1 bottle film putty, 2 spare lenses, 2 glass discs for cooler, 1 objective mount with double rackwork motion, 1 objective of 350 mm focal length for glass picture projection, 1 photo-slider for high and oblique shapes with 6 insets for pictures 9 × 12 cm. — Suitable films on application.	46.10. 0

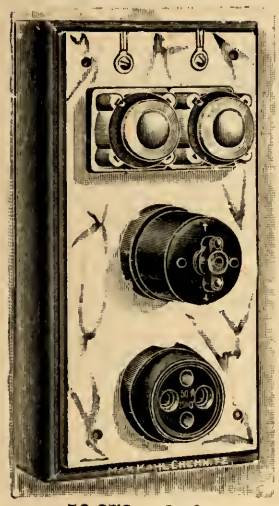
Accessories for Projection Apparatus.

Fixed Type Series Resistances, for a **15 Ampere** Direct Current Arc Lamp, Fig. 50,869.

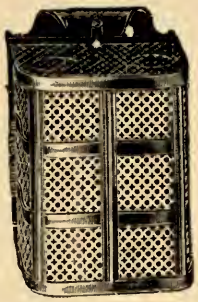
List No.	**50,868**	**50,869**	**50,870**	**50,871**
Working Pressure	65	110	150	220 volts
Price £	**1. 0. 0**	**1. 15. 0**	**2. 10. 0**	**4. 0. 0**

— idem, for a **20 Ampere** Direct Current Arc Lamp.

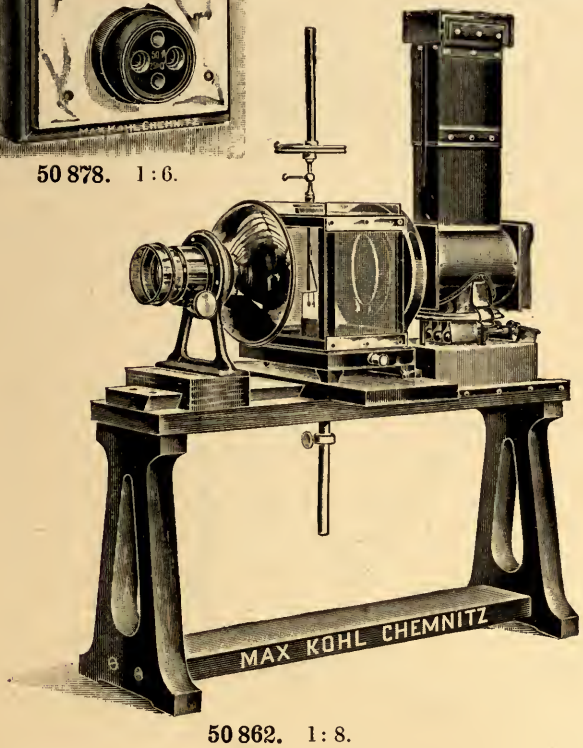
List No.	**50,872**	**50,873**	**50,874**	**50,875**
Working Pressure	65	110	150	220 volts
Price £	**1. 5. 0**	**2. 0. 0**	**3 0. 0**	**5. 0. 0**



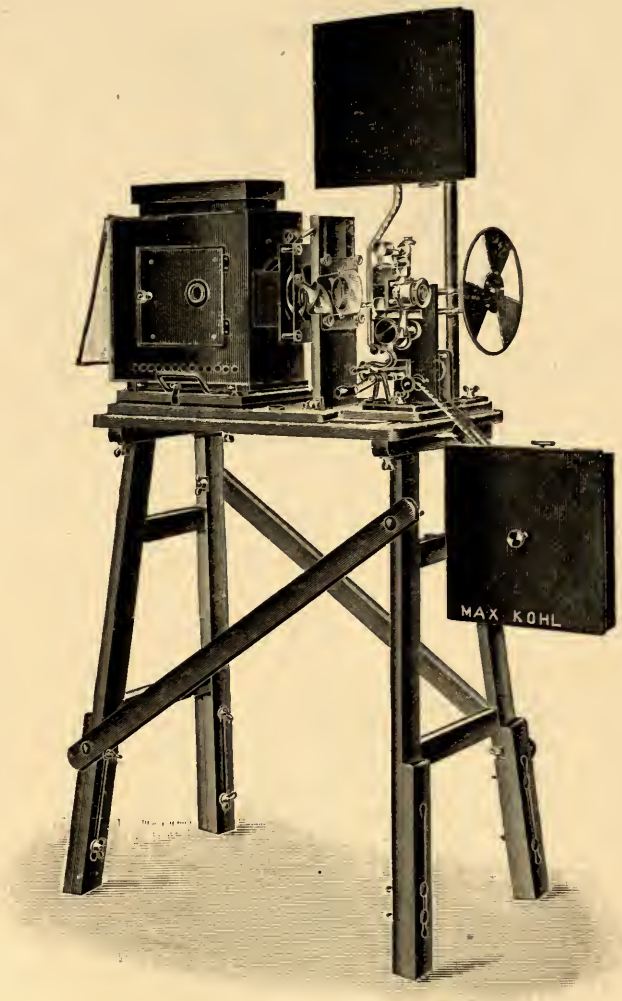
50 878. 1 : 6.



50 869. 1 : 10.



50 862. 1 : 8.



50 867. 1 : 15.

— The preceding, for a **25 Ampere** Direct Current Arc Lamp. £ s. d.

List No.	**50,876**	**50,877**	**50,877 a**	**50,877 b**	
Working Pressure	65	110.	150	220	volts
Price £	**1. 10. 0**	**2. 10. 0**	**4. 0. 0**	**6. 0. 0**	

50,878. **Switchboard** for connecting up the Projection Apparatus with the wall, Figure, can be used for current of up to 30 amperes. Price without series resistance . . . 1. 10. 0

50,879. — do., for connecting up the Projection Apparatus with the ceiling 1. 10. 0

50,880. **Transformer** for Alternating Current Arc Lamps of up to 25 amperes with a working voltage of **100—125 volts,** with contact resistance 3. 0. 0

When using alternating current, it is under all circumstances advisable in view of the great saving of current to provide a transformer for stepping down the network voltage to that of the lamp. Separate series resistances are thus done away with. When submitting orders, kindly state precisely the network voltage.

We would ask that series resistances and transformers be ordered at the same time as the lamp, so that the two can be regulated together, this greatly simplifying erection and working.

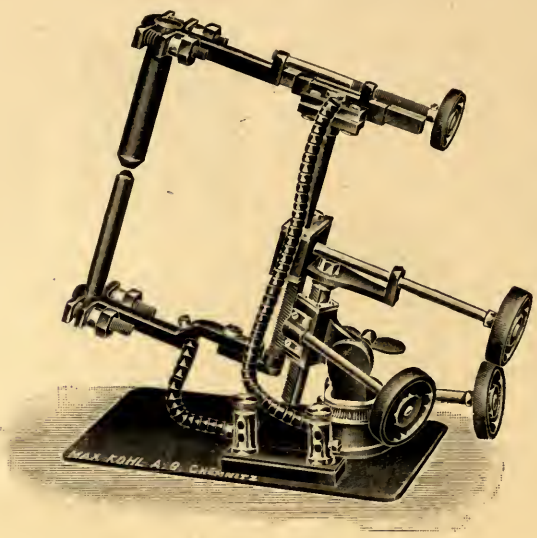
50,881. — The preceding, for working pressures of from **190—220** volts, for 1 arc lamp to 20 amperes 3. 5. 0

50,882. **Mercury Vapour Alternating Current Rectifier** (Cooper-Hewitt's), Figure, for a D. C. output of **30 amperes,** with automatic starter. 25. 0. 0

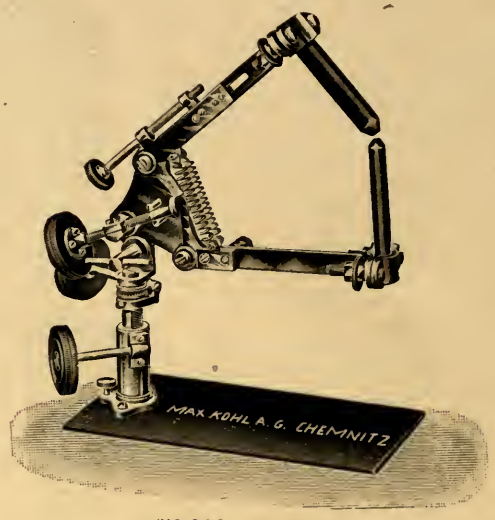
Flexible Double Conducting Cable, armoured, for connecting the lantern with the switchboard.

List No.	**50,883**	**50,884**	**50,885**	**50,886**	**50,887**	
Section, abt. sq. mm	2.5	4	6	10	16	
Permissible load	15	20	25	35	60	amps.
Price per metre	**1 s. 6 d.**	**1 s. 8 d.**	**2 s. 0 d.**	**3 s. 0 d.**	**4 s. 0 d.**	

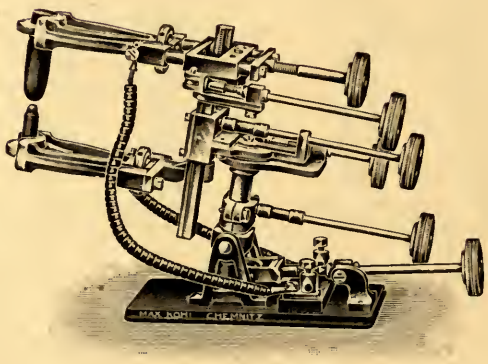
The two thickest sections are suitable for the Megadiascope and Epidiascope.



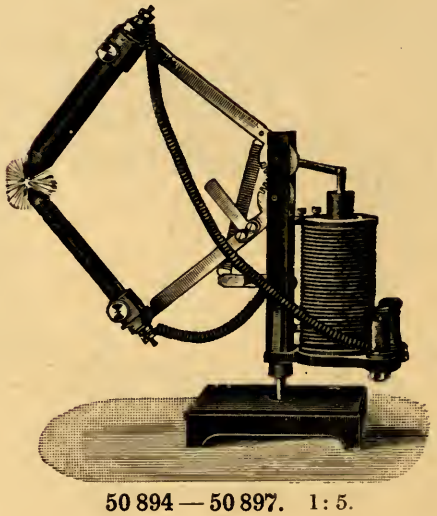
50 889. 1:4.



50 890. 1:4.



50 893. 1:8.



50 894 — 50 897. 1:5.

	s. d
50,889. **Projector Arc Lamp, for hand regulation,** Figure, with carbons for placing either vertically or tilted, low type, for currents of to **30 amperes** Direct or Alternating Current The arc can be adjusted upwards, downwards or laterally by rack and pinion, and the upper carbon holder can be slid backwards and forwards.	4. 0. 0
50,890. **Projector Arc Lamp, for hand regulation,** Figure, for currents to **35 amperes** .	2.17. 0
50,891. — do., for currents to **50 amperes**	3.15. 0
50,892. — do., as No. 50,890, without fine motion, for height and lateral adjustment, therefore with clamping screw	2. 2. 0
50,893. **Projector Arc Lamp for Direct Current,** Figure, for currents to **100 amperes,** with universal adjustment by 6 screws	6.15. 0

Simple Projector Arc Lamp for Direct Current, Figure, with auto-regulation, ball and socket joint and height adjustment, intended for use with simple skioptica (W. D., 4th Edition, Fig. 51).

List No.	**50,894**	**50,895**
Current, amps.	3—6	8—16
Price £	**2. 0. 0**	**2. 6. 0**

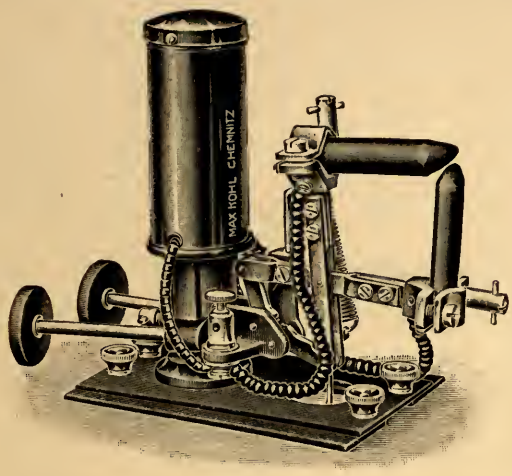
— The preceding, for Alternating Current, Figure.

List No.	**50,896**	**50,897**
Current, amps.	3—6	8—16
Price £	**2. 0. 0**	**2. 6. 0**

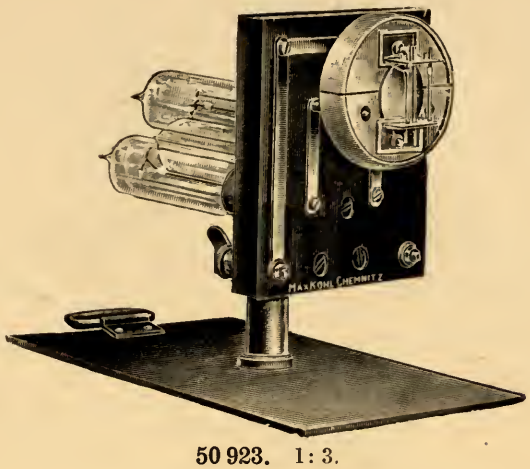
The lamps are main current lamps for connecting up singly to 100—220 volts.

A Series Resistance (Nos. 50,868—50,879) or a Regulating Resistance (Nos. 9645—9648 d) is necessary for the arc light regulators used with Direct Current; it is, however, advisable to use a Transformer (No. 50,880 or 50,881) for Alternating Current.

Cl. 5431, 5447, 5272, 241.



50 898. 1: 7.



50 923. 1: 3.

50,898. **Projector Arc Lamp with auto-regulation,** Figure, for 10—30 amperes Direct Current, with fixed illumination point and pointed arc, with arrangement for adjusting vertically and laterally, the carbons being at an acute angle relatively to each other — £ s. d. 3. 8. 0

Cored Carbons for Arc Lamps.

List No.	**50,899**	**50,900**	**50,901**	**50,902**	**50,903**	**50,904**	**50,905**
Diameter	10	11	12	13	14	15	16 mm
Price per 1 m length	**5 d.**	**6 d.**	**6½ d.**	**7 d.**	**8 d.**	**9 d.**	**10 d.**
List No.	**50,906**	**50,907**	**50,908**	**50,909**	**50,910**	**50,911**	
Diameter	17	18	19	20	21	22 mm	
Price per 1 m length	**11½ d.**	**1 s. 1 d.**	**1 s. 2 d.**	**1 s. 3 d.**	**1 s. 4 d.**	**1 s. 8 d.**	

Solid Carbons for Arc Lamps.

List No.	**50,912**	**50,913**	**50,914**	**50,915**	**50,916**	**50,917**	**50,918**	**50,919**	**50,920**	**50,921**
Diameter	6	7	8	9	10	11	12	13	14	15 mm
Price per 1 m length	**2 d.**	**3 d.**	**3½ d.**	**4 d.**	**5 d.**	**5½ d.**	**6 d.**	**6½ d.**	**7 d.**	**8 d.**

No extra charge is made for cutting the carbons to a definite length or for pointing on one side. It is absolutely necessary if the lamp is to burn well that carbons of correct length be employed. When forwarding orders, therefore, kindly state diameters and lengths of the carbons supplied by us or, in the case of new orders, quote the necessary length of carbon as well as the kind of current and amperage used.

50,922. **6 Cored Carbons filled with Salts,** for spectrum experiments, together with the corresponding solid carbons, each 100 mm long. Price together 0. 9. 0

Each carbon is filled respectively with salts of sodium, potassium, barium, strontium and calcium. If desired, we also supply other fillings at special prices to be arranged.

50,923. **Nernst Projection Lamp** with triple glower (Greil's), Figure, about 500 metric C. P. at 110 volts, for connecting up to from **100—200 volts;** current consumption 4 amperes 1.10. 0

This lamp gives a very brilliant light with a small current-consumption, and it may be connected up to any glow lamp lead. Special resistances are unnecessary. The lamp must be heated at first by a gas or spirit flame. When ordering, kindly state network voltage and type of current.

50,924. **Spare Burner** with 3 glowers 0. 7. 0

50,925. **Burner Base** for 100—160 volts. 0. 3. 6

50,926. — do., for 161—260 volts 0. 3. 6

50,927. **Interchangeable Glowers** for No. 50,923 . . . . . **Each** 0. 1. 3

50,928. **Series Resistance** for No. 50,923 . . . . . **Each** 0. 1. 3

50,929. **Nernst Projection Lamp,** self-igniting, adaptable for **65—300 volts,** current-consumption 4 amperes 1.17. 0

The candle power is increased with rise in the working voltage. At 110 volts it is about 700 metric and at 220 volts about 1400 metric candles.

When ordering, kindly state working voltage and kind of current.

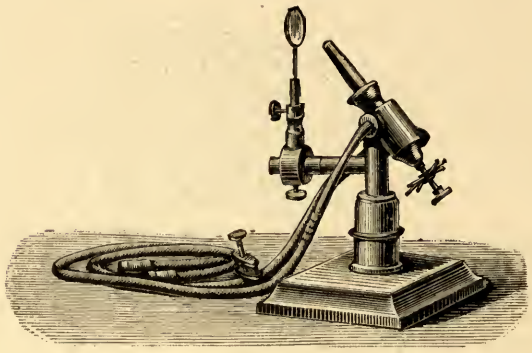
50,930. **Spare Burner** 0.12. 0

50,931. **Series Resistances** . . . . . **Each** 0. 1. 3

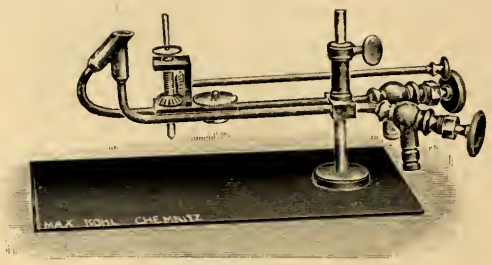
50,932. **Focus Glow Lamp,** of about 100 metric candles, with silver reflector, on adjustable stand, suitable for all projection lanterns 2. 0. 0

The glow lamp is supplied for a working pressure of 110 volts.

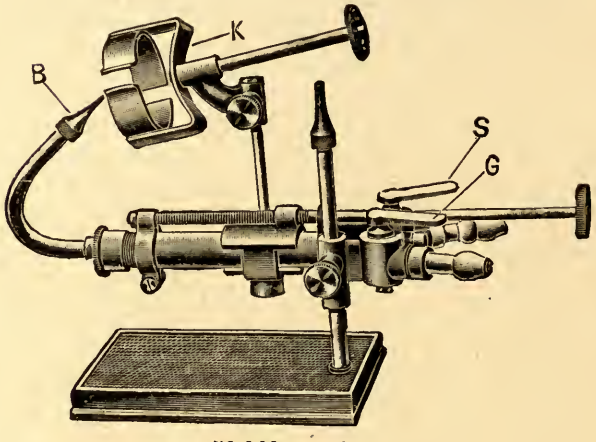
A Series Resistance (Nos. 50,868—50,879) or a Regulating Resistance (Nos. 9645—9648 d) is necessary for arc light regulators used with Direct Current; while for Alternating Current it is advisable to use either Transformer No. 50,880 or 50,881.



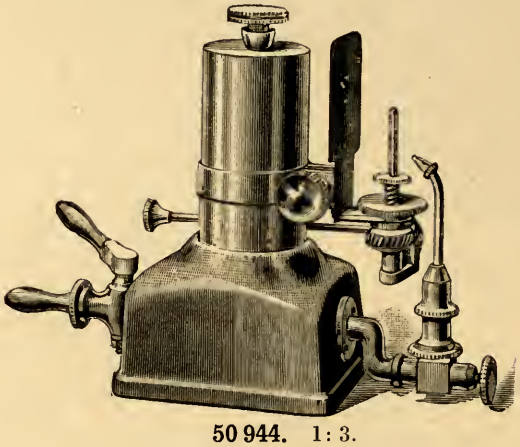
50 933. 1: 3.



50 936. 1: 5.



50 940. 1: 3.

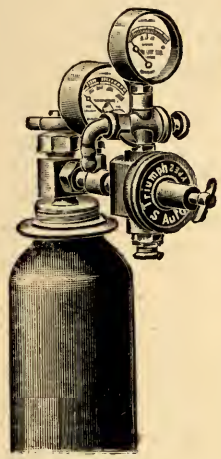


50 944. 1: 3.

	£ s. d.
50,933. **Thorium Light Burner** (as suggested by Prof. Linnemann), Fig. 50,933, with 1 thorium plate	2. 5. 0
The light is produced by rendering incandescent a thorium slab mounted in platinum, by means of a flame supplied by house gas and oxygen. The thorium slabs can be used many hundreds of times. The consumption of oxygen and house gas is: for 60 candle-power, 24 litres gas and 15 litres oxygen; „ 120 „ 37 „ „ „ 26 „ „; „ 200 „ 48 „ „ „ 44 „ „ per hour. The gas is conducted to the disc at ordinary pressure, the oxygen being compressed to 15 times this pressure.	
50,934. **Thorium Discs,** mounted in platinum, as spare to No. 50,933, 10 mm diameter . .	0.15. 0
50,935. — do., 15 mm diameter	1. 0. 0
We recommend the use of thorium discs in lieu of the zirconium discs previously employed, as the life of the former is considerably longer. The used platinum is allowed for if returned.	
50,936. **Limelight Burner,** Figure, for house gas and oxygen, or for hydrogen and gas, with regulating taps. The lime cylinder can be rotated and adjusted vertically by bevil gear. With support	1. 0. 0
50,937. — The preceding, giving about 500 metrie C. P.	1. 5. 0
50,938. — idem, as No. 50,936, with regulator tap for quickly regulating the burner without the jet being entirely extinguished and in such manner that the ratio of mixing remains unchanged	1.10. 0
50,939. — idem, as No. 50,937, with regulator tap and arrangement for quickly removing the cylinder from the burner and replacing same, and having lateral and vertical adjustment by rack and pinion	3.15. 0
50,940. **Limelight Burner** (Drummond limelight), Figure, for compressed hydrogen or compressed house-gas, or house-gas taken from the lead, for gasoline, or for ether with compressed oxygen	2. 0. 0
For Gasoline Carburettor, etc., see Nos. 50,957—50,959.	
50,941. **Lime Cylinders,** of Vienna lime, with hole. Price per 12 in case	0. 5. 0
50,942. — do., each one separate in case. . . . . **Each**	0. 0. 9
50,943. **Lime Discs,** 40 mm diameter . . . . . Priee per 12 in case	0. 5. 0

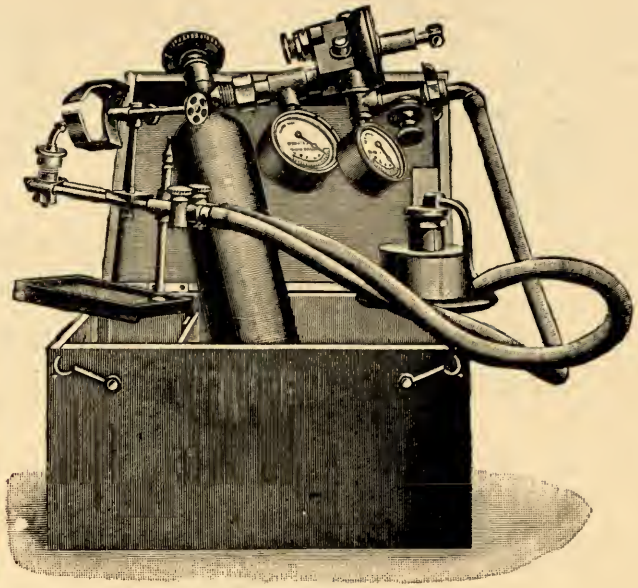
Cl. 254, 5292, 5399, 258.

50 947. 1:10.



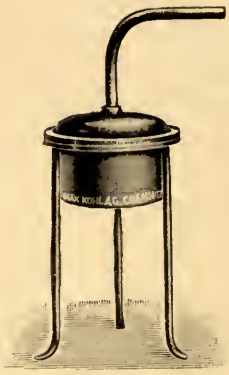
50 953. 1:15.

50 954. 1:10.

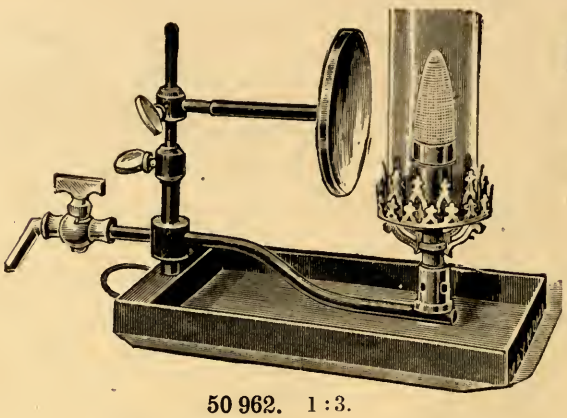


50 955. 1:10.

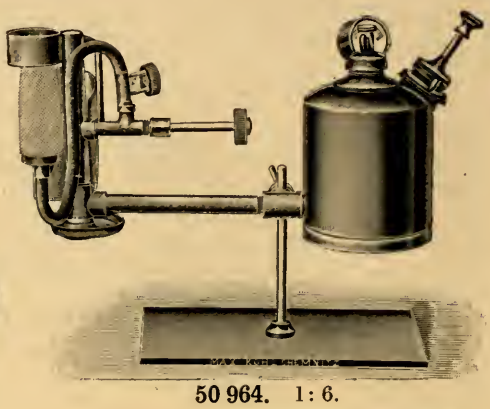
	£ s. d.
50,944. **Limelight Burner** for **Ether** and **Oxygen,** Figure, about 500 metric C. P. . . . This gas mixing apparatus can be recommended where house gas is not available. The lamp fits all lanterns, requires but little attention, has only one tap, and consumes only 80 g ether per hour.	3. 0. 0
50,945. — do., **larger,** to give about 1000 metric candles	6. 0. 0
50,946. **Beakers** for filling Nos. 50,944 and 50,945	0. 4. 0
50,947. **Steel Flask** (Bomb) for 1000 litres Oxygen, Figure, empty, with right-handed thread . . . . . **Note:** The cylinders for oxygen are painted black and those for hydrogen red. Under no circumstances whatever must an oxygen cylinder be used for hydrogen or vice-versa.	1.16. 0
50,948. Filling with Oxygen . . . . . 1000 litres The cost of carriage to our works and back must be borne by the person ordering.	0.10. 0
50,949. **Steel Flask** (Bomb) for 1000 litres Hydrogen, cf. Fig. 50,947, empty, with left-handed thread	1.16. 0
50,950. Filling with Hydrogen . . . . . 1000 litres The person ordering must bear the cost of carriage to and fro.	0. 7. 9
50,951. **Foot Board** for Oxygen cylinders (as suggested by Fr. C. G. Müller, M. T., p. 9) .	0. 5. 0
50,952. **Lever Key** for Oxygen flasks (as suggested by Fr. C. G. Müller, M. T., p. 9. — Ztschr. f. d. phys. u. chem. Unt., **12,** 1899, p. 25)	0. 6. 0
50,953. **Pressure Reduction Valve** for Oxygen flasks, Figure, with pressure gauge for the reduced pressure and high-pressure gauge (**capacity meter**), without steel flask . . . . The reading of the high-pressure manometer multiplied by the capacity in litres of the flask gives the supply of gas in litres.	2. 5. 0
50,954. **Capacity Meter** for the Oxygen cylinders, cf. Figure, on distance piece, without steel bomb . . . . . We also supply the preceding valves and capacity meters with left-handed threads for hydrogen cylinders, at the same price.	0.16. 0
50,955. **Complete Lighting Box** for projection purposes, Figure, suitable for travelling; weight about 9 kg, 20 cm high, 27 wide, 54 long . . . . . The following are arranged very neatly in this trunk-shaped box: 1 small oxygen cylinder, 1 pressure-reduction valve with working pressure gauge, 1 capacity meter and key, 1 limelight burner with gasoline box and the necessary tube connections as well as lime discs or lime cylinders.	7.15. 0
50,956. **Spare Lime Discs** or **Lime Cylinders** for the burner of the lighting box. Per 12 .	0. 5. 0
50,957. **Gasoline** . . . . . 1 litre	0. 1. 6
50,958. **Supply Vessel for Gasoline,** free from danger of explosion, volume 1 litre	0. 4. 0
50,959. **Gasoline Carburetting Box**	0.13. 0



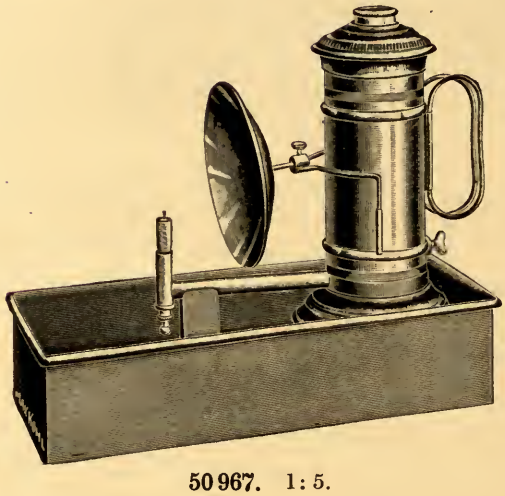
50 960. 1:8.



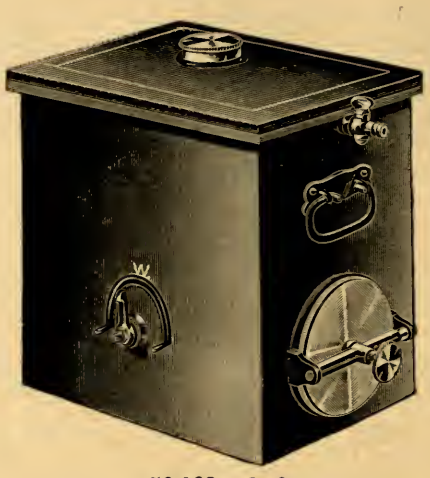
50 962. 1:3.



50 964. 1:6.



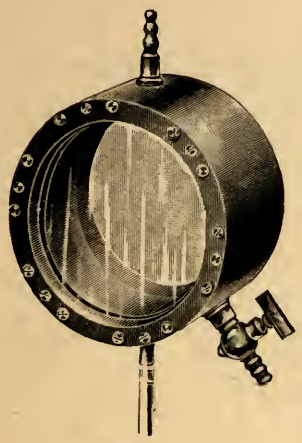
50 967. 1:5.



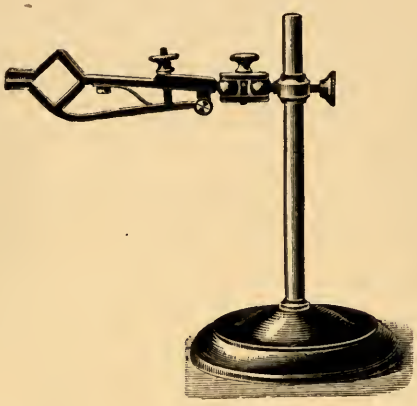
50 968. 1:6.

	£ s. d.
50,960. **Retort** for generating Oxygen, Figure, constructed of cast iron with wrought iron annex pipe, on tripod, unexplosive as it is lagged with plaster of Paris. Price without burner and having capacity of $1^1/_2$ litres	0. 8. 0
50,961. — do., of copper, pear-shaped flask with tube screwed on; capacity about 300 g	0.12. 0
50,962. **Incandescent Gas Burner,** on stand, with reflector, chimney and mantle, Figure	0.16. 0
50,963. **Spare Mantle**	0. 0. 9
50,964. **Spirit Incandescent Burner,** Figure, with pressure pump, manometer, pure nickel reflector and 4 double mantles An excellent source of light is obtained with this burner, as pictures 4 metres square can be secured with it. The arrangement is quite simple and safe to manipulate. The pressure is generated by a small pressure pump and should be about 1 atmosphere. The construction differs from the illustration.	2.10. 0
50,965. **Spare Double Mantle**	0. 0. 9
50,966. **Burner portion** for spirit incandescent burner	0. 3. 0
50,967. **Acetylene Lamp,** Figure, with sheet iron base This lamp generates its own gas, is quite safe, and gives a very clear, brilliant light.	1. 4. 0
50,968. **Acetylene Lamp,** Figure, quite safe, of extraordinary efficiency and easy to work The carbide holder takes up to 500 g calcium carbide and lasts about 2 hours for 1 double burner.	1.15. 0
50,969. — do., larger This apparatus takes up to 1 kg carbide and lasts about 4 hours for 1 double burner.	2. 5. 0
50,970. **Acetylene Gas Burner,** giving a first-class light, with reflector and stand and 2 burners	0.12. 0
50,971. — do., with triple burner with reflector and stand	0.18. 0
50,972. **Calcium Carbide** .Per kg Lower prices are quoted for quantities greater than 1 kg.	0. 1. 0
50,973. **Diapositive Holder** with change frame, for plates 13×18 cm	1. 5. 0

For **Hydrogen Generating Apparatus, Rubber Bags and Gasometers,** see later parts of this list. Cl. 5789, 263, 3280, 266, 5198.



50 976. 1 : 5.



50 978. 1 : 5.

50 983. 1 : 8.

50 984. 1 : 6.

50 985. 1 : 9.

	£ s. d.
50,974. **Slider with stand,** for setting up Nicol prisms, lenses, etc. on the optical bench of the projection apparatus	0. 10. 0
It is advisable to order, say, from 3 to 6 such sliders, not only in view of the fact that a number of sliders have to be used simultaneously for many experiments, but also in order that diaphragms, slits, lenses, etc. which are placed in them may be inserted ready for use before the experiment, thus allowing the latter to be made expeditiously.	
50,975. — do., with lateral motion of the stand by screw	0. 18. 0

Cooling Tank, for continuous-flow cooling by water (F i g u r e), fitted with good plate glasses, also with handle for inserting in a slider (No. 50,974).

List No.	**50,976**	**50,977**
Diameter of Condenser	102 and 122	152 mm
£	**2. 0. 0**	**2. 10. 0**

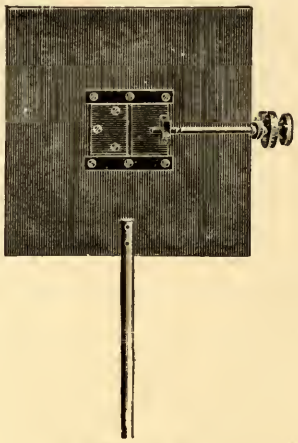
The cooling vessel is absolutely necessary in polarisation experiments or when introducing microscopical preparations, provided, of course, the projection apparatus has no cooling vessel between the condensers.

50,978. **Universal Stand,** F i g u r e, with clamp adjustable in every direction, for small objects to be projected	0. 12. 0

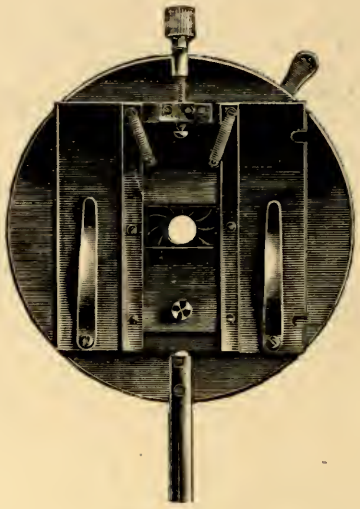
Bi-concave Lens, in mount, with diaphragm and handle, for obtaining parallel rays.

List No.	**50,979**	**50,980**	**50,981**
For Condensers	102	122	152 mm diameter
Prices	**16 s. 0 d.**	**18 s. 0 d.**	**£ 1. 0. 0**

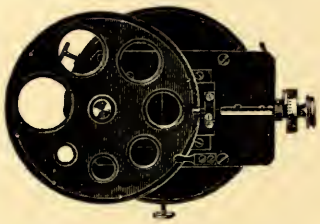
50,982. **Collimating Lens,** 100 mm diameter and about 33 cm focus, for spectrum experiments; in mount, with diaphragm and haft	0. 18. 0
This lens is used for obtaining a true slit image when a prism is employed.	
50,983. **Diaphragmic Disc,** F i g u r e, rotatory, with handle, with 9 apertures, for diffraction phenomena with sun or electric light	1. 4. 0
50,984. **Iris Diaphragm,** F i g u r e, max. aperture 10 cm, with haft for sticking in the stands of the optical benches	1. 15. 0
50,985. **Adjustable Slit** with diaphragm and handle, F i g u r e	0. 18. 0



50 986. 1:6.



50 988. 1:3.



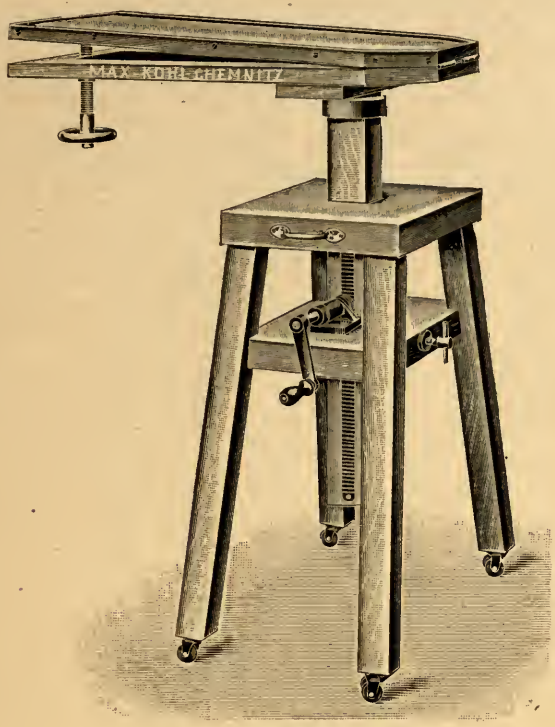
50 987 a. 1:4.

50 993. 1:10.

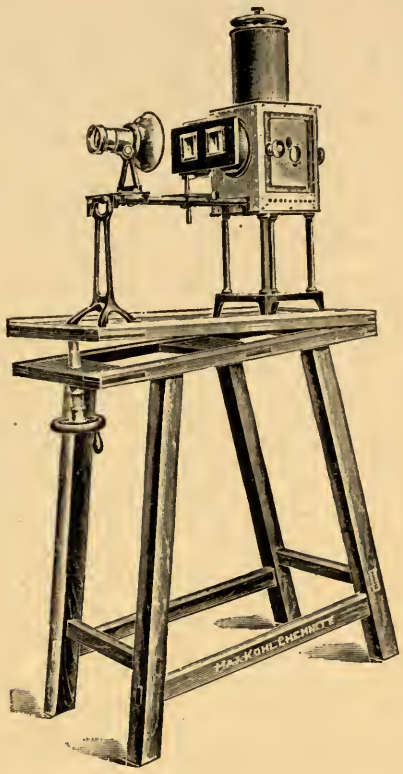
50 994. 1:20.

	£ s. d.
50,986. **Adjustable Slit** with diaphragm and handle, Figure, adjustable by micrometer screw motion	1. 8. 0
50,987. **Adjustable Slit** with Diaphragmic Disc for varying the length of slit also. With diaphragm and handle	1. 6. 0
50,987 a. — do., the slit being fitted with micrometer screw, Figure	1.16. 0
50,988. **Adjustable Slit** with Iris Diaphragm, Figure, slit with screw adjustment, with handle	2. 6. 0
50,988 a. — do., with Micrometer Screw	2.16. 0
50,989. **Undulating Slit,** with diaphragm and handle	0.16. 0
50,990. **Row of holes** for inserting in the shade of the undulated slit	0. 4. 0
50,991. **Diaphragmic Disc** with circular holes of different sizes, with handle	0.18. 0
50,992. **Diaphragmic Disc** with different shaped holes, equilateral triangle, square, equilateral pentagon, rhombus and rectangle, with handle	1. 1. 0
50,993. **Table Top,** for tilting, 85×26 cm, Figure, with handle, for tilting the lantern The table top is intended to be used with Model A and B lanterns. We will quote prices for other similarly constructed lanterns on application.	1.10. 0
50,994. **Stand for Projection Lanterns,** size of top 90×45 cm, with hand wheel and gearing for vertical adjustment; table top is rotatory. Figure This table top is intended for setting up Model A and B lanterns. Prices on application for other lanterns.	4.10. 0
50,995. — Preceding, with inclinable rotatory top, Figure; size of top 90×45 cm; travelling on castors	6. 5. 0

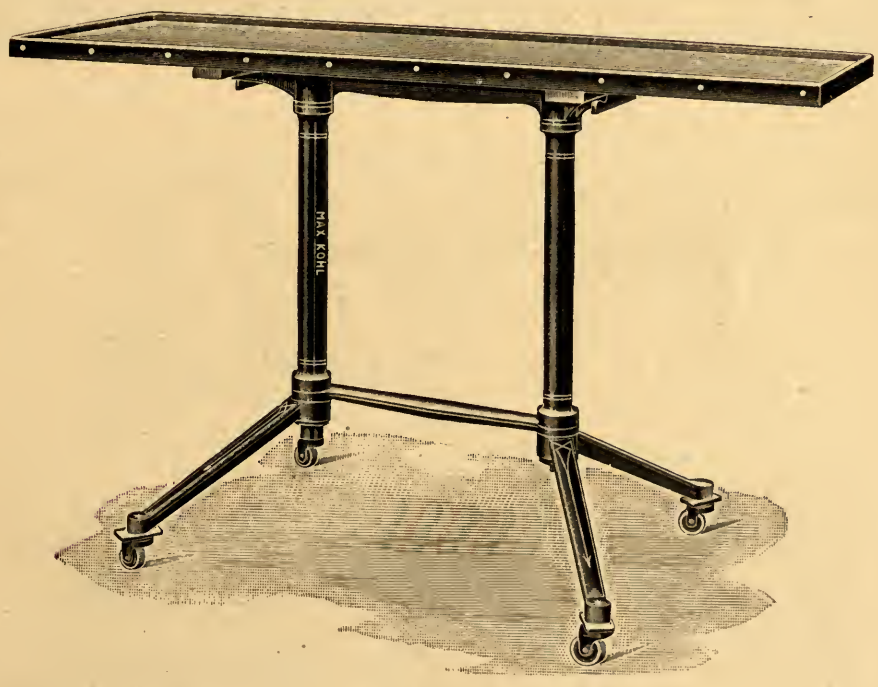
Cl. 5454, 297, 323, 232, 232'.



50 995. 1 : 14.

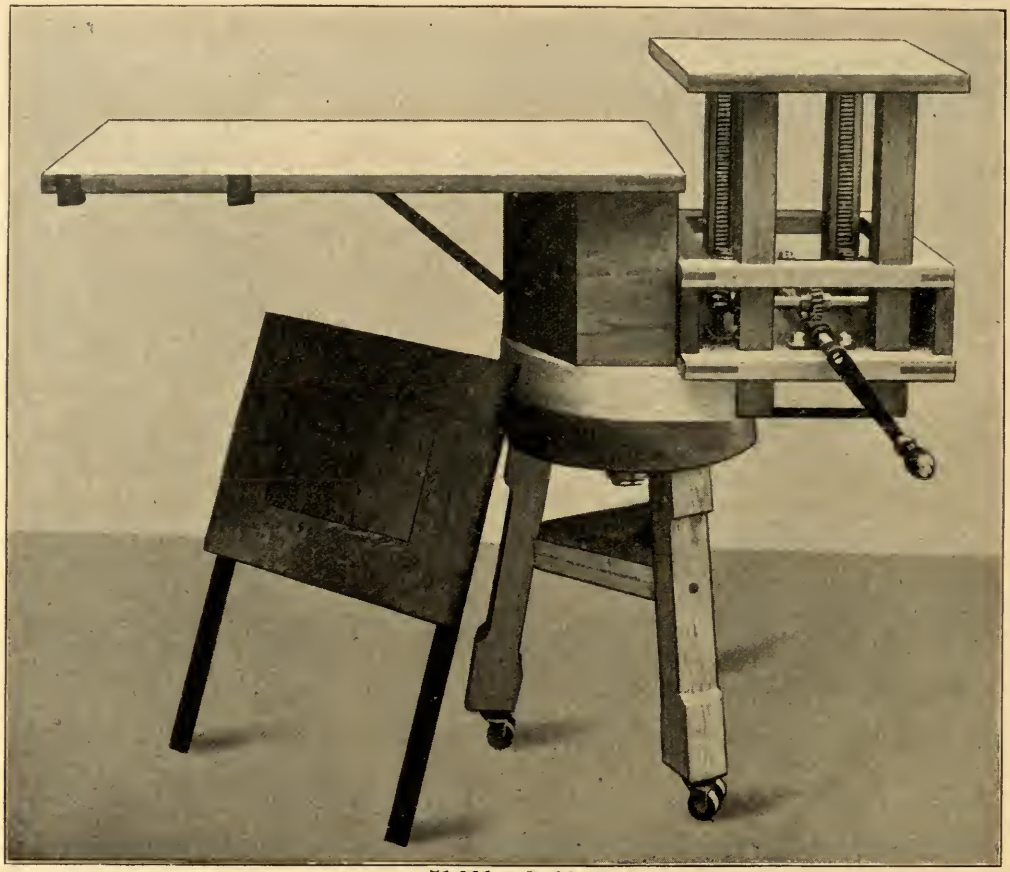


50 996. 1 : 24.



50 997. 1 : 15.

	£ s. d.
50,996. **Table for Projection Lanterns,** with tilting top; size 100×50 cm, top of oak, body of pine, Figure. Price, without lantern	3. 0. 0
50,997. **Travelling Table for Projection Apparatus,** with massive iron frame, Figure, 1 m high, 1.75 m long, 52 cm wide, with widely projecting legs, on castors	5. 0. 0
This table is intended to take the projection lantern and the large Paalzow bench; it has raised edges to prevent small articles falling off.	
50,998. — The preceding, with top which can be tilted	6. 0. 0
50,999. **Table,** as No. 50,997, but smaller; length 1.35 m.	4. 10. 0
51,000. — do., with top which can be tilted	5. 10. 0



51 001. 1:10.

51 002. 1:13.

51 007. 1 : 33.

51,001. **Travelling Type Stand Table for Projection Apparatus,** Figure, upper part can be rotated. It has a top in three parts, 50 cm width and 1.70 m total length, one part being adjustable vertically; height of fixed top 1 m. As supplied to the Physical Institute of Leipzig University . . . . . £ 14. 0. 0

The substructure rests on double rotatory rollers; it is constructed of pine and carries the oak tops, which are composed of frame and pannellings. The fixed part of the top is 90 cm long, while the lengthening leaf and the adjustable part are each 40 cm long.

51,002. **Travelling Type Projection Table,** with inclinable top, Figure; top with height adjustment, an extending and a separate leaf (the latter of these having vertical adjustment); large top in the undermost position 90 cm high. Total length of top 1.80 m; width, 55 cm. As supplied to the Physical Institute of Leipzig University . . . . . £ 17.10. 0

The substructure has 4 massive legs and rests on rotatory double rollers; it is constructed of pine and carries the vertical adjusting arrangement for the table top. The table can be firmly fixed by means of a foot screw and hand wheel. The tops are of oak, composed of frame and pannellings. The large table top, weighted at one end by a 15 kg lead weight, is 1 m long, the two leaves being each 40 cm long.

Projection Screens.

51,003. **Small Transparent Projection Screen,** size 0.5×0.5 m, for facilitating the focussing of the apparatus in interference experiments, diffraction experiments, etc., with frame and stand . . . . . £ 0.10. 0

51,004. **Projection Screen,** seamless, of linen, 2 m square . . . . . £ 0.13. 0

51,005. — do., constructed of shirting . . . . . £ 0. 7. 0

Projection Screen with Rolling-up Device by means of draw cord, Figure, the screen being of prepared pure white fabric, suitable for reflected light; for fixing firmly on the wall, on the ceiling, or above the cornice of the blackboard frame.

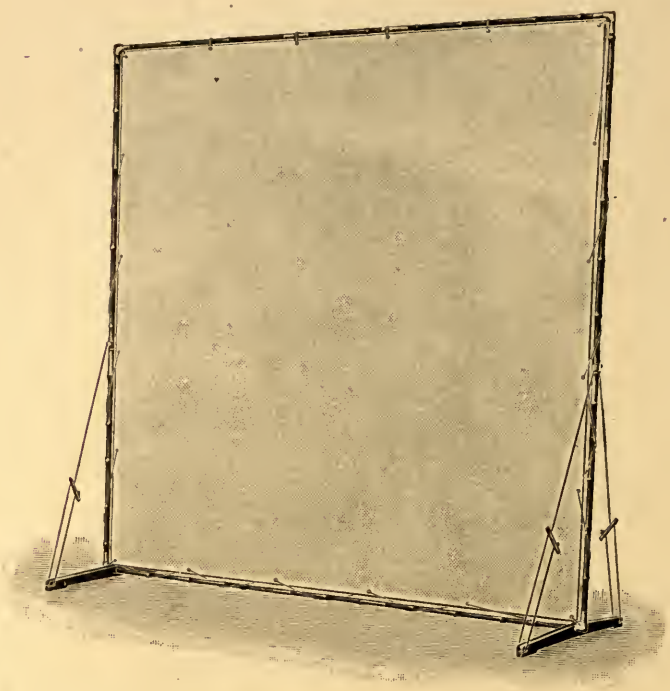
List No.	**51,006**	**51,007**	**51,008**	**51,009**	**51,010**	**51,010 a**
Size m	2.5×3	3×3	3.5×3.5	4×4	4.5×4.5	5×5
£	**2. 10. 0**	**3. 0. 0**	**3. 15. 0**	**5. 5. 0**	**7. 0. 0**	**9. 5. 0**

These screens have a dead white surface, are 3 m long without seam, and are kept above the cornice under waxed cloth strips, thus preventing their becoming damaged or covered with dust when not in use.

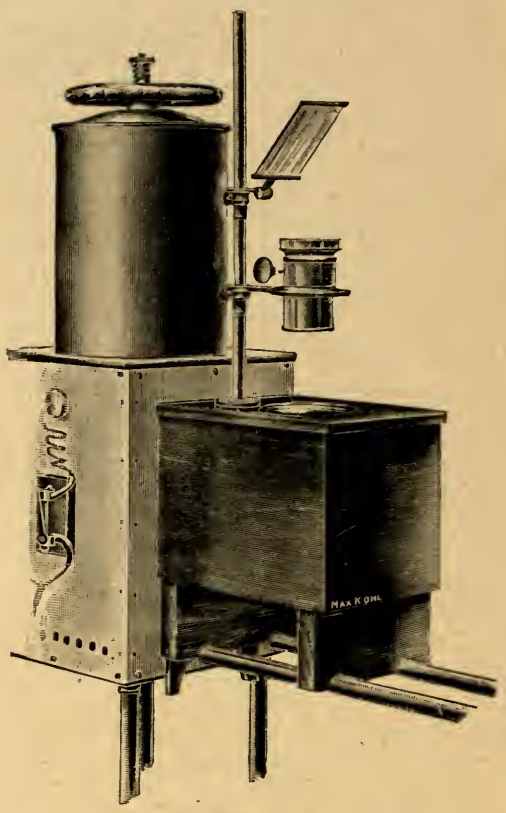
NEW. Projection Screen with Metallic Coating, with draw-cord device for rolling up (cf. Fig. 51,007), for reflected light; for fixing firmly on the wall, the ceiling, or above the cornice of the blackboard frame. Light construction screen.

List No.	**51,011**	**51,012**	**51,013**	**51,014**
Size m	2×2	2.5×2.5	3×3	3.5×3.5
£	**3. 0. 0**	**4. 5. 0**	**5. 10. 0**	**7. 0. 0**

Please refer also to the travelling type Projection Table No. 50,379, p. 77, and the Projection Table firmly fixed on the Lecture Table, Fig. 50,346 A, p. 58.



51 024. 1: 30.



51 032. 1: 8.

Projection Screen, as Nos. 51,011—51,014, with device for rolling up, screen of heavy construction. £ s. d.

List No.	51,015	51,016	51,017	51,018
Size m	2×2	2.5×2.5	3×3	4×4
£	**3. 10. 0**	**4. 15. 0**	**6. 0. 0**	**9. 5. 0**

NEW. Projection Screen with Metallic Surface, without device for rolling up.

List No.	51,019	51,020	51,021	51,022	51 023
Size m	1×1	2×2	2.5×2.5	3×3	4×4
£	**1. 7. 6**	**8. 5. 0**	**11. 11. 0**	**15. 2. 6**	**24. 15. 0**

The sizes up to 2 m length of side are supplied with fixed wood frame, the larger screens having buckles and loops.

51,024. **Portable Bamboo Stand,** Figure, with Projection Screen, size 2.4×2.4 m, of white linen, in carrying bag; parts can be taken to pieces (Frick, Phys. T., Fig. 349) . . 3. 0. 0

The stand can be reduced to 1.2 and to 1.8 m.

51,025. — do., with screen, 3×3 m, stand can be reduced to 1.2 m 4. 0. 0

51,026. — do., with screen, 4×4 m; stand can be reduced to 1.2 m 6. 0. 0

51,027. **Portable Bamboo Stand with Projection Screen for rolling up,** size 2.5×3 m . . . 6. 0. 0

51,028. **Projection Screen with Stand** for vertical adjustment (as suggested by Müller, M. T., Fig. 122) 0.16. 0

51,029. **Automatic Cord Winder,** which winds up the cord hanging down when the screen is rolled up 0. 5. 0

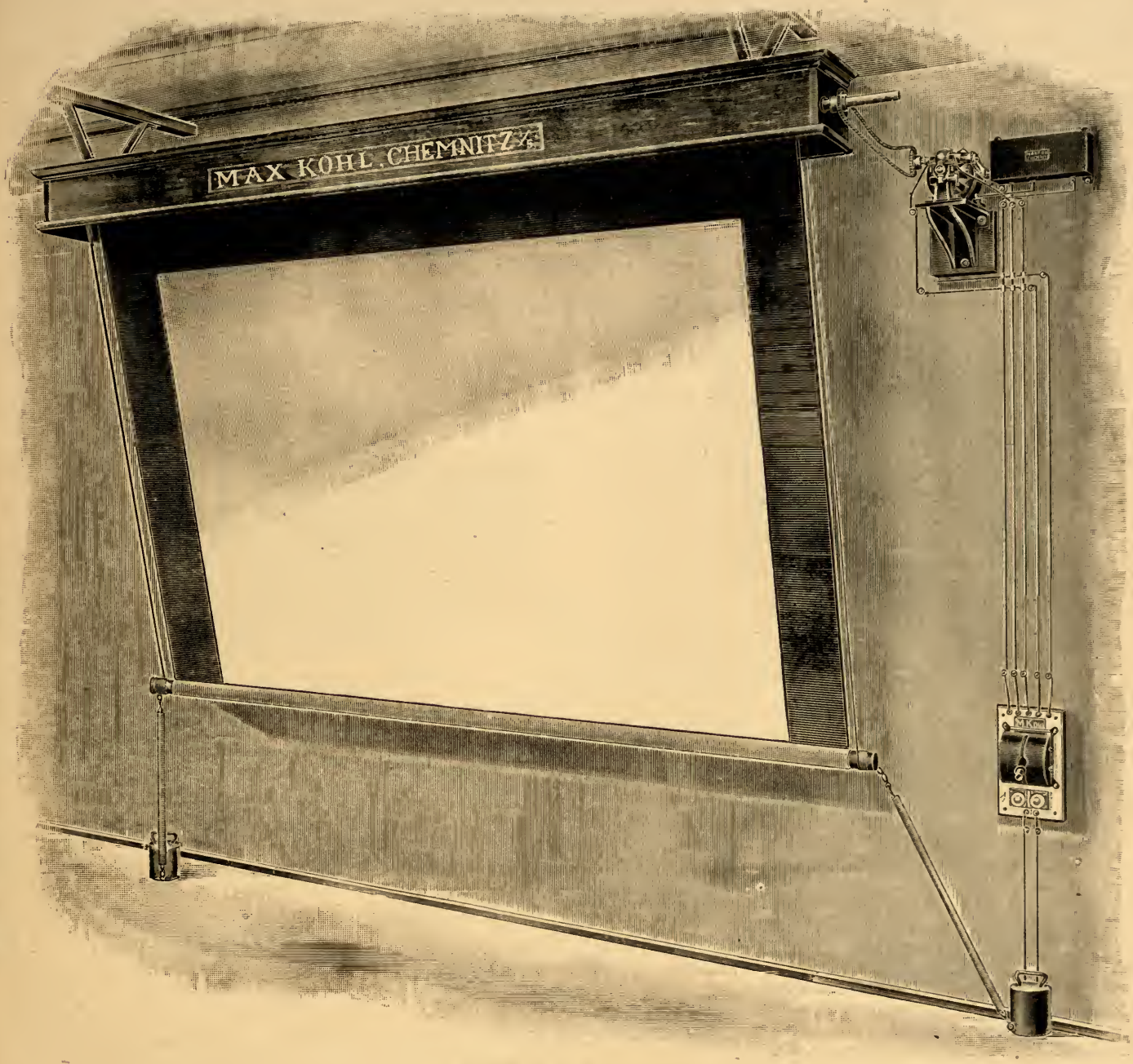
51,030. **Projection Screen with Electric Device for Rolling up,** Figure, with prepared screen, 3×3 m white surface, surrounded by a 25 cm wide black border; with 110 volt D. C. Motor and wood protecting cornice; without ceiling fastening or tilting device 30. 10. 0

The driving motion is effected by means of an electric motor with worm gear fitted on a wall bracket. The device can be controlled from any part of the room simply by putting the motor in circuit by a hand reversing switch, which, together with the fuses, is placed on a marble slab on the wall. The motor is automatically put out of gear at the two extreme positions of the screen by means of a cut out.

The arrangement is supplied for **Three Phase** Current at an **extra price** of **£ 1.**

The roof fixture illustrated differs in each case according to the varied conditions prevailing on the spot and must therefore be specially estimated for.

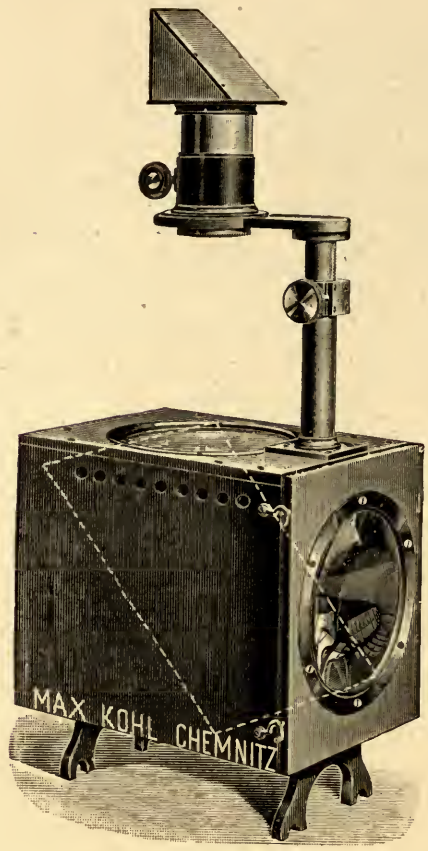
51,031. **Tilting Device,** consisting of 2 iron weights and 2 spiral springs, cf. Figure . . 1. 5. 0



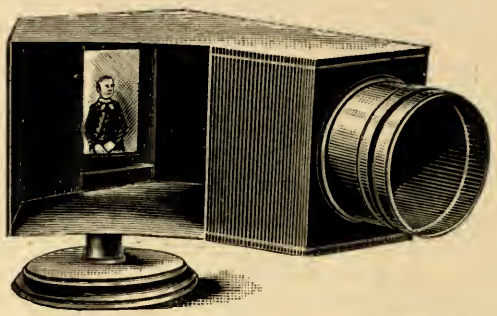
51 030 et **51 031.** 1 : 30.

Auxiliary Apparatus for Projection Purposes.

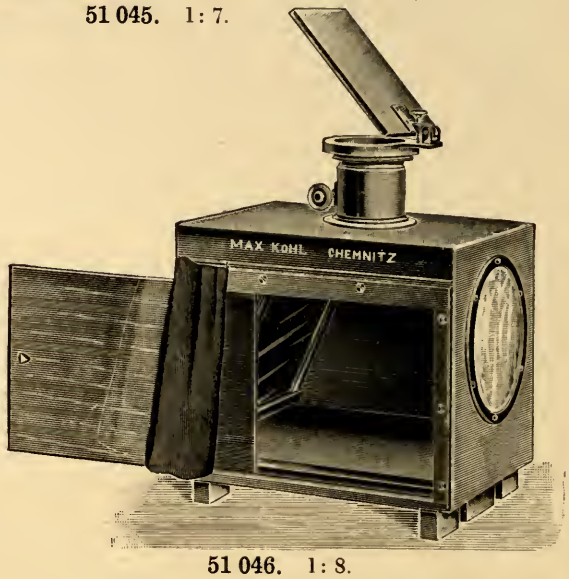
	£ s. d.
51,032. **Apparatus for Projecting Horizontal Objects,** Figure, with 2 condenser lenses, 122 mm diameter, 1 projection objective, 55 mm diameter, and 1 erecting mirror silvered on the back	4. 5. 0
51,033. — The preceding, with erecting mirror silvered on the front	5. 0. 0
By using an erecting mirror silvered on the front "ghosts" are obviated and greater sharpness of image is secured.	
51,034. — The preceding, but with Glass Prism of 70 mm side and height instead of the upper mirror	5.10. 0
By employing a reflecting prism in lieu of the upper mirror "ghost" images are avoided and great sharpness of image is secured. The prism is shown in Fig. 51,038. When using the apparatus in conjunction with lanterns having condenser lenses 102 or 122 mm diameter, the front condenser lens should be removed; the entire condenser being taken away when the apparatus is employed with lanterns having 152 mm condenser lenses.	



51 038. 1: 6.

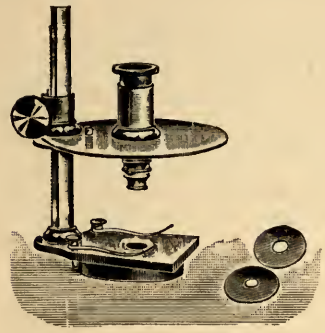


51 045. 1: 7.

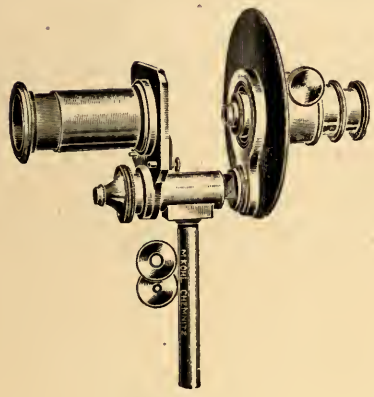


51 046. 1: 8.

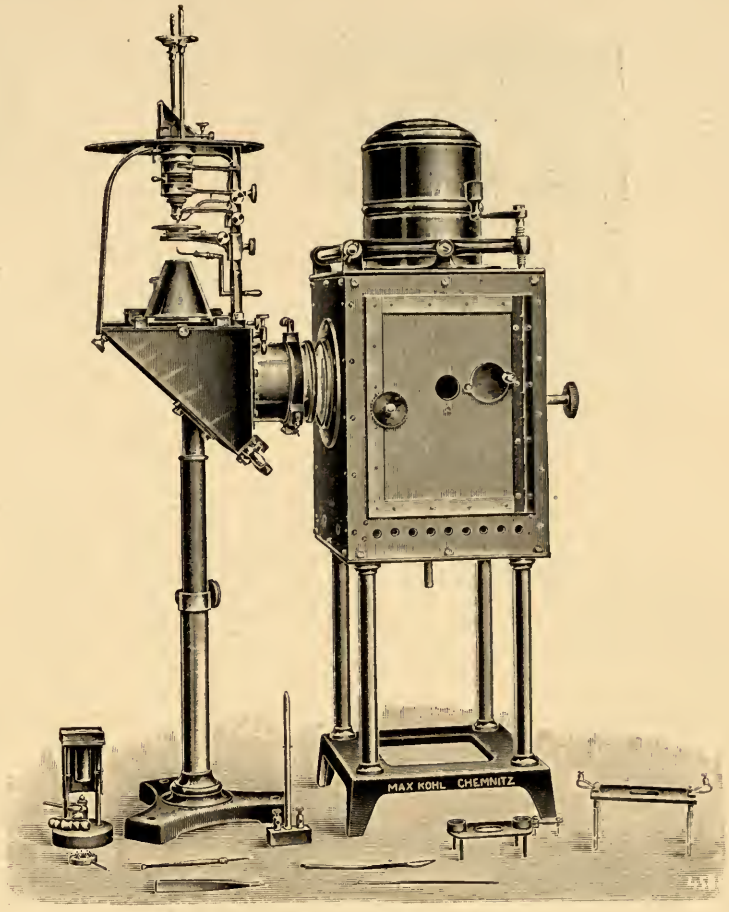
	£ s. d.
51 038. **Apparatus for Projecting Horizontal Objects,** Figure, with 2 Condenser Lenses, 122 mm diameter, 1 Prism, 70×70 mm, and 1 Projection Objective, 55 mm diameter	6. 10. 0
This apparatus is specially intended for Model A and B lanterns, but it can be used for all lanterns. When in use the entire condenser must be removed from the lantern.	
51,039. — do., with a glass mirror silvered on the front, in lieu of the prism	6. 0. 0
51,040. **Reflecting Prism** for erecting the images of apparatus which are placed in front of the lantern (W. D., Fig. 52 [47]), 45×45 mm, suitable for Projection Lanterns with 42 mm diameter objective	1. 10. 0
51,041. — do., **larger,** 60×60 mm, suitable for Projection Lanterns with 54 mm diameter objectives	1. 15. 0
51,042. — do., 70×70 mm, suitable for Projection Lanterns with 60 mm diameter objectives	2. 0. 0
51,043. **Reflecting Prism** in rotatory mount, suitable both for erecting pictures of apparatus and as a reflecting prism for the Horizontal Projector, 60×60 mm, for Projection Lanterns with objective to 60 mm diameter	2. 0. 0
51,045. **Megascope** for Projecting opaque objects, Figure, simple design	1. 10. 0
This apparatus is used for introducing wood cuts from text books, photographs, drawings, the inside of a watch, etc. The front condenser lens of the skiopticon is removed when this apparatus is employed, by screwing off the ring of the mount.	
51,046. **Megascope** for Projecting opaque objects, Figure, large Model, with illuminating lens, illuminating mirror, achromatic Objective and erecting mirror silvered on the front	6. 10. 0
For projecting wood cuts from text books, photographs, the inside of a watch, etc.	
The apparatus is set up in front of the projection lantern after removing the condenser. The light passes through the large lens on to the illuminating mirror, being thence projected on the opaque object, which is laid upon the bottom of the apparatus. The objective and plane mirror above cast	



51 047. 1:5.



51 048. 1:5.



51 058, 50 796, 51 060 a, b, k. 1:9.

an image on to the projection screen. The bottom board can be adjusted to various heights, in order to equalise the thickness of the objects. £ s. d.

51,047. **Projection Microscope for Projecting Microscopical Preparations,** Figure, with rack motion, but excluding objective 2. 10. 0

The microscope can also be fitted with 2 bright tourmaline discs to enable polarisation phenomena to be demonstrated: see No. 51,056.

51,048. — The preceding, with Micrometer Adjustment for high magnifications, Figure 4. 0. 0

Objectives for above, achromatic.

List No.	51,049	51,050	51,051	51,052	51,053
Hartnack Objective No.	2	3	5	7	9
£	**0. 18. 0**	**1. 7. 0**	**1. 13. 0**	**1. 18. 0**	**3. 6. 0**

51,054. **Revolving Collar** for 2 Objectives, for rapidly changing the magnification 0. 16. 0

51,055. **Revolving Collar** for 3 Objectives 1. 2. 0

51,056. **2 clear Tourmalines,** in mount, to enable the microscope to be used simultaneously as a polarisation apparatus 2. 5. 0

One of the tourmalines is placed under the object stage and the other in the tube of Microscope No. 51,047. If the device is intended for use with No. 51,048, this fact should be mentioned when ordering as the mounts in this case must be constructed differently.

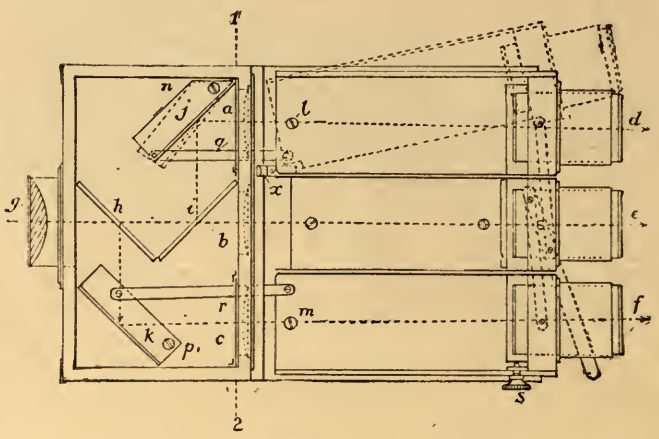
51,057. **Projection Microscope** (Lehmann's), cf. Fig. 51,058, for observing objectively the formation, growth, etc. of solid and liquid crystals (Frick, Phys. T. I., 1, Fig. 437), with large water trough fitted with draining cock and cooling coil, heating and cooling device (which can be regulated), 2 holders for the nicol mounts (which can be pushed out), rotatory object stage, for setting on the optical bench of the projection lanterns, megadiascope, etc. Price, in box, without objectives or nicols 20. 15. 0

Among the extensive literature on the subject of the observation of solid, flowing, liquid and apparently live crystals, special mention may be made of the following: O. Lehmann, „Die scheinbar lebenden Kristalle", Anleitung zur Demonstration, Esslingen, 1907.

Cf. also the water-colled Projection Microscope, No. 9531, listed on p. 1222.

Cl. 275, 4506, 2751.

51 062. 1:4.



51 064 A. 1:5.

51,058. **Projection Microscope** as No. 51,057, on stand, Figure on p. 183, new and improved construction, as independent apparatus, for setting up in front of the projection lantern or the heliostat. Price exclusive of the projection lantern illustrated in Fig. 51,058, or other accessories . . . . . £ s. d. 22. 10. 0

We carry a complete special price list of apparatus for observing solid, flowing and liquid crystals, which will be sent post free on application.

51,059. **2 Nicol Prisms** in brass mount, polariser 20 mm, analyser 16 mm length of side, for the Lehmann Projection Microscopes just listed. Price (which is liable to alteration without notice) 6. 0. 0

51,060. **Complete Set of Accessories** to the Projection Microscope (Lehmann's) No. 51,057 or 51,058 . . . . . 10. 9. 6

(a) **Micro Gas Burner** for heating the preparations (**12 s.**); (b) 2 Electrolysis Stages for observations during electrolysis, each 25 s. (**50 s.**); (c) 20 Preparation Glasses, hexagonal (**2 s. 6 d.**); (d) 20 round Watch Glasses, 3 cm diameter (**3 s.**); (e) 20 ditto, 4 cm diameter (**4 s.**); (f) 100 Crystal Glass Object Holders, 4.8 ×2.8 cm (**2 s.**); (g) 100 Cover Glasses, 1.5 ×1.5 cm (**2 s. 6 d.**); (h) 100 ditto, 2 ×2 cm (**3 s. 6 d.**); (i) Slide Wire Rheostat for securing fine regulation in electrolytical experiments (**20 s.**); (j) 4 Achromatic Objectives, 1 each 18, 8, 5.8 and 3.2 mm focal length (**105 s. 6 d.**); (k) Miscellanies: flask with pipette, tweezers, needle holder, preparing needle, spoon with spatula of white bone (**4 s. 6 d.**).

51,061. **3 further Objectives,** 4.4, 2.5 and 2.2 mm focus respectively 7. 18. 0

Chemicals for making **Preparations, Diapositives of solid, liquid and apparently live crystals:** in accordance with separate complete list.

Ready-made Preparations — on terms to be arranged.

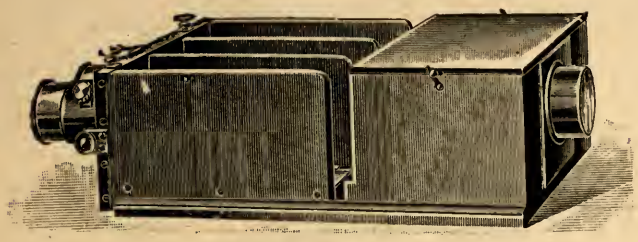
51,062. **Collection of Microscopical Preparations for the School,** 50 in calico case, Figure, with complete description 1. 15. 0

This collection contains: mole's hair; fish bone; bone; scale of eel; spider's foot; spinning wart; proboscis of fly, bee and butterfly; feeler of beetle; fly's eye; spiracle; fly's foot; paunch of ruminants; bee's sting; butterfly's wing; scale of butterfly; silk; corn thrips; saltatorial leg of cercopis; louse of domestichen; trichina; limb of tape worm; radula; cucumaria; moss corals; polypus; calcareous spicules of coral; mail-coat animalcule; sponge, parenchyma; prosenchyma; cork; spiral ducts; dicotyledons; epidermis; scale of leaf; crystals; sporangia; pollen; cotton; starch; peat moss; corn mildew; smut; bunt; conferva; diatoms; marl slate.

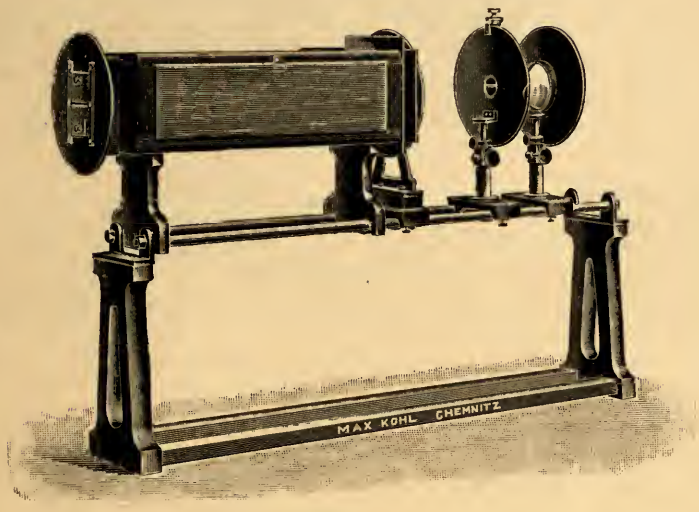
51,063. — Other collection of 50 preparations, without description 1. 18. 0

Ventriculus, sectio transversalis; Hepar, injectio; Ren, injectio; Sanguis salamandrae; Dimorphus columbae; Chelifer cancroides; Ixodes ricinus; Empis pennipes, caput; Empis pennipes, tarsus; Ala apis; Tarsus apis; Fila erucarum; Epidermis erucae; Tipula, caput; Tracheae erucae; Trichina calcarata; Mysis, auditus membra; Pennaria cavolini; Angora, lana; Merino, lana; Cannabis sativa, fila; Linum usitatissimum, fila; Phormium tenax, fila; Amylum Tritici; Farina Secalis; Cristals of asparagine; Octaedric cristals of asparagine; starformed parenchym cells; Cellulae crassatae; Cellulae palmae; Cribrose ducts; Lactial ducts; Scalariform ducts; Punctiform ducts; Ramified hairs; Multicellular hairs; Cycas leaf; Spiral Chlorophyll; Monocotyledon stem (Section); Section of acotyledon; Pollen coryli; Spores with elaters; Section of moss; Section of ivy sprig; Puccinia asparagi; Scleroderma vulgare; Erysiphe communis; Campylodiscus clypeus; Diatomic earth; Marine diatomic earth of Newguinea.

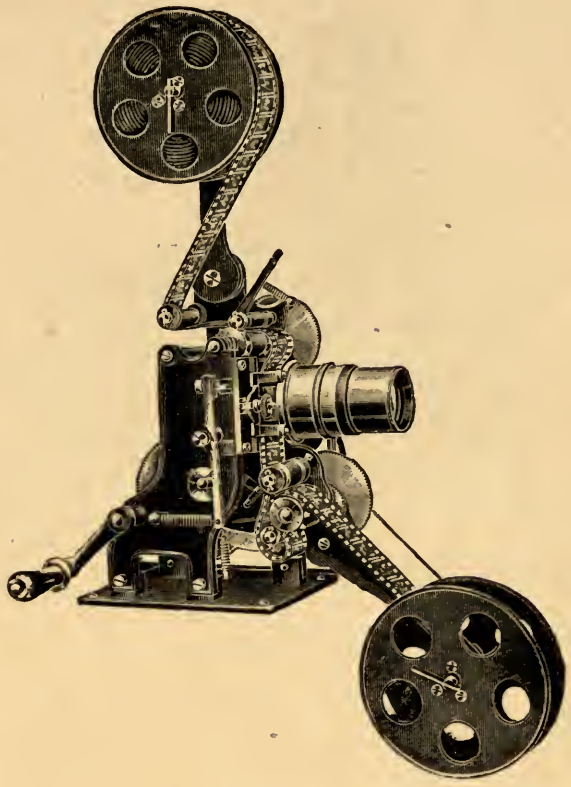
In addition to the above-listed collections, we also supply single preparations of the individual classes and orders from the **animal, plant** and **stone kingdoms,** as well as special collections for particular purposes, e. g., **Wool** and **Silk Preparations; Preparations** relating to the **Fur Industry; Vegetable Textile Fibres, Paper Preparations; Preparations** relating to **Viticulture, Zymology** and **Dairy Produce; Fission Fungi, Nitrobacteria;** further, preparations of **Starch, Wheat, Roots, Fruits, Condiments;** of Provisions



51 064. 1: 6.



51 066. 1: 12.



51 067. 1: 5.

(also adulterated) and of **Substitutes;** further, **pharmacognostical, pathological, tinctured** and **injected Preparations,** and **Preparations of physiological Products of man.** £ s. d.

When sending inquiries, we should be obliged for full details as to the kind of preparations desired, and we will then get together special collections to suit.

51,064. **Projection Chromoscope (Ives's),** for producing images in natural tints, Figure, with 3 pictures 12. 0. 0

Fig. 51,064 shows an elevation of the apparatus, and Fig. 51,064 A is a ground plan. The action is as follows: Three diapositive images corresponding to the 3 fundamental colours red, green and blue-violet of the photographed object, are united on the screen into one image of the original colours by means of light coloured to correspond.

51,065. **Photographs** for chromoscope No. 51,064, 3 diapositives on 1 plate. Price, each 0. 7. 0

List of pictures on application.

51,066. **Projection Diffraction-Chromoscope,** Figure (more complete), independent apparatus, for setting up in front of the Projection Lantern, with elegant polished mahogany stand. 6 photo-plates containing grating images (Wood's), size of image about 6.5 cm, are given in. (Cf. Dr. B. Donath, „Grundlagen der Farbenphotographie", Brunswick, 1906) 11.10. 0

This apparatus is used for producing objectively the colour photographs obtained by diffraction gratings in accordance with Wood's method.

On an elegant, polished mahogany stand having iron sliders, are arranged the necessary slits and lenses together with their diaphragms, also the arrangement for introducing the photographic plates (placed in stand chariots so as to be capable of to and fro motion). For rendering possible the vertical adjustment of the slit visible to the right of the illustration, and of the lens, the base of the column carrying this slit is fitted with a rack and pinion movement. For facilitating the adjustment of the photographic plate, lenses and slits, the slit adjacent to the projection apparatus and the device for introducing the plates are combined in a box having an extension. Focussing is very rapidly effected. The box has large flap doors at the sides to facilitate the demonstration of the arrangement of the apparatus.

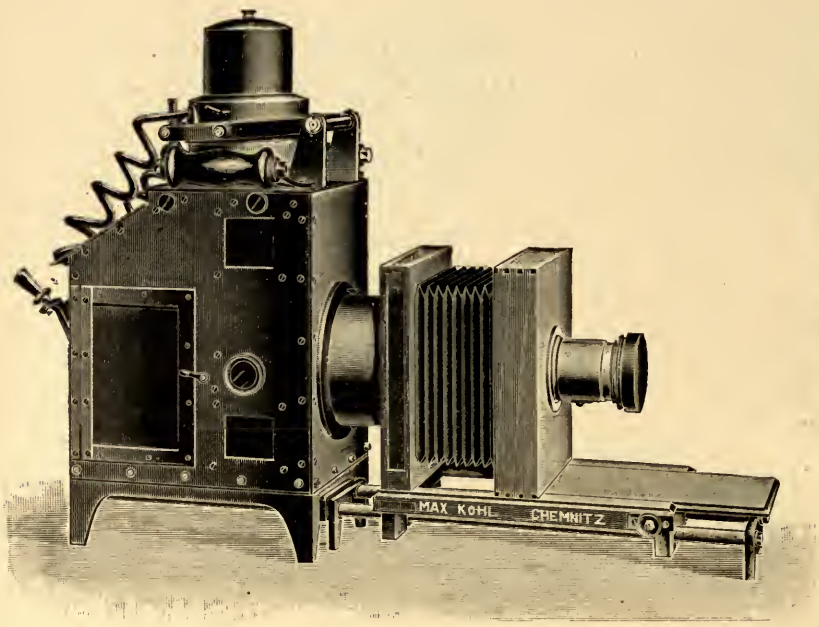
We carry a special list, with description, of diffraction chromoscopes, which is sent free on application.

51,066 a. — The preceding, but without optical bench 10. 0. 0

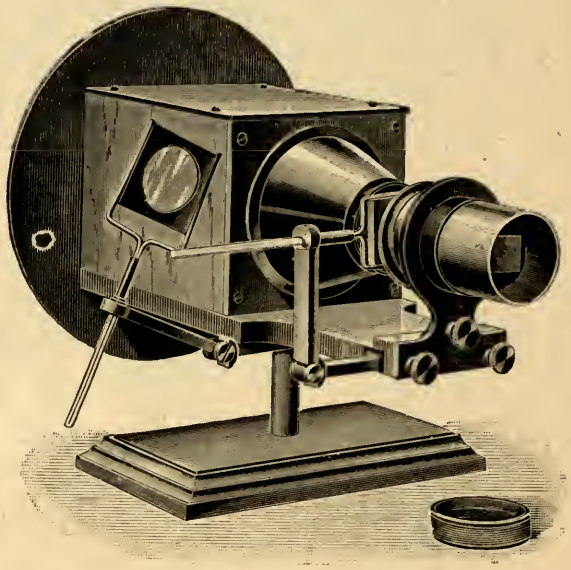
51,067. **Cinematograph,** new model, reliable construction, with Objective, Figure . . . 7.10. 0

This apparatus can be used in conjunction with any available projector.

At a distance of 5 m it gives a picture 1 × 1.5 m wide. The spools can be used for a length of film up to 60 m.



51 073. 1:11.



51 074. 1:4.

	£ s. d.
51,068. **Films,** 16, 24, 32, 48 m in length, suitable for the cinematograph. Price per metre	0. 1. 6

The prices of the individual films vary according to the length. List on application.

We also supply Cinematographs for spools up to 200 m length of film, estimates for which we will gladly submit.

Cf. also complete equipment No. 50,867, p. 168.

Wood Frames for Photographic Enlargements.

List No.	**51,069**	**51,070**	**51,071**	**51,072**	
For plates	8×8	8.5×10	9×10.5	9×12	cm
Suitable for lanterns	50,768—50,782, 50,807—50,809 and 51,073				
Price	**5 s.**	**5 s.**	**5 s.**	**5 s.**	

51,073. **Photographic Enlarger,** Figure, for plates to 9×13 cm, for placing on the optical bench of the projection lanterns types A and B and the Schuckert type. Price exclusive of lantern or objective	3. 5. 0
51,074. **Polarisation Apparatus** for objective Demonstration, Figure (W. D., Fig. 305 [293]), with large column of plates of the finest thin, white plate glass, with 20 mm nicol and with arrangement for clamping preparations	7. 0. 0

The apparatus gives very good images, is very simple and convenient, and can be employed with any projection apparatus or with the heliostat.

Complete description on p. 1212 (sewn in at the end of this list).

For further Polarisation Apparatus, see Optics section.

References as to Projection Lanterns and Skioptica.

Aarau, Cantonal School
Aas, near **Christiania,** Agricultural High School, Physics Collection
Allenstein, Royal Gymnasium
Oberrealschule
Altenburg (S.-A.), Landes-Verein für christl. Liebestätigkeit im Herzogtum Altenburg
Amsterdam, G. B. Salm
Anklam, High School for Girls
Apenrade, Kgl. Realschule
Arad (Hungary), Kgl. Obergymnasium
Augsburg, Kgl. Gymnasium St. Stephan
Aussig, Aussig Commercial Academy
Communal-Gymnasium
Backnang (Wttbg.), Realschule
Bartenstein, Kgl. Gymnasium
Basle, Fr. Klingelfuss & Co. (3)
Obere Töchterschule
Batoum, Grossfürstl. Michaels-Nikolaus-Gymnasium
Batumer Mädchen-Gymnasium
Belgrade, High School for Girls
Belovar, Kgl. Realgymnasium
Berlin, Adolph Schwabe
Ver. Fabriken für Laboratoriums-Bedarf
Berne, M. Schaerer & Co.
Beuthen i. O.-S., Kgl. Gymnasium
Bielefeld, Stiftische evangel. Höhere Mädchenschule und Lehrerinnen-seminar
Blankenese, Realschule
Bochum, H. Musset
Bologna, F. Liuzzi
Bonyhad, Evangel. Gymnasium
Bregenz, Communal-Gymnasium
Bremerhaven, W. Ludolph, Nautical Institute
Gymnasium und Realschule
Breslau, Priebatsch's Buchhandlung
Munic. Elec. Works (3)
Briesen (West Prussia), Kgl. Real-gymnasium
Brixen (Tyrol), Hl. Vincentinum
Brünn (Moravia), K. k. böhm. techn. Hochschule, Phys. Institut
K. k. böhm. Staatsgewerbeschule
Deutsche Technik, Mineralien-Kabinett
I. Deutsches Staatsgymnasium
Bartelmus, Donas & Co.
Brussels, Robert Drosten (4)
Budapest, Kgl. Ung. höh. Töchterschule
Julius Feldmann, Ungarische Lehrmittel-Anstalt
Caltanissetta (Sicily), R. Instituto tecnico
Chemnitz, Rudolf Wiedemann
Baumeister Schneider
Christchurch (N. Z.), School of Engineering, Canterbury College
Cracow, K. k. St. Anna Gymnasium, Physics Dept.
Czernowitz (Bukovina), Romuald Schally
Danzig-Langfuhr, Technical High School, Phys. Institute
Darmstadt, Grossh. Landesbaugewerkschule
Detmold, Gymnasium mit Realschule
Deva (Hungary), Staatsoberrealschule
Dornbirn, K. k. Oberrealschule
Dortmund, Munic. Realschule
Dresden, F. B. Lehmann
Duderstadt, Kgl. Gymnasium
Dundee (Scotland). University College, Physics Dept.
Eckernförde, Realschule
Ekaterinburg (Russia), Realschule
Ekaterinoslav (Russia), School of Commerce
II. Realschule vorm. Zesarewitsch Alexander Nikolaus
Women's Gymnasium
I. Munic. Women's Gymnasium
Erlangen, Alex Erdmann
Feldberg (Black Forest), C. Meyer, "Feldbergerhof"
Fiume, Gustav Wihrheim
P. Rippa, Ottico succ. di P. Avanzo & Co.
Freiburg i. Schl., Städtische Oberrealschule
Gaesdonck (b. Goch), Collegium Augustinianum
Gera (Reuss), High School for Girls
Glauchau, Pestalozzischule
Goldap, Reform-Realgymnasium
Graudenz, Oberrealschule
Hajdunanas (Hungary), Ev. ref. Obergymnasium
Halberstadt, Tramway and Electr. Works
Kgl. Kreisbauinspektion I
Halle a. S., Neue Oberrealschule
Hamburg, A. Kölling
Hanover, Veterinary High School, Chem. Section
Hann. Münden, High School for Girls
Haynau, Municipal Realschule
Heide (Holstein), Realschule
Helsingfors (Finland), Polytechnic Institute, Phys. Laboratory
University, Laboratory for Applied Physics
Ischevsk (Gouv. Wjatka), Progymnasium
Itzehoe, Realschule (Extensions)
Jassy (Roumania), École normale V. Lupu
Jennisseissk, Männliches Gymnasium
Joensuu (Finland), Girl's School
Jyväskylä (Finland), Seminarium
Kamensk (Russia), Realgymnasium
Kamenz i. Sa., Otto Lindner
Kaschin (Russia), Alexejeff-Realschule
Kassel, Luisenschule
Kecskemét (Hungary), Röm.-kath. Obergymnasium
Kharkoff (Russia), Imp. University
A. Edelberg
Kieff, Zweite Handelsschule
K. Zivotsky
Mädchengymnasium
Frauengymnasium von O. F. Pletneff
Klagenfurt i. Kärnten, Naturhistorisches Landes-Museum
K. k. Staats-Oberrealschule
K. k. Maschinengewerbliche Fachschule
K. k. Staatsgymnasium
Knoxville, University of Tennessee
Kolozsvar (Klausenberg), Franz Lutze
Ev. ref. Obergymnasium
Komotau, Communal-Gymnasium
Königsberg i. Pr., University, Phys. Institute
Kotelnitsch (Russia), Frauen-Gymnasium
Krems, Landes-Oberrealschule
Kyoto (Japan), Imperial University, Literature College
Laibach, Staats-Gymnasium
La Plata (Argentine), Physics Institute of National University
Lehe i. Han., Oberrealschule
Lemberg (Galicia), F. M. Zlotnicki (6)
Lengenfeld i. V., Municipal School
Le Pirée (Greece), Mairie du Pirée
Lima (Peru), Society of Engineers, Lima
Löbau i. Sa., Max Forster, Electric Works
Lodz, A. Diering (2)
Lübeck, Reform-Realgymnasium
Ludwigshafen a. Rh., Kgl. Gymnasium
Ludwigslust i. M., Grossherzogliches Realgymnasium
Lüneburg, Higher Grade School for Girls
Lünen a. d. Lippe, Wilhelm Zurbeck
Luxemburg, Grossherzogliches Gendarmen- und Freiwilligen-Korps
Madrid, Viuda de Aramburo
Angel Basabe
Magdeburg, Boré & Berger
Kgl. Maschinenbauschulen
Meppen, Kgl. Gymnasium
Milan, G. Eisentraeger
R. Scuola Tecnica Femminile Cattaneo Angelo
Minden, Gymnasium und Oberrealschule
Mitow (Russia), Gymnasium
Moscow, E. S. Tryndins Söhne (39)
Grossmann & Knoebel (3)
Moscow School of Agriculture
Ferd. Scheer
Imp. Techn. High School, Eng. Laboratory
Munich, Kgl. Kreislehrerinnen-Bildungsanstalt
Naples, A. C. Zambelli
Neu-Ruppin, Gymnasium (Physics Section)
Neustadt a. d. Haardt, Realschule
New York, O. T. Louis Co.
Nikolsk-Ussurijsk (Eastern Siberia), I. East Siberian Spark Telegraph Co.
Novo-Alexandria, Institut f. Land- u. Forstwirtschaft (Physics Section)
Novosybkoff (Russia), Weibl. Gymnasium
Odessa (Russia), F. & M. Lautenschläger
Oldenburg i. Gr., H. Wempe
Oldesloe (Schleswig-Holstein), Realschule
Olmütz, K. k. Deutsches Staatsgymnasium, Physics Section
K. k. Lehrerbildungsanstalt
Schul- und Pensionsgebäude
Osnabrück, Bürgerschule a. d. Hakenstrasse
L. Häberlein
Palermo, Circolo di Cultura
R. Università
Paris, Richard Heller
Patschkau, Kgl. Gymnasium
Pavia (Italy), University (Physics Section)
Pernow (Russia), Heinrich Jacoby
Pfarrkirchen, Kgl. Landwirtschaftsschule

Pforzheim, High School for Girls
Philadelphia, Arthur H. Thomas Co.
Plettenberg, Realschule
Posen, Kgl. Augusta-Victoria-Gymnasium
Pribram (Bohemia), Imperial School of Mines
Quedlinburg, Kgl. Gymnasium
Radautz (Bukovina), Bildungs-Verein
Ratibor, Gymnasium
Recklinghausen, Realschule
Rheydt, Städt. Gymnasium
Ried (Austria), K. k. Staatsgymnasium
Riesa, Realprogymnasium
Riga (Russia), Riga School of Commerce
Municipal School for Young Ladies
Weibl. Lomonosobsker Gymnasium
Realschule Friedrich Germann
N. N. Mironoff's School of Commerce
Höhere Töchterschule Olga von Hasford
Rio de Janeiro, Escola Politechnia, Laboratorio de Physica
Rufach (Alsace), Imperial School of Agriculture
Saarbrücken, Stadtbauamt
Salamanca (Spain), Adolfo Winzer
Samara (Russia), Weibl. Privat-Gymnasium von Frl. Hardin
Santiago, Mauricio Gleisner & Co. (3)
Escuela Normal de Preceptores de Santiago de Chile
Sarajewo (Bosnia), Obergymnasium
St. Petersburg, A. D. Min
Friedrich Raum (5)
St. Petersburg, Alexander Hohenstam & Co.
V. 4th Class Male Municipal School
Kaiserl. Medizinische Kriegsakademie
Institut Kaiser Alexander I. für Wegebau-Ingenieure, Electr.-Laboratory
Viktor Frantzenn
Schässburg (Siebenbürgen), Gymnasium, Physics Museum
Schazk (Gouv. Tambow), Realschule
Schleusingen, Kgl. Gymnasium
Schopfheim (Baden), Realschule
Schwerin a. W., Städt. Realschule
Sereth (Bukovina), K. k. Staats-Gymnasium, Physics Section
Sofia (Bulg.), Ministry of Public Instruction
Stettin, Friedrich-Wilhelms-Realgymnasium
Stuttgart, C. & E. Fein
Taganrog (Russia), J. Simont, Druggist
Tarnow (Galicia), K. k. Oberrealschule
Teplitz, Staats-Elektrotechnikum
Tetschen (Bohemia), Kommunal-Realgymnasium
Tiflis (Russia), I. Weibl. Gymnasium der Grossfürstin Olga Feodoroffna
Tomsk, Technisch-Industrielles Bureau
Trieste, Imperial Commercial and Nautical Academy, Commercial Section
Tsingtau (German China), Kaiserl. Gouvernements-Schule
Tula (Russia), Männliches Gymnasium
Tver (Russia), Mädchengymnasium
Ufa (Russia), Ufimsker II. Weibl. Gymnasium
Realschule
Knabengymnasium (Physics Section)
Ulm, W. Gottschick
Uralsk (Russia), Realschule
Valdivia (Chile), Normalschule
Valladolid (Spain), Carlos de la Cuesta
Vienna, Lehmann & Co.
Allgem. österr. Lehrmittelanstalt
Vladicowcas (Russia), Wladikaukaser Kadettenkorps
Votinsky (Russia), Mittlere techn. Schule
Wanne, Realprogymnasium der Ämter Wanne und Eickel
Warsaw, Steinauer & Rejchmann, vorm. Jul. Herman & Co.
Berent & Plevinski (3)
Höhere 7 kl. Kommerzschule
A. K. Ubysch
Weinheim (Baden), Reform-Gymnasium
Weiz i. Nö. b. Graz, Franz Pichler & Co. Weiz Electric Works
Wels (Upper Austria), Städt. Gymnasium (Physics Section)
Wilhelmshaven, Realschule
Wilmersdorf b. Berlin, Cecilienschule
Witebsk (Russia), Weibliches Alexejeff-Gymnasium
Wjasma (Russia), Gymnasium Kaiser Alexander III.
Zeitz, Realschule

Testimonials as to Projection Apparatus.

The following are a few unsolicited testimonials which have been sent us.

Glarus (Switzerland), 31st March 1909.

As far as my observations up to the present go, the apparatus (arc light regulator and transformer) works well.

O. Hiestand, Ph. D., Höh. Staatsschule.

Biebrich, 16th October 1908.

I have carried out the fitting and mounting of the Megadiascope myself and tested it at once. It works very well. The images obtained are brilliant and sharp.

L. Stritter, Director.
Realschule mit Reform-Realgymnasium.

Bremerhaven, 16th April 1908.

As the projection apparatus recently supplied by you has been set up and submitted to repeated tests, I cannot refrain from telling you, that this works in an excellent manner, and it has therefore, like the other apparatus (especially the Weinhold optical bench) met with approval on all sides. The whole consignment arrived here without a fault.

K. Hansel, Oberlehrer, Gymnasium und Realschule.

Minden i. W., 3rd December 1907.

The projection apparatus supplied by you to us has given entire satisfaction both to my colleagues and myself.

Prof. Dr. **Kohn.**

Königsberg, Pr., 13th September 1907.

I acknowledge with many thanks the receipt of the altered Horizontal Projection Apparatus, and have pleasure in stating that it works excellently and admits of demonstrating many phenomena so plainly and beautifully that I myself am surprised.

E. Jancke,
Oberlehrer a. d. Städt. Oberrealschule i. E.

Jassy, 5th May 1907.

I take this opportunity of thanking you very much for the quality of the projection apparatus, which works perfectly.

I. Nitru, Director of the École Normale "V. Lupu".

Duisburg-Meiderich, 10th March 1907.
(Lower Rhine)

I am glad to state that the efficiency of the megadiascope has given us entire satisfaction. It has yielded very good services in a number of lantern lectures.

Prof. **Hermanni,** Realgymnasium i. E.

Berlin, 31st August 1906.

The blackboards and the projection screen suit the wall of the lecture room very well; the boards act perfectly.

Dr. **F. F. Martens,** Handelshochschule.

Cleveland, Ohio, 31st May 1906.

The second consignment of apparatus was duly received in perfect order, and all is very satisfactory. The oil air-pump and the Megadiascope are pleasing in the highest degree.

Dayton **C. Miller,**
Case School of Applied Science, Department of Physics.

Unter-Barmen, 25th May 1906.

I am satisfied with the Megadiascope supplied.

Direction der Königl. Baugewerkschule Barmen-Elberfeld.

Duisburg-Meiderich, 22nd December 1905.
(Lower Rhine)

The Megadiascope has done all that is expected of it in a school lecture.

H. Hermanni.

Berlin, 15th November 1905.

In acknowledging the receipt of the spirit glow lamp I am glad to be able to inform you that it entirely fulfils my expectations. It yields a beautiful, bright light, which fully suffices for school purposes. The attention required by same is of a much more simple character than I expected at first.

Oberlehrer **Jost,** XI. Realschule.

Kalocsa, 13th December 1904.

I am greatly satisfied with the microprojection outfit.

Alexander Riegl, Curator, Obergymnasium.

Some Estimates of Cost of Projection Outfits.

If desired, some special estimates will be prepared to conform to special local conditions. If a different mode of lighting or a different voltage or kind of current are to be used than given, the prices are altered correspondingly.

Estimates for Outfits with the Megadiascope: see p. 1230.

Outfit with the School Projection Apparatus, Modell A, tall Form.

	£ s. d.
50,735. **1 School Projection Apparatus, Model A, tall Form,** for projecting Apparatus and Slides, with 122 mm diameter condenser, achromatic Projection Objective 55 mm diameter and 180 mm focal length, Optical Bench, Change Frame with inset frame for slides 8.5 × 10, 9 × 10.5 and 9 × 12 cm plate-size, 1 Stage and 1 adjustable Slider with stand for taking the Change Frame, the Stage or other objects, with an Are Lamp Hand Regulator, which ean be used both for Direct or Alternating Current and for various currents up to 30 amperes . . .	12. 10. 0
50,878. **1 Switchboard** for conneeting the Projection Apparatus up to the Wall, for 30 amps. maximum	1. 10. 0
50,869. **1 Series Resistance** for 15 amps. in conjunetion with 110 Volts Direct Current .	1. 15. 0
51,007. **1 Projection Screen** 3 × 3 m, of prepared pure-white fabrie for refleeted light, with draw-eord rolling-up device, for firmly fixing to the ceiling	3. 0. 0
— **Cases and Packing** for land transit . . .	0. 15. 0
Total £	19. 10. 0

In the ease of Three-phase or Alternating Current plants a transformer No. 50,880 or 50,881 is used instead of the series resistance.

Extra price, for 220 Volts Alternating Current . . . . . £	1. 10. 0

Outfit with Model B Projection Apparatus, having Aluminium House.

	£ s. d.
50,790. **1 Projection Apparatus, Model B, with Aluminium House,** for projeeting Apparatus and Lantern Slides, with 122 mm diameter condenser, achromatie Projection Objective 55 mm diameter and 180 mm focal length, with Optical Bench, Change Frame with inset frame for photographs of 8.5 × 10, 9 × 10.5 and 9 × 12 cm plate-size, 1 Stage and 1 adjustable Slider with stand for taking the Change Frame, the stage or other objects, and with an auto-regulating Direct Current Are Lamp for 15 amps.	16. 10. 0
50,878. **1 Switchboard** for connecting the Projection Apparatus up with the Wall	1. 10. 0
50,869. **1 Series Resistance** for 15 amps. in conjunction with 110 Volts Direct Current	1. 15. 0
51,007. **1 Projection Screen,** 3 × 3 m, of prepared, pure-white fabric for refleeted light, with draw-cord rolling-up device, for firmly fixing to the ceiling	3. 0. 0
— **Cases and Packing** for land transit . . .	0. 15. 0
Total £	23. 10. 0

In the case of Three-phase or Alternating Current plants, a Projection Apparatus No. 50,791 is used instead of the above called, and a Transformer No. 50,880 or 50,881 is used in lieu of the abovementioned series resistance. Extra price for same, for 220 Volts Alternating Current. . . £ 2. 0. 0

Outfit with Projection Apparatus with tilted Lamp. Schuckert System.

	£ s. d.
50,803. **1 Projection Apparatus** with tilted Lamp (Schuckert system), tall form, for projecting Apparatus and Photographs, with 122 mm diameter condenser, achromatic Projection Objective 55 mm diameter and 180 mm focal length, Optical Bench, Change Frame with inset frame for taking photographs 8.5 × 10, 9 × 10.5 and 9 × 12 cm size of plate, 1 Stage and 1 adjustable Slider with stand for taking the Change Frame, the stage, or other objects, with an auto-regulating Direct Current Arc Lamp for 20 amps.	18. 10. 0
50,878. **1 Switchboard** for connecting the Projection Apparatus up with the Wall	1. 10. 0
9,646. p. 1228. **1 Regulating Resistance** for 20 amps. at 110 Volts Direct Current.	4. 15. 0
51,007. **1 Projection Screen**, 3 × 3 m, of prepared, pure-white fabric, for reflected light, with draw-cord device for rolling up, for firmly fixing to the ceiling	3. 0. 0
— **Cases and Packing** for land transit	0. 17. 0
Total £	28. 12. 0

In the case of Three-phase or Alternating Current plants, a transformer No. 50,880 or 50,881 should be used in lieu of the regulating resistance. The price is then **decreased** (for 220 Volts A. C.) by . . . £ 1. 10. 0

Outfit with a School Projection Apparatus, low Form, with Limelight Burner and hand-regulated Arc Lamp, for travelling Lecturers.

	£ s. d.
50,738. **1 School Projection Apparatus, Model A, low Form**, for projecting Apparatus and Photographs, with 122 mm diameter condenser, achromatic Projection Objective 55 mm diameter and 180 mm focal length, Optical Bench, Change Frame with inset frame for photographs 8.5 × 10, 9 × 10.5 and 9 × 12 cm size of plate, 1 Stage and 1 Slider with stand for taking the change frame, the stage or other objects, with Limelight Burner for house gas and Oxygen	11. 0. 0
50,947. **1 Steel Flask** for Oxygen	1. 16. 0
50,948. **1000 litres Oxygen Charge**	0. 10. 0
50,953. **1 Pressure Reduction Valve**, with capacity indicator	2. 5. 0
Carried forward £	15. 11. 0
Brought forward	15. 11. 0
51,025. **Portable Bamboo Stand** with Projection Screen 3 × 3 m	4. 0. 0
— **Cases and Packing** for land transit	0. 15. 0
Total £	20. 6. 0

If it be desired to connect the apparatus to a Direct or Alternating Current electric network, the following must also be provided for:

50,890. **Projection Arc Lamp**, hand-regulated.	2. 17. 0
50,871. **Fixed Series Resistance** for 15 amps. on 220 Volts Direct Current	4. 0. 0
50,881. **Transformer** for 220 Volts Alternating Current	3. 5. 0
— **Cases and Packing** for land transit	0. 2. 0
Grand Total £	30. 10. 0

Outfit of Accessories for Projection Lanterns.

	£ s. d
50,974. 4 Sliders with stands for prisms, etc., each 10 s.	2. 0. 0
50,975. — 1 ditto, with lateral adjustment	0. 18. 0
50,976. 1 Cooling Vessel	2. 0. 0
50,980. 1 Bi-concave Lens	0 18. 0
50,982. 1 Collimator Lens	0. 18. 0
50,986. 1 Adjustable Slit with micrometer screw	1. 8. 0
50,987 a. — i d e m, with diaphragmic disc	1. 16. 0
50,998. 1 Travelling Type Table with inclinable top	6. 0 0
51,003. 1 Small, Transparent Projection Screen	0. 10 0
Total £	16. 8. 0

Outfit of Auxiliary Apparatus for Projection.

	£ s. d.
51,032. Apparatus for projection of Horizontal Objects	4. 5. 0
51,046. **Megascope** for projecting opaque objects, large type	6. 10. 0
51,047. Projection Microscope	2. 10. 0
51,049—51,051. Objectives for above, No. 2, 3 and 5	3. 18. 0
51,055. Revolving collar for 3 Objectives	1. 2. 0
51,062. Collection of Microscopical Preparations	1. 15. 0
51,057. Projection Microscope for observing solid, liquid and flowing Crystals by Lehmann's method	20. 15. 0
51,059. 2 Nicol Prisms	6. 0. 0
51,060. Complete set of Accessories	10. 9. 6
51,064. Projection Chromoscope (Ives')	12. 0. 0
51,066 a. Diffraction Chromoscope	10. 0. 0
51,067. Cinematograph	7. 10. 0
51,068. Films, 50 m	3. 15. 0
51,074. Polarisation Apparatus	7. 0. 0

Physical Apparatus for Projection.

The following pages contain a list of those pieces of physical apparatus which are used in conjunction with the projection lantern.

Further details as to these, illustrations, references to literature on the subject, etc. are to be found in the previous edition of our Price List No. 21 and in the supplements, under the respective List Numbers.

We hold a large selection of photographs, diapositives, microscopical preparations, etc. When requiring such, we should be glad if application be made for our complete list of these, stating in connection with which branch of the sciences the photographs and preparations are chiefly desired.

Mechanics.

		£ s. d.
21,504.	Plateau's Apparatus for showing the oblateness of a sphere of oil	1. 2. 0
21,505.	Piezometer (Weinhold's)	2. 5. 0
21,506.	Apparatus for demonstrating surface tension	0. 5. 0
21,507.	Apparatus for capillary depression of non-moistening solutions	0. 5. 0
21,508.	5 Different Capillary Tubes	0. 2. 0
21,509.	Capillary Tubes with stand	0. 8. 0
29,764.	2 Wide Tubes with capillary tubes communicating therewith	0 8. 0
29,997.	Wide tube with 5 communicating capillary tubes	0. 7. 6
21,510.	Capillary Tubes with plane-parallel glass vessel	0. 13. 0
21,511.	Capillary Tubes alone	0. 1. 3
21,512.	Capillary Plates	0. 5. 0
21,513.	— do., with stand	0. 10. 0
21,514.	— do., larger, with adjustable angle	0. 17. 0
21,515.	Apparatus for showing the behaviour of moistening and non-moistening liquids in a conical tube	0 4. 0
28,688.	Apparatus for showing that the issuing jet consists of drops	1. 6. 0

Wave Theory and Acoustics.

		£ s. d.
21,516.	Wave Projection Machine	2. 0. 0
21,517.	Cova's Wave Machine	2. 0. 0
21,518.	Transverse Wave Machine	2. 6. 0
21,519.	Apparatus for the reflection and interference of wave motion	1. 10. 0
21,520.	Adjustable Mirror and large bi-concave lens for same	2. 5. 0
21,521.	7 Tuning fork curves on stand	1. 4. 0

Optics.

		£ s. d.
21,522.	Reusch's light-refraction Apparatus	0. 15. 0
21,523.	Apparatus for refraction in plane glasses	0. 5. 6
21,524.	Kaleidoscope with lens	1. 10. 0
21,525.	Total Reflection Apparatus (for showing total reflection in a jet of water)	2. 10. 0
21,525 a.	— do., smaller and without base	0. 9. 0
40,770.	Apparatus for showing total reflection in glass rods	0. 18. 0
21,526.	Transparent Colour Disc	1. 0. 0
—	Solar Spectrum, transparent	1. 0. 0
21,527.	Apparatus for imitating the irradiation of the crescent moon	0. 7. 6
21,528.	2 Discs (Plateau's) for demonstrating irradiation (for illustration see under No. 28,903 a)	0. 4. 0
21,529.	Projection Stroboscope	1. 0. 0
21,529 a.	3 Extra Discs for above	0. 6. 0
21,530.	Projection Stroboscope	1. 4. 0
21,531.	Anorthoscope	1. 6. 0
21,532.	Colour circle	1. 0. 0
21,533.	Apparatus for causing ocular fatigue and the successive colour contrast	0. 6. 0
21,534.	— do. (Weinhold's)	0. 10. 0
21,535.	Apparatus for successive and simultaneous colour-contrast	0. 6. 0
21,536.	2 Coloured Glass Sheets for simultaneous contrast	0 5. 0
21,537.	Apparatus for demonstrating the contrast colours as colour shadows	0. 7. 6
40,771.	Projection Plates for optical illusions, apparently diverging, parallel lines	0. 4. 0
40,772.	— do., apparently bent, parallel lines	0. 4. 0
40,773.	— do., 4 right angles are apparently acute and obtuse in pairs	0. 4. 0
21,539.	2 Plane-parallel Glass Vessels for the objective demonstration of the colours of pigment-mixtures	0. 15. 0
29,705.	2 Colour Discs for the mixing of coloured lights and the overlapping of transparent colours	1. 5. 0
21,540.	Powdered Glass for colour rings	0. 4. 0
21,541.	Newton's Colour Rings, 70 mm diameter	0. 12. 0
21,542.	— do., 100 mm diameter	0. 18. 0
21,543.	— do., 120 mm „	1. 4. 0
21,544.	— do., 150 mm „	1. 10. 0
21,545.	Newton's Colour Rings, with stand, rotatory, 70 mm diameter	1. 12. 0
21,546.	— do., 100 mm diameter	1. 18. 0
21,547.	— do., 120 mm „	2. 4. 0
21,548.	— do., 150 mm „	2. 10. 0
40,008.	von Lommel's reflecting Stephanoscope	0. 15. 0
40,009.	— do., larger	1. 5. 0
40,043.	Projection-diffraction-chromoscope	11. 10. 0
29,846.	Circular, photographic grating	0. 16. 0
21,450.	Polarisation Apparatus for the whirling table	1. 8. 0
21,451.	Weinhold Polarisation Apparatus	2. 0. 0
21,452.	Dubosecq Polarisation Apparatus	2. 15. 0
21,453.	Polarisation Apparatus on stand	4. 15. 0
21,454.	Simpler Polarisation Apparatus (Tyndall's)	3. 0. 0
40,010.	Reflection-Polarisation Apparatus (Grimsehl's)	1. 0. 0
40,011.	Demonstration Analyser (Grimsehl's)	1. 12. 0
40,012.	Glass Tube for polarisation experiments, as suggested by Grimsehl	1. 5. 0

Heat.

		£ s. d.
21,549.	Apparatus for showing the expansion of liquids	0. 1. 9
21,550.	— do., with open capillary tube	0. 1. 9
21,551.	Apparatus for linear expansion of solids	2. 10. 0
21,552.	Apparatus for explaining the phenomena during the freezing of water and melting of ice, and the behaviour of water on boiling	0. 14. 6
21,553.	— do., without projection thermometer	0. 10. 0
21,554.	Apparatus for determining the maximum density of water	0. 8. 0
21,555.	Apparatus for proving the expansion anomaly of water	0. 8. 6
21,556.	Apparatus for showing circulation of water	0. 6. 0
21,557.	Rühlmann's Apparatus for the expansion of gases at constant pressure	0. 11. 0
21,558.	Freezing-point Thermometer	0. 6. 0
21,559.	Projection Thermometer — 40° to + 50° C.	0. 5. 0
21,560.	— idem, — 10° to +160° C.	0. 5. 0
21,561.	Projection Thermometer with long limb, 0° to 30° C., graduated in tenths	0. 10. 0

	£ s. d.
21,562. — idem, graduated in $^1/_{20}$ths	1. 0. 0
21,563. 3 Small Thermometers with various liquids	0. 10. 0
21,564. Andrews' Press for the compression and liquefaction of carbonic acid gas	2. 0. 0
21,565. Apparatus for critical temperature phenomena	0. 5. 6
21,566. Sectional Model of a steam cylinder	2. 0. 0
21,567. Apparatus for conduction of heat in metal rods	0. 10. 0
40,774. Apparatus for demonstrating the different thermal conduction of copper, lead and wood	0 13. 0
21,568. Apparatus for demonstrating the decrease in temperature produced by removing the source of heat	0. 15. 0
21,569. Gypsum Slab for showing the elliptical propagation of heat in crystals	0. 5. 0
21,570. Small Flat Flask for filling with carbon disulphide and iodine	0. 1. 9
21,571. Plane-parallel Vessel for solution of alum	0. 11. 0
21,572. — do., entirely of glass	0. 6. 0
21,573. Device for the absorption of heat rays by coloured glasses	0. 17. 0

Magnetism and Electricity.

	£ s. d.
21,574. Apparatus for demonstrating magnetic distribution in bar magnets	1. 16. 0
21,575. 2 Small Magnets for producing lines of force	0. 3. 6
21,576. 1 Set apparatus for explaining the theory of the magnetic lines of force (as suggested by Berghoff)	3. 10. 0
21,577. Declination Needle	0. 7. 6
21,578. Dip Needle	1. 2. 0
41,150. Russner Magnetic Pendulum	7. 10. 0
41,151. — do., for setting up on optical bench	6. 5. 0
21,579. Aluminium Leaf Electroscope (von Beetz's)	1. 2. 0
21,580. Kolbe's Aluminium Electrometer	3. 0. 0
21,581—21,583. Accessories to aluminium electrometer	0. 16. 0
29,003—29,006. Further accessories to the aluminium electrometer	1. 6. 6
40,015. Grimsehl's Aluminium Leaf Electrometer	3. 10. 0
40,016—40,018 and 40,021—40,023. Accessories.	1. 18. 0
40,019. Graphite Conductor for demonstrating drop of potential	1. 10. 0
40,020. — do., graduated	1. 17. 0

— Absolute Electrometer (for lecture purposes), Braun's, for projection, see p. 963 and 1155.

Volts	0—1500	0—1500	3500
Graduated from	100—100	500—500	100—100 volts
£	**2. 18. 0**	**2. 7. 0**	**3. 2. 0**

— idem:

Volts	3500	10,000
Graduated from	500—500	500—500 volts
£	**2. 10. 0**	**3. 11. 0**

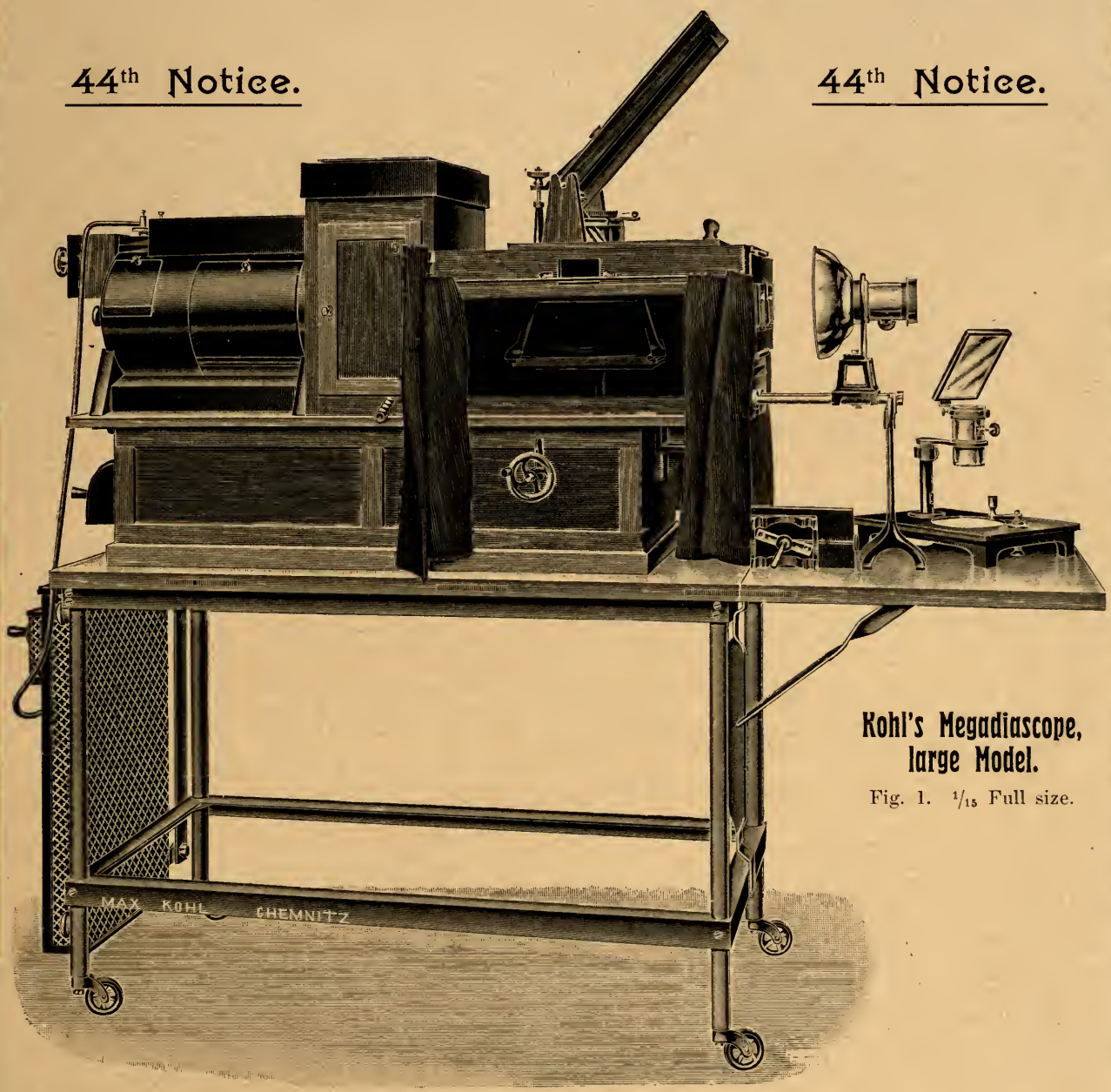
	£ s. d.
21,584. Pile Electrometer	3. 5. 0
21,585. — do., with open piles	3. 15. 0
29,936. Pendulum Electrometer (Weinhold's)	4. 5. 0
29,936 a. Water Chest for above	0. 6. 0
28,692. Electrometer for investigating radio-active substances	4. 0. 0
28,693. Curie Electrometer	6. 0. 0
28,694. — do., with reading microscope (for illustration see No. 29,871)	7. 10. 0
29,022. Simple Projection Cell (Kolbe's)	0. 3. 0
28,691 a. Kolbe Double Projection Cell	0. 6. 0
21,586. Vertical Galvanoscope	1. 0. 0
21,587. Vertical Galvanometer	1. 13. 0
21,588. Small Galvanometer for the horizontal projection apparatus	3. 6. 0
— Demonstration of the hot-wire measuring instrument (as suggested by Scotti)	1. 5. 0
21,589. Moving Coil Projection Galvanometer	4. 0. 0
41,203. Moving Coil Galvanometer for demonstration and projection purposes	8. 0. 0
21,590. Apparatus for showing the heating effect of the electric current	0. 10. 0
21,591. Water Decomposing Apparatus	0. 8. 0
21,592. Apparatus for electric endosmose	0. 10. 0
21,593. Apparatus for objectively demonstrating electrolytic decompositions and crystallisation	0. 11. 0
21,594. Saturn's Tree for above	0. 4. 0
21,595. Projection Trough with auxiliary for capillarity phenomena, communicating tubes, electrolytic phenomena, lines of force, etc.	4. 0. 0
21,596. Apparatus for demonstrating the migration of a drop of mercury through the electrolytically-produced inequality of the surface tension (for illustration, see *re* No. 29,174)	0. 7. 0
21,597. Capillary Galvanoscope (Weinhold's)	0. 9. 0
21,598. Electro-magnet (Weinhold's)	2. 0. 0
21,599. Apparatus (as suggested by Töpler) for the production of magnetic curves	1. 2. 0
21,600. Apparatus for the rotation of liquid conductors	0. 10. 0
21,601. Apparatus for showing damping by induction	0. 16. 6
21,602. Apparatus for demonstration of the flow of current in 3-phase conductors	1. 0. 0
21,603. Electro-thermal Apparatus as suggested by Schumann	1. 13. 0

Miscellaneous.

	£ s. d.
21,604. International Clock	1. 0. 0
21,605. Rotatory Star Chart	1. 13. 0
28,695. 10 Movable Photographs relating to Astronomy	6. 0. 0

Kohl's Megadiascope

44th Notice. 44th Notice.



Kohl's Megadiascope, large Model.

Fig. 1. 1/15 Full size.

Max Kohl A. G.

Telegraphic Addr.: = Physik =

Electrical and Mechanical Instrument Makers,

Telephone Nrs: 104 and 531

Chemnitz, Saxony.

Adorferstraße 20. Adorferstraße 20.

Kohl's Megadiascope.

General.

The employment of electric light has greatly facilitated the introduction of various forms of projectors for educational purposes. The convenience, cleanliness and high candle-power of projection apparatus having an arc lamp as the source of illumination are such valuable qualities, that the use of such apparatus cannot be too highly recommended.

The high candle power especially enables experiments to be carried out which are impossible, or, at least, the same amount of completeness is not possible, when other sources of light are utilised. In connection with the complete range of experiments mention may be made of polarisation and spectrum experiments, the projection of microscopical preparations, and, more especially, the projection by reflected light of drawings, book, etc., illustrations and opaque objects.

For demonstration purposes the projection apparatus must be so built as to be adaptable to all the exigencies of demonstrating, and these are very numerous.

With a view to obtaining the maximum degree of adaptability we have constructed a new projection apparatus, in two sizes, to which we have given the name "Megadiascope". This apparatus can be thoroughly recommended for the following purposes:

a) Employing transmitted Light.

1. Projection of diapositives (Fig. 4);
2. Projection of apparatus which are erected on the optical bench of the megadiascope (Fig. 5);
3. Projection of apparatus independently of the optical bench, the instruments being placed in front of the megadiascope;
4. Projection of apparatus lying horizontally (magnets with lines of force, fluid strata, etc.) by transmitted light (Fig. 6);
5. Projection of microscopical preparations by means of the projection microscope with or without ocular (Fig. 7 and 7a);
6. Projection of microscopical preparations with a stand microscope (Fig. 8);
7. Projection of stable, flowing and liquid crystals and their observation during existence, by means of the projection microscope fitted with heating and cooling device: Fig. 11 (special descriptive catalogue on application);
8. Demonstration of Spectrum phenomena (Figs. 12);
9. Demonstration of Polarisation phenomena in parallel and convergent light (Fig. 13 to 19);
10. Demonstration of Interference and Diffraction phenomena (Fig. 20 to 22);
11. Projection in natural tints with Ives' trichrome apparatus (Fig. 23);
12. Projection in natural tints by diffraction (Fig. 24);
13. Projection with the cinematograph (Fig. 25).

b) Employing reflected Light.

14. Projection of Wood-Cuts, Drawings and Flat Objects (Fig. 26);
15. Producing a small pencil of light for the Lissajou curves, the oscillograph, etc.

In conjunction with the wide scope of adaptability, the new megadiascope is very simple and convenient to manipulate and the apparatus can be changed over from one mode of projection to another in a few moments by turning one or two handles.

Source of Light. The source of light is a direct current arc lamp with horizontal carbons, the crater of the positive carbon being turned towards a parabolic mirror. The total quantity of light from the lamp is reflected by the concave mirror on to the condenser, while in the case of projection apparatus having carbons arranged vertically or obliquely only a comparatively small portion of the total light passes into the condenser. By adopting this advantageous arrangement, considerable

brilliancy of the image is obtained with a proportionately low current consumption, and opaque drawings, illustrations and flat objects are projected by reflected light with the requisite difinition and brilliancy. The brilliancy of the views resulting from the projection of opaque book illustrations is of course dependent on the candle-power of the source. When importance is attached to great brilliancy of image, it is advisable to employ the large megadiascope with 50 amp. arc lamp. The large megadiascope fitted with 30 amp. lamp or even the small megadiascope with 25 amp.[1]) lamp will probably suffice for less exacting demands.

The direct current arc lamp can be supplied either with automatic or hand regulator. More recently the preference has been given to the hand regulator on the score of its requiring little attention, being more certain in its action, and somewhat less expensive. The automatic regulators require no attention and are very reliable. See Figs. 2 and 3.

Size of Image. Projection by transmitted light is effected by an objective of small focus, while opaque objects projected by reflected light an objective of larger focus is used. The reason for this is that the diapositives ordinarily obtainable have an opening of image of 7×7 cm. and require to be magnified 40 times if the size of the resultant image on the projection screen is to be 3×3 m. The illustrations to be projected should on the other hand, be as large as possible, since when these are magnified more than 20 times the images are not brilliant enough. If it be desired to carry out both systems of projection with a long focus objective, it will be then be necessary to alter the position of the apparatus, in order to get on the projection screen equally large images of the unequally large objects; e. g., with the small diapositives of 7×7 cm. free opening of image, the distance of the megadiascope from the screen would have to be 13 m. while in the case of drawings 17 cm. in diameter a distance of 4 to 5 m. from the screen would be correct. In many cases a variation of the distance in these limits is quite out of the question as the class rooms and lecture theatres are amphitheatrical in construction, thus rendering it impossible, or at least very inconvenient, to move the projection apparatus backwards and forwards. In the arrangement with two objectives of different foci the position of the megadiascope can remain unaltered, and images of sufficient and equal size are nevertheless obtained.

When for certain reasons it is desirable to place the megadiascope at a greater distance than 4 to 5 m. feet from the screen, objectives of longer focus must be selected to allow of the image appearing on the screen not more than 3×3 m. with consequent weakness of illumination. The following table explains the various ratios.

Table of Distances between Megadiascope and Screen, of Size of image appearing on the Screen and as to the focus of the Objectives.

Free aperture of the Diapositives 8,5×8,5 cm.; size of the opaque images 17 cm.

Optical Outfit Size	1	2	3	4	5
Focal Length of the Objective for Projection by transmitted Light, mm.	120	150	180	210	240
Focal Length of the Objective for Projection by reflected Light, mm.	240	300	360	420	480
Size of Image on Screen	Distance between Megadiascope and Screen				
3 × 3 m.	4 m.	5 m.	6 m.	7 m.	8 m.
3,5 × 3,5 m.	4,6 m.	5,8 m.	7 m.	8,15 m.	9,3 m.
4 × 4 m.	5,3 m.	6,6 m.	8 m.	9,3 m.	10,6 m.
4,5 × 4,5 m.	6 m.	7,5 m.	9 m.	10,5 m.	12 m.

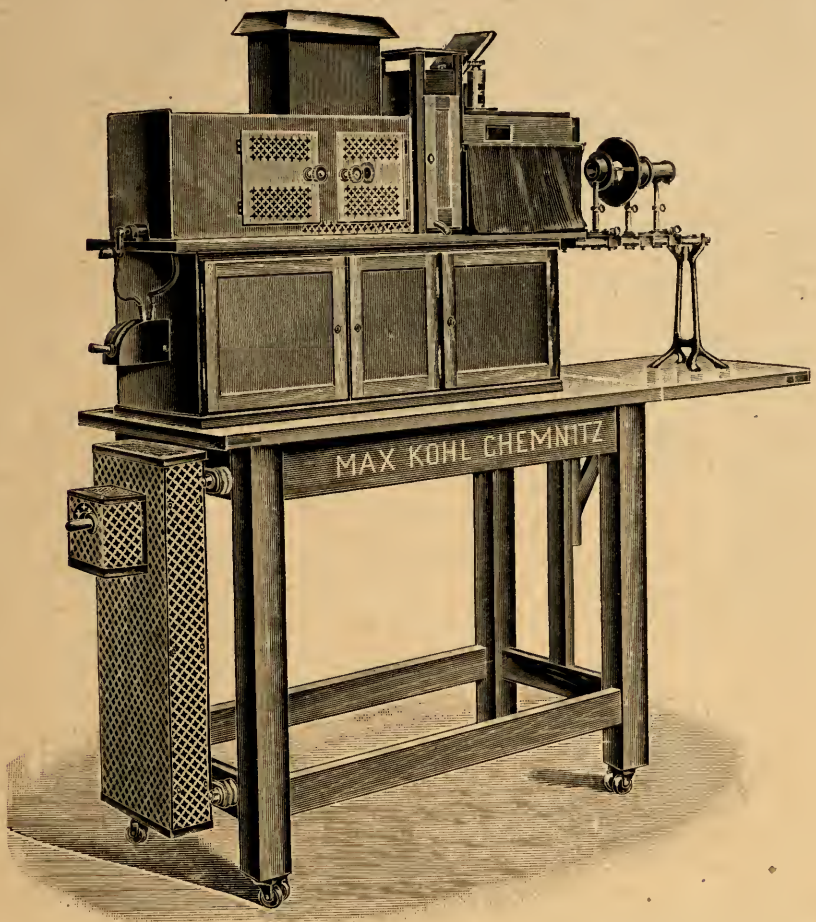
Description of Kohl's Megadiascope.

Fig. 1 on the title page shows the large model Kohl megadiascope 1/15 actual size; the apparatus is erected on a portable table. Fig. 2 shows (1/20 actual size) the smaller model which is likewise erected on a portable table. An illustration of the smaller model with hand regulated arc lamp is shown in Fig. 3. The substructure of the smaller model has a small cupboard for containing the horizontal projector, megascope, etc.

The superstructure of both models is fitted with a sheet iron house containing the

[1]) In the case of a 3 wire system a current of 25 amperes can only be taken from the outer and inner leads. A proportionately smaller and not more costly series resistance is therefore necessary and working is not more expensive on account of the nullification of an unproportionately large excess voltage.

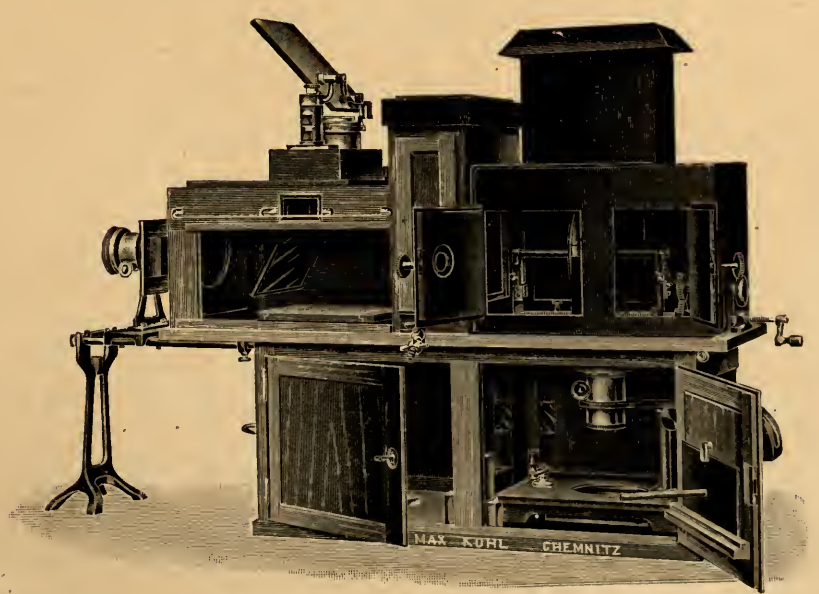
horizontally placed carbons and the parabolic mirror. In order to screen from the object to be projected the heat given off at the arc and that reflected by the concave mirror, a mica disc and water trough are suitably arranged. The latter has a cooling coil and inlet and outlet for the water. The cooling trough can therefore be filled with a constant supply of fresh running water, or a solution of ferrous ammonium sulphate can be poured into the trough, this solution absorbing the heat to a great extent; the solution can then be cooled by passing cold water through the cooling coil.



Megadiascope, small Model, with Table and Regulating Resistance, and Arc Lamp with auto-regulator. Fig. 2. 1 : 20.

The apparatus have an optical bench with objective carrier and objective, and an adjustable stage for holding the objects of projection. The optical bench is composed of two round metal rods maintained parallel by end pieces.

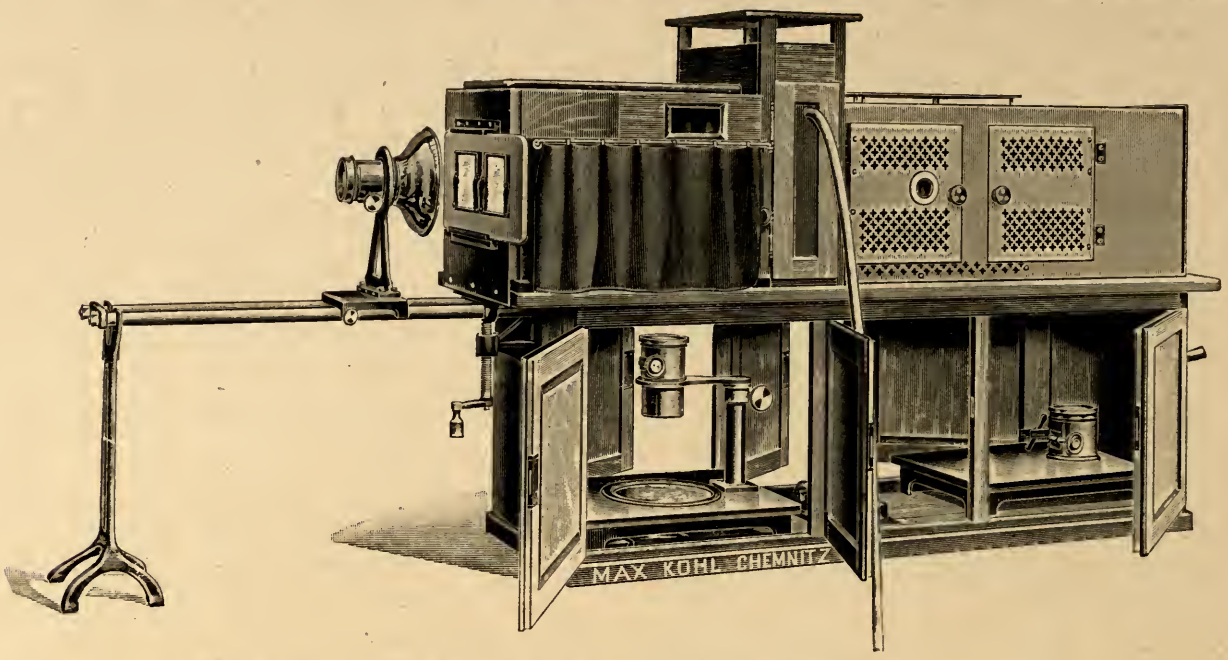
When not in use this bench can be pushed completely under the substructure, thereby rendering possible the setting up and projection of apparatus in front of the condenser independently of the bench. The bench is supported at its front end by a stand to prevent sagging when heavy instruments, etc. are placed on it.



Megadiascope, small Model, with hand-regulated Arc Lamp. Fig. 3. 1 : 15.

A special apparatus is provided for projecting horizontal objects, and is placed on the megadiascope (see Fig. 6).

For projecting opaque, flat objects and woodcuts, drawings and other illustrations the Megascope is used (Fig. 26), which is placed upon the megadiascope in place of the horizontal type projector.



Megadiascope, small Model, the arc lamp fitted with automatic Regulator.
Fig. 4. 1 : 10.

For the projection of microscopical preparations the projection microscope (Fig. 7, 7a and 7 b) is employed.

We will now give a description of the foregoing apparatus, also others for demonstrating the spectrum, polarisation, and interference phenomena, the projection in natural colours (after Ives). The arrangements of the experiments will also be described.

Description of the Individual Experiments.

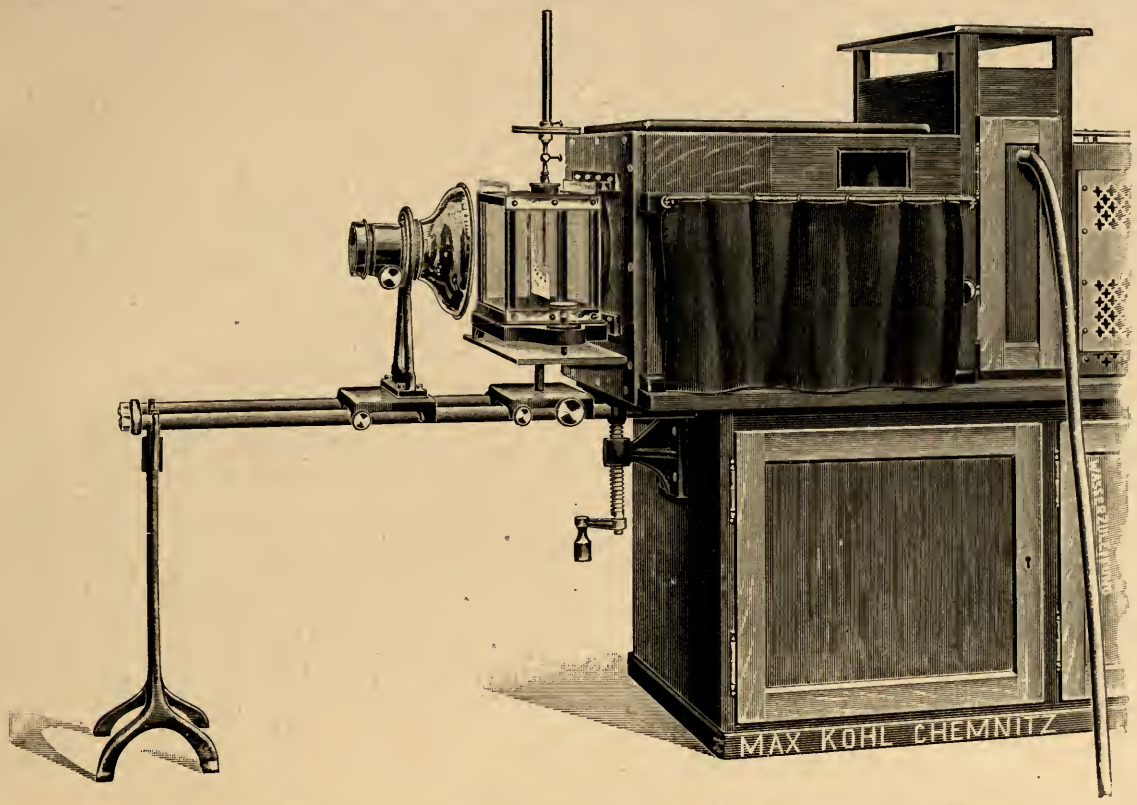
a) Employing transmitted Light.

I. Projection of Diapositives (Fig. 4).

Two grooved rails are fitted in front of the condenser, into which former the changing frame for the diapositives can be slipped. The optical bench is drawn out from under the apparatus and the objective carrier is placed upon the bench. The light falls from the crater of the positive carbon of the arc lamp on to the parabolic concave mirror, and is thence reflected as a parallel pencil on to the condenser. The distance between the arc lamp and the parabolic mirror can be adjusted; in the larger apparatus the mirror can be brought nearer to or further away from the condenser, after loosening an adjusting screw, by pushing in or pulling out a knob which is placed at the end of the megadiascope on the side opposite to the condenser, the arc lamp remaining stationary. In the small megadiascope, however, the arc lamp is moved to and fro by means of a screw fitted with handle, fixed in the corresponding position of the apparatus: the parabolic mirror remaining stationary during this operation. By this means the light can within certain limits be concentrated more or less on the condenser with the object of increasing the brilliancy of the image.

With a Petzaval projection objective of 120 mm. focal length, a sharp and brilliant image of 3×3 m. is obtained from a diapositive 7×7 cm. the distance between objective and screen being 4,5 m. If it be desired to obtain at the same distance images of the same size from larger dispositives, objectives of correspondingly longer focus should be used, and should be ordered as an extra. Regarding the size of image at other distances reference should be made to p. 1204.

Sometimes it is desirable that the centre of the image on the screen should be higher than the centre of the objective on the megadiascope, e. g., in projecting over the lecture table. To facilitate this, the superstructure of the megadiascope can be raised by means of a vertical screw with handle fitted to the substructure at the objective side. The pencil of light is thus directed



Projection of apparatus which are placed on the Optical Bench of the Megadiascope.
Fig. 5.

obliquely in an upward direction. If the inclination is considerable, the projection screen must naturally be adjusted obliquely in the same proportion.

The diapositives are contained in a change frame which slides in the two grooves above and below the condenser. The change frame given with the megadiascope is the usual diapositive size (9×10.5 cm. $= 3.54 \times 4.13$ ins.). This is the usual size of the diapositives dealing with astronomy meteorology, physical geography and physics, of which we have a special list which we shall be glad to forward post free to all interested. Instead of the frame for size $9 \times 10{,}5$ cm. we can also supply it size $8{,}5 \times 10$ cm. (the usual size of landscape views sold) or size 9×12 cm. without change of price.

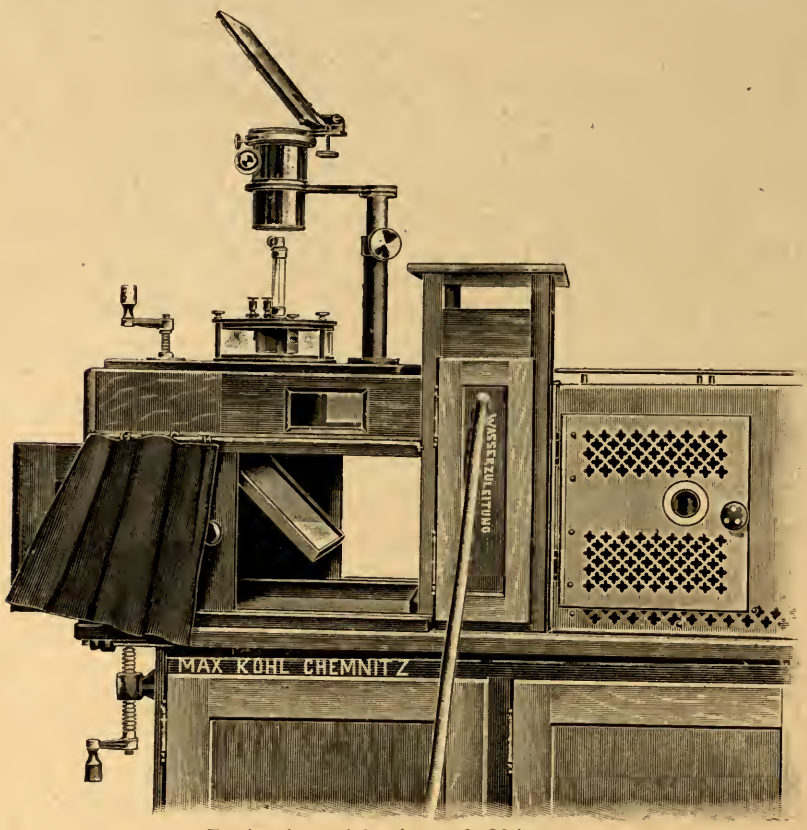
The images are focussed on the projection screen in a coarse manner by sliding the objective carrier along the optical bench, and fine focussing is obtained by means of a knob on the objective. As to the method of obtaining maximum brilliancy of the images, reference should be made to the first paragraph of this section.

In place of the achromatic projection objective, a Steinheil group antiplanet, a Voigtländer Heliar or a Zeiss Tessar of the same focus may be selected when great importance is attached to obtaining an image which is equally as sharp at the edges as in the centre. The objectives just mentioned are more efficient than the projection objective, but the cost is also greater.

We have included some rules for the manipulation of the arc lamp, on page 1217.

2. Projection of apparatus which are placed on the Optical Bench of the Megadiascope.

Fig. 5 shows the arrangement for this method of projection. The adjustable stage supplied with the megadiascope is fixed to the optical bench: the apparatus to be projected being mounted on this stage. The illustration indicates the method of setting up a Kolbe electrometer for projection. In the same manner all the fine instruments can be projected which are arranged for objective projection and their number is steadily on the increase. We will only mention the wave-projecting machine, Newton's transparent colour discs, sectional model of steam cylinder, Andrew's press, the rotating star chart, etc., etc. By means of the projection thermometer, the action during freezing, the mixture of liquids, etc. can be very beautifully demonstrated. All phenomena which are capable of projection at all can be projected by the megadiascope.



Projection of horizontal Objects.
Fig. 6.

Collection of Microscopical Preparations.
Fig. 7b. 1 : 4.

3. Projection of Apparatus independently of the Optical Bench of the Megadiascope.

In addition to those apparatus which are set up on the bench of the megadiascope, there are a number of such instruments, etc. which are placed independently in front of the condenser for the purpose of being projected, as, for instance, Duboscq's polarisation apparatus, Mach's polarisation apparatus, Paalzow's optical bench, the projection microscope for observing the existence of crystals, etc.

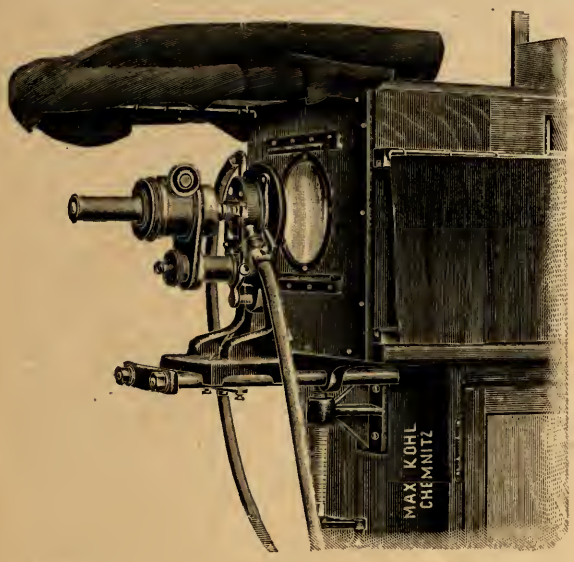
To place these apparatus in position it is necessary to remove the optical bench: to this end it can be pushed completely under the framework of the megadiascope, and is thus out of the way. This arrangement has the further advantage that the bench when thus pushed away takes up no space and is always ready at hand when required.

We must not refrain from mentioning here that the foregoing methods of projection are of the utmost importance for educational purposes, especially in connection with physics. In spite of this fact, this projection is not possible at all in a number of new models of projectors, because attention has not been given to what we have just mentioned, in designing such apparatus. **Before purchasing a projection apparatus, therefore, it is desirable to find out whether the model in view permits of the projection of apparatus and the setting up of the optical bench in front of the projector.**

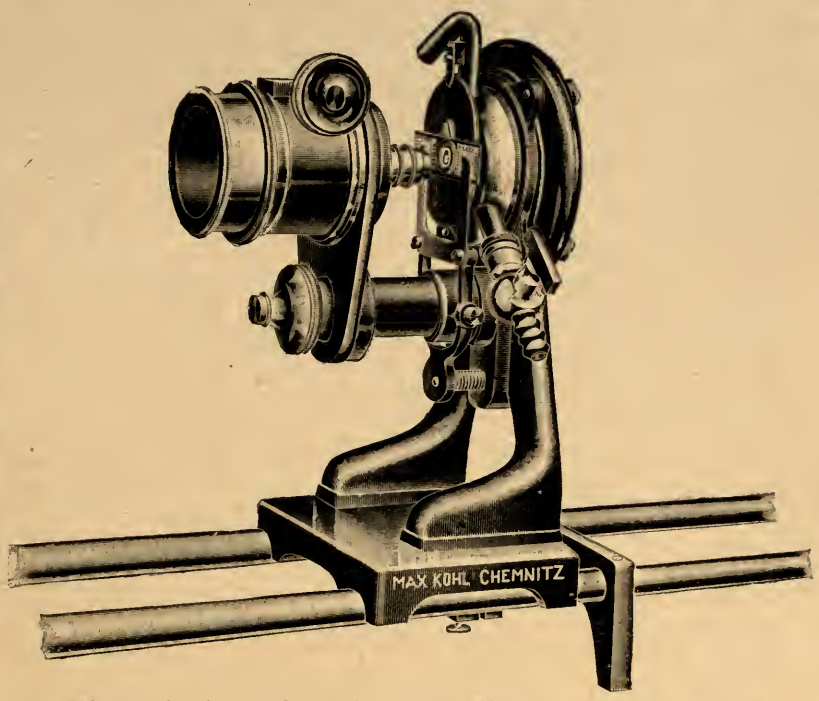
4. Projection of horizontal Objects.

Horizontal objects are projected with the **Horizontal Projection Apparatus** (Fig. 6). This consists of a wood baseplate with a frame completely surrounding it, underneath, and with a pillar carrying an objective and erecting mirror fitted to it. Inside the frame a further mirror in metal mount is arranged under the baseplate, and is capable of rotation, and it assumes an angle of 45 ° in consequence of its own weight when the screw, with handle, shown to the left of Fig. 6 is screwed out. Inversely, the mirror is raised and placed in a horizontal position when the screw is screwed in. In the latter position the mirror fits into the frame surrounding the base.

The baseplate carries a condenser of 150 mm. diameter and the pillar has a rack and pinion arrangement for raising and lowering the projection objective. The tilting reversing prism is placed on the mount of the objective and clamped with screws. The mirror is silvered on the front side, and polished, and it **must therefore not be touched with the fingers.**



Microprojection with the Projection Microscope.
Fig. 7.



Microprojection with the Projection Microscope, without ocular.
Fig. 7a. 1 : 5.

In use the horizontal projeetor is plaeed on the megadiaseope in the manner shown in Fig. 6, after a wood eover has been taken off.

By means of the horizontal projeetion apparatus, horizontally lying objeets such as Berghoff's apparatus for magnetie foree lines, the apparatus for magnetie distribution in magnet bars, the dip needle, etc., ete. ean be projected in a very beautiful manner.

The condenser lens is amply dimensioned, being 150 mm. in diameter, in order that the objects need not be too small or the magnifieation too great. With a magnifieation of ×20 an image 3 m. in diameter is obtained on the sereen, the distance of the apparatus from the sereen being 4,5 m.

Fig. 6 shows the ereetion of a galvanometer with transparent scale (No. 21 588 of our List No. 21) in eonjunetion with the horizontal projeetion apparatus.

5. Microprojection with the Projection Microscope.

The projeetion of mieroseopical preparations (or **microprojection**) plays a very important part in education. The **Projection Microscope** is employed for attaining this end (see Fig. 7 and 7a).

On a special slider a pillar is fixed which earries the stage and the tube. Illumination is provided by the peneil of light issuing from the condenser.

In order to obviate the stage and the preparation beeoming considerably heated by the heat rays coming from the condenser, the stage is eonstrueted hollow and is provided with **water inlet and outlet in order that it may be kept cool by flowing water.** Moreover, the stage is insulated where fitted to the stand and is projeeted from heat rays by a miea disc. The tube for the flowing water is conneeted to the coek at the lower end of the stage: the outlet at the upper end of the stage being connected by a length of piping with the large water trough of the megadiaseope. The water thus flows first through the stage and then through the trough. The stage has a rotating diaphragm with apertures of 10, 6, 3, 2, 1.5 and 1 mm (0.39, 0.23, 0.11, 0.078, 0,058 and 0.039 ins.) eorresponding to the different magnifieations of the objeetives. The objects are held to the stage by a spring clamp.

The stage is shaped in sueh manner that the object holder projeets slightly in order that the preparation may be taken hold of by the fingers and moved to and fro a little, for the purpose of bringing all parts of the same into the field of view (see Fig. 7a). In the case of projecting without an oeular the objeetives are serewed on to short tubes with whieh they are inserted in the wide tube

of the microscope. For each objective it is best to use a special tube the length of which is so dimensioned that on being inserted the objective is at approximately the correct distance from the object and only requires a little correction. If it be desired to proceed rapidly from one magnification over to another, a revolving collar for 3 objectives is a decided advantage.

Very suitable objectives to employ are Hartnack's, System Nos. 2, 3, 5 and 7.

With Hartnack No. 2 an image of 1,7 m. diameter is obtained at a magnification of × 170, the distance from screen being 4,5 m. and the diameter of diaphragm 10 mm.

With Nr. 3 an image of 2 m. diameter is obtained at a magnification of × 330, the distance from screen being 4,5 m. and the diameter of the diaphragm 6 mm.

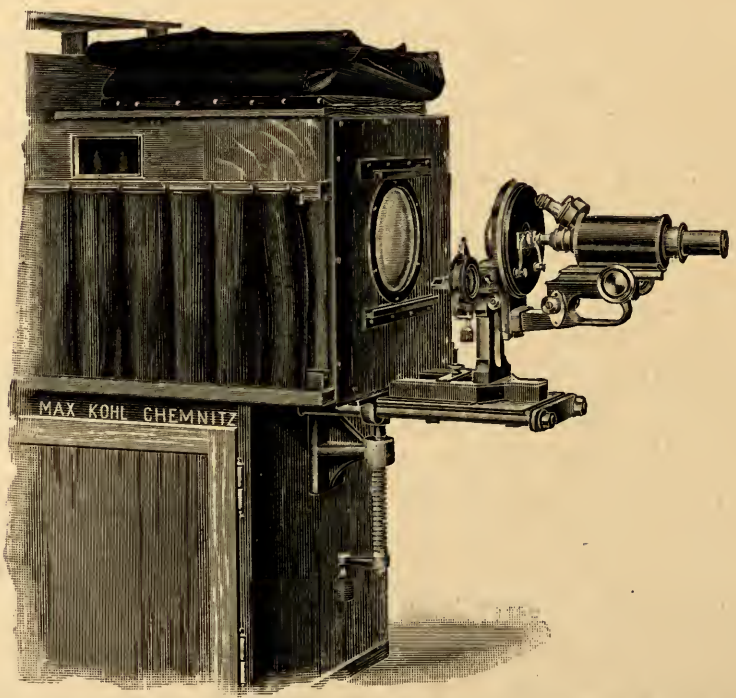
With No. 5 the diameter of the image is about 1,8 m. with a magnification of × 900, the distance from screen being 4,5 m. and the diameter of the diaphragm 2 mm.

With No. 7 the diameter of the image is about 2 m. with a magnification of × 1300, the distance from the screen being 4,5 m. and the diameter of the diaphragm 1,5 mm.

In spite of this considerable magnification (which suffices for all purposes) the images are very bright. The magnification can be measured in a very convenient manner by placing on the stage an object micrometer (1 millimeter divided into 100 parts) and measuring on the screen, with a ruler, the number of millimeters taken up by the magnified millimeter on the screen. The magnification is thus ascertained direct.

In projection with an ocular the ocular-tube is slipped into the tube of the projection microscope. The objectives are either contained in a revolving collar or are screwed to the ocular tube. Greater magnification is obtained when an ocular is used. The coarse focussing of the objectives is made by rack and pinion on the tube, and fine focussing is obtained by means of a micrometer screw.

Any disturbing light is kept off by curtains fitted to a drop board.



Projection of microscopic Preparations with a collapsible Stand Microscope. Fig. 8.

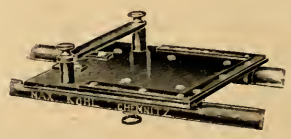


Fig. 9. 1 : 10.

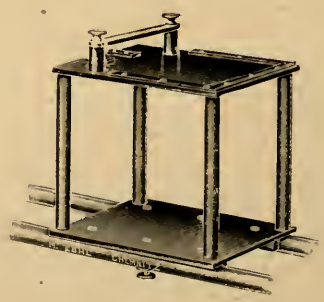


Fig. 10. 1 : 10.

6. Projection of Microscopic Preparations with a Stand Microscope (Fig. 8).

Micro-projection can also be carried out with a swinging stand microscope as shown in Fig. 8. The most suitable microscope stand for the purpose is that used for micro-photography and projection (No. 9543) which is illustrated in Fig. 8. This stand can be used equally well for all microscopic work in conjunction with subjective observation. It has a rotating vulcanite stage (which can be centred) and the usual condenser; it can however be supplied with detachable condenser also. Instead

of the rotating and centrable vulcanite stage, the stand is also supplied with cross stage or microphotographic stage. The prices are given in the second part of this catalogue.

The microscope stand is mounted on a special slider with fixing bridge (F i g. 9) which is fixed o the optical bench by means of a turnbuckle. Fillets on the slider maintain the stand in the correct position. The bridge and a nut hold the foot of the stand firmly on the slider so that the stand cannot fall through.

In many cases preparations are used with the object glass in a horizontal position, and the microscope must therefore assume a vertical position. In such cases a special arrangement is employed for placing the microscope stand higher on the optical bench (F i g. 10). A special mirror is then necessary for the purpose of illuminating the object; also an erecting mirror, placed on the tube of the microscope, and a rectifying prism: the latter being essential when it is desired to work with oculars.

The optical outfit which we recommend is that catalogued as "Complete Optical Outfit" in this list. We shall be pleased, however, to quote for simpler outfits.

All disturbing light is held off by a curtain fitted on to a drop board.

7. Projection of Stable, Flowing and Liquid Crystals (Fig. 11).

For demonstrating crystallisation (an important and interesting section of physics and physical chemistry) a special **Projection Microscope** is requisite which permits of the preparation remaining in a **horizontal position** and renders it possible to **heat** and **cool** the preparations as desired, and which can be fitted with **electric leads** for electrolytic experiments. An arrangement has been provided whereby a polariser and analyser can be rapidly interposed in the passage of the rays; it is thus possible to show the peculiar structure of the liquid crystals, which cannot be demonstrated in ordinary light.

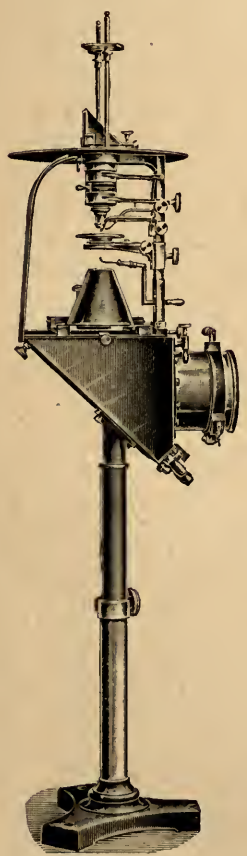
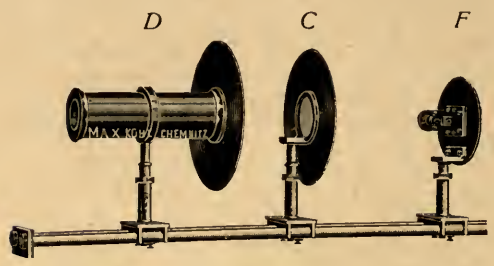


Fig. 11. 1:9.

With this object we have constructed a **Projection Microscope** based on the suggestions of Prof. O. Lehmann (Karlsruhe), the discoverer of liquid crystals, and we supply all the **necessary accessories** as well as **chemicals, preparations, collections of preparations;** also diapositives from photographs which have been taken during the process of crystallisation, and especially of the phenomena of **liquid crystals,** which have been closely studied by Prof. Lehmann. These phenomena have shown that considerable **analogies** exist between the **liquid crystals** and many of the **lower animalculae.** Prof. Lehmann observed, for instance, that certain of the liquid crystals as it were **devour each other;** others **grow together** and form a large subject of similar shape; in the case of some of the crystals **buds** form in the liquid state, and new independent shoots grow from these buds. Many **needle shaped crystals** distribute themselves like bascillæ in a number of smaller needles, which continue to grow and finally themselves acquire the property of distributing themselves. There are **liquid crystals having the shape of snakes and earth worms,** which as it were endowed with life move backwards and forwards, turn themselves about their vertical axis or execute serpentine movements. With the aid of this apparatus it is possible to demonstrate before the very eyes of the audience the fact that regular shaped crystals which have lost their complete form on account, say, of mechanical influences **have their broken ends restored** — their injuries, so to speak, healed. In addition, **the crossing of various kinds of crystals, the existence of mixed crystals,** the prevention of the growth of the crystals in solutions to which **foreign bodies** are added, that is to say, a kind of poisoning can readily be observed by the intermediary of the apparatus stated. We might make mention here of the following publications by Prof. Lehmann dealing with the subject: „Flüssige Kristalle", Leipzig 1904; „Flüssige Kristalle und die Theorien des Lebens", Leipzig 1906; „Die scheinbar lebenden Kristalle, Anleitung zur Demonstration", Esslingen 1907; Frick-Lehmann „Physikalische Technik", Vol. I, Part 2, and Vol. II, Part 1, Brunswick 1905 and 1907 respectively.

We shall be pleased to send a complete descriptive list, **with prices,** on application.

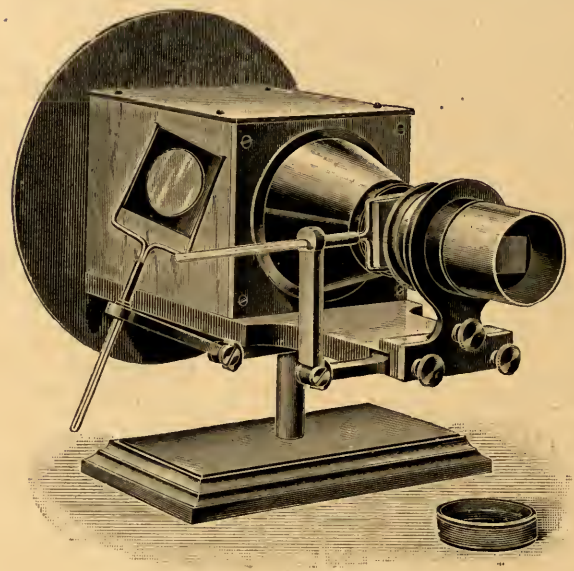


Spectrum Phenomena with a direct-vision prism.
Fig. 12.
D = Direct-vision prism, *C* = Collimator lens, *F* = Adjustable slit.

8. Demonstration of Spectrum Phenomena (Fig. 12).

An adjustable slit (Fig. 12), F, is placed on the optical bench in front of the condenser. At some distance from the slit the collimator lens, 4, is set up and adjusted until a sharp image of the slit is obtained on the screen. The direct-vision prism, D, is last of all introduced in the passage of the rays, thus producing an extended spectrum on the screen. The slit has a small piece suitably arranged for the reception of an absorption vessel.

9. Demonstration of all Polarisation Phenomena in Parallel and in Convergent Light (Figs. 13—19).

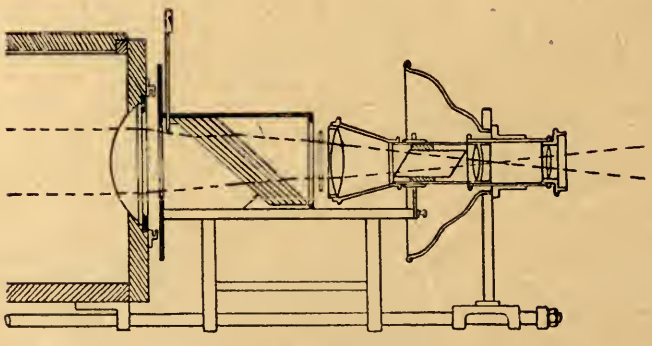


Projection Polarisation Apparatus.
Fig. 13.

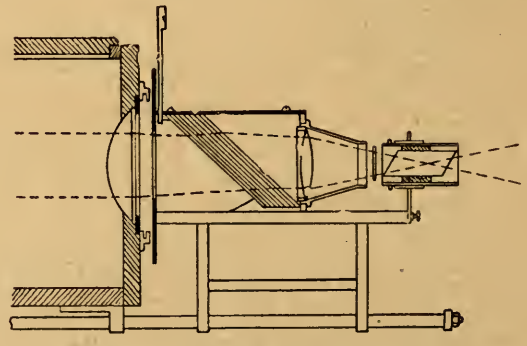
Polarisation phenomena may be demonstrated either with the **Projection - Polarisation apparatus** (F i g. 13) or by Paalzow's method in the open (F i g. 16).

The **Projection-Polarisation apparatus** (F i g. 13) consists of a wooden box in which is contained a column of glass plates. The box has a large aperture diaphragm at the side opposite to the condenser of the megadiascope; at the reverse side it is closed by a sheet of brass to the opening of which a funnel is screwed. This funnel has a lens at the wide end, and at the narrow end it is provided with a thread into which the neck of the nicol screws. A special holder is fitted at the front of the apparatus, which is intended to take the neck of the prism when it is screwed off the funnel.

The polarisation apparatus is used in two different ways (1) for the projection of preparations by means of parallel, or more correctly, weakly converging light-rays; (2) for polarisation in strongly convergent light.



Polarisation in Parallel Light.
Fig. 14.



Polarisation in Converging Light.
Fig. 15.

T o p r o j e c t i n p a r a l l e l l i g h t, the funnel is screwed off from the box and on to the neck of the nicol, and the objective head of the megadiascope is placed in front of the nicol (F i g. 14). The preparations are contained in a holder, the two being placed in the space intervening between the box and the funnel. The arc lamp is adjusted in relation to the mirror in such manner that the light-pencil issuing from the condenser is longer, and the light-rays thus pass from the condenser slightly convergent. The following are quite suitable for projection in parallel light: rapidly annealed glasses, thin slabs of gypsum, and gypsum figures.

To avoid any serious heating of the nicol it is well to extinguish the arc lamp at the intervals between the introduction of the various specimens, or to shut off the polariser by means of the shutter supplied with it, so that the light-pencil does not rest too long on the nicol prism.

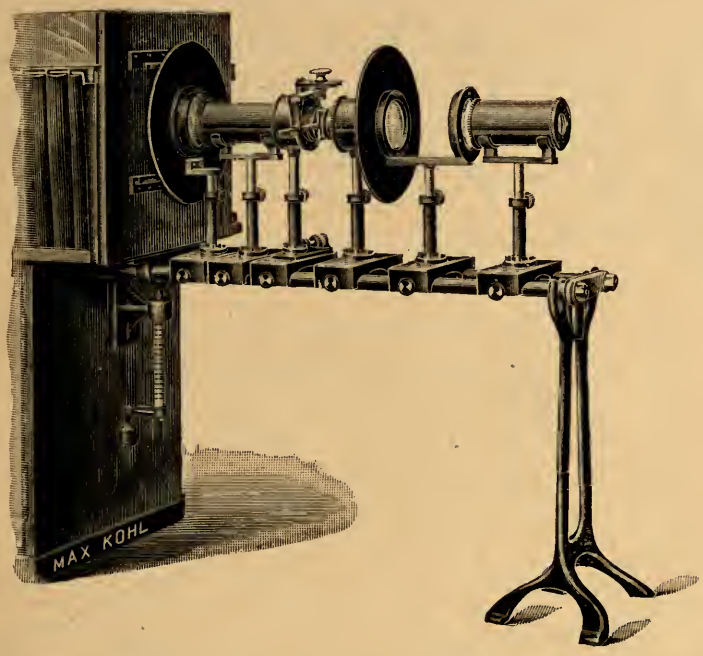
The fourfold change of the phenomena is brought about by rotating the neck of the prism, and not the specimen.

For projecting in strongly converging rays, the funnel is screwed off the neck of the nicol and on to the box. The preparations are held in the space intervening between funnel and nicol neck (Fig. 15).

The objective head of the megadiascope is not employed in this arrangement; the remarks made above as to the adjustment of the arc lamp apply in this case also.

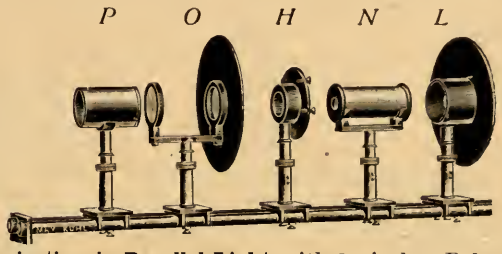
The following are well suited for projection in strongly convergent light: calc-spar, rock crystal, aragonite, potassium cyanide, strontium aceto-cuprate and tourmaline.

The Open Arrangement after Paalzow (Fig. 16) has the advantage that all parts necessary for polarisation, such as nicols, lenses, condensers, holders for the preparations, etc. are mounted individually in the open so that the course of the rays may be followed. The nicol mounts lie in half round bearings from which they can be quickly and easily removed. In this way it is possible for the phenomena to be demonstrated rapidly one after the other first in polarised and then in unpolarised light.



Polarisation in Converging Light with 2 Nicols and 2 Condensers for uniaxial and biaxial Crystals.

Fig. 16.

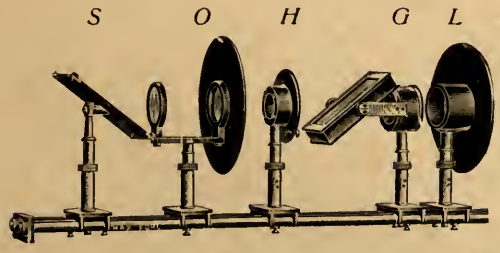


Polarisation in Parallel Light with 1 nicol as Polariser and 1 double refracting Prism.
P = double refracting Prism, *O* = open Objective, *H* = rotating object holder, *N* = Nicol, *L* = bi-concave lens.

Fig. 17.

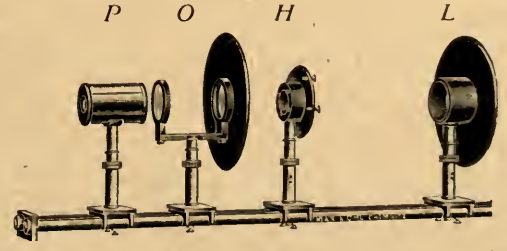
Fig. 16 shows the open arrangement for **polarisation in converging rays.** In front of the condenser is first placed a bi-concave lens which renders parallel the converging rays issuing from the condenser. The parallel pencil now passes successively through the large polarising nicol, the first condenser, the preparation, the other condenser, the open objective, and finally the small analysing nicol. The images of the axes even of biaxial crystals appear on the 4 m. distant projection screen $1^1/_2 - 2$ m large and in a very beautiful manner. The quadruple alternation of the phenomena is obtained by rotating the analyser.

Fig. 17 shows the arrangement for **polarisation in parallel rays.** Instead of the nicol prism an achromatic, double-refracting calc-spar prism is employed as analyser, in order to demonstrate that such a prism may be used both as polariser and analyser.



Polarisation with Glass Plate Column and dark Mirror.
S = dark Mirror, *O* = open Objective, *H* = rotary Object Holder, *G* = Glass Plate column, *L* = bi-concave lens.

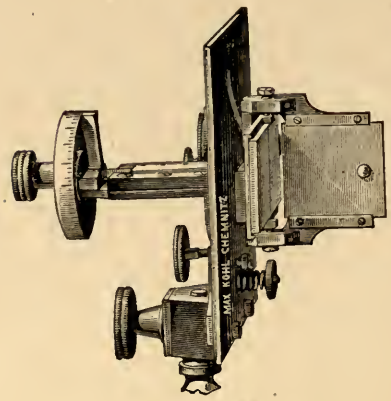
Fig. 18. 1 : 10.



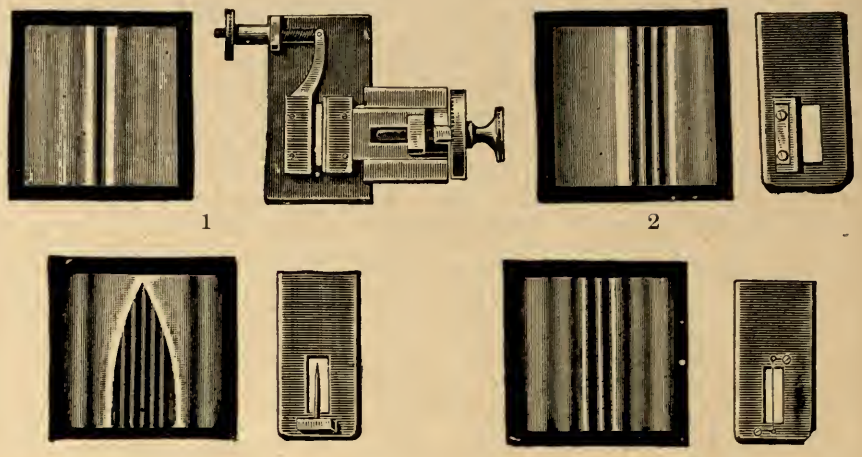
Double Refraction with 1 or 2 double refracting prisms.
P = double refracting prism, *O* = open Objective, *H* = rotary Object Holder, *L* = bi-concave lens.

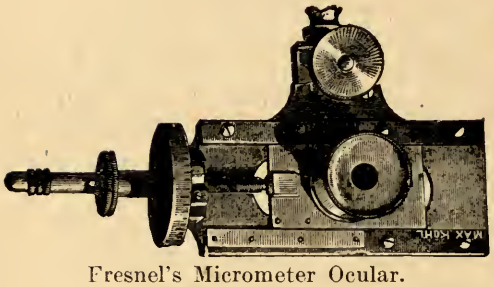
Fig. 19. 1 : 10.

Fig. 18 illustrates the arrangement with **Glass Plate Column** and **dark Mirror.** Fig. 19 shows **double refraction** with 1 or with 2 double refracting prisms.

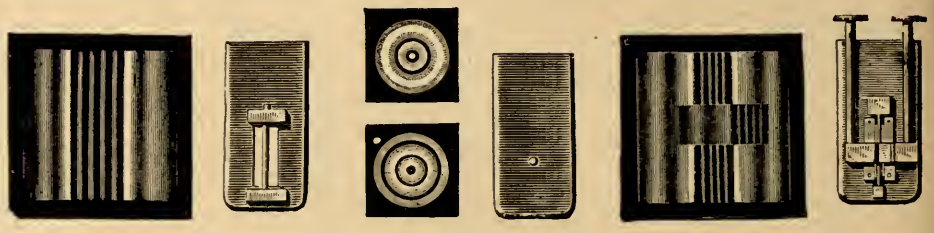


Interference Mirror.
Fig. 20. 1:3.





Fresnel's Micrometer Ocular.
Fig. 22. 1:2.



Diffraction Phenomena with narrow Apertures.
Fig. 21. 1:3.

The open objective is focussed so that a sharp image of the diaphragm of the object holder is obtained on the screen. If, now, a double refracting prism be brought in front of the objective, two circles of half the brilliancy appear on the screen, these circles rotating around eaeh other when the prism is rotated. If now a gypsum slab of suitable thickness is placed on the object holder, the two circles appear on the screen in the complcmentary colours. If after removing the gypsum slab the second double refracting prism be introduced into the mount intended to take the double refracting prisms, on turning this prism in quadruple alteration one, two or four circles are obtained on the screen, and on replacing the gypsum slab in the object holder the circles appear in the complementary colours and on combining to one circle this appears white and with the maximum brilliancy.

10. Demonstration of Interference Phenomena (Figs. 20—22).

A micrometer slit is placed in front of the condenser, the former being adjusted to $^1/_2$ millimeter (0.019 inch) width. At 50 cm. distance from this the interference prism is set up. The highly coloured interference bands appear plainly on the 2 — 3 m. distant screen.

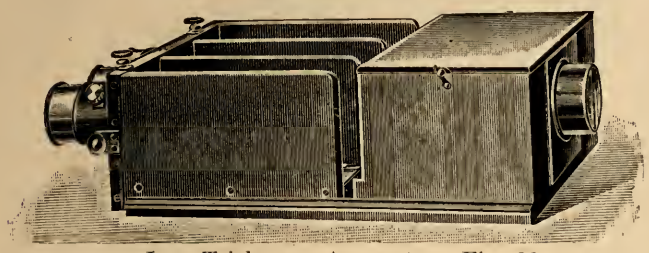
If instead of the interference prism the interference mirror is placed on the optical bench, the slit must be so regulated that the two mirror images on the screen overlap. The mirror is fixed on a slider the column of the slider being laterally adjustable so that the mirror may be adjusted in such manner that the light leaves the first mirror at a very obtuse angle.

The diffraction phenomena with narrow openings, gratings and double gratings (Fig. 21) can be demonstrated both in an objective and subjective manner with the aid of the Fresnel micrometer eyepiece (Fig. 22) or a magnifying glass.

In Fig. 21:

No. 1 shows the bands resulting from the passage of the rays through two parallel slits.
No. 2 shows the bands which result when the rays encounter the edge of a screen.
No. 3 shows the bands which result when the rays encounter a thick needle in a slit.
No. 4 shows the bands produced when the rays encounter a hair in the slit.
No. 5 when the rays encounter a thick opaque thread.
No. 6 shows Grimaldi's experiment when the rays pass through a round hole with a black or white point in the centre, and according to the distance of the screen.
No. 7 shows the displacement of the bands on the insertion of a sheet of mica.

A concise description of the arrangement of the experiments is appended to the apparatus.



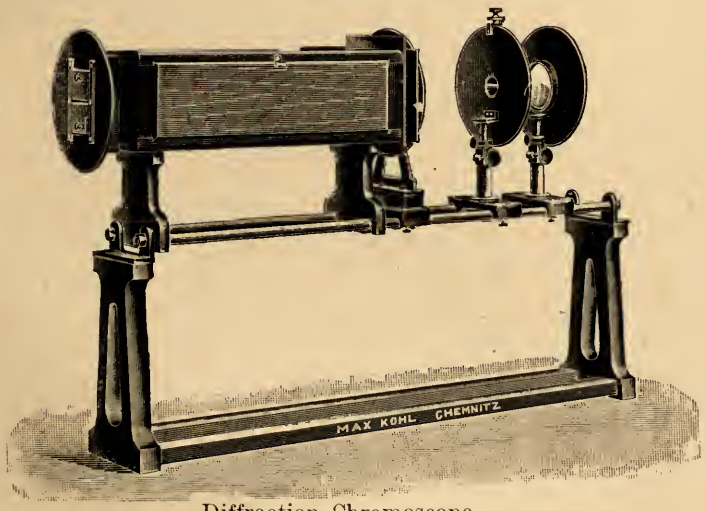
Ives Trichrome Apparatus. Fig. 23.

II. Projection in Natural Colours with the Ives Trichrome Apparatus (Fig. 23).

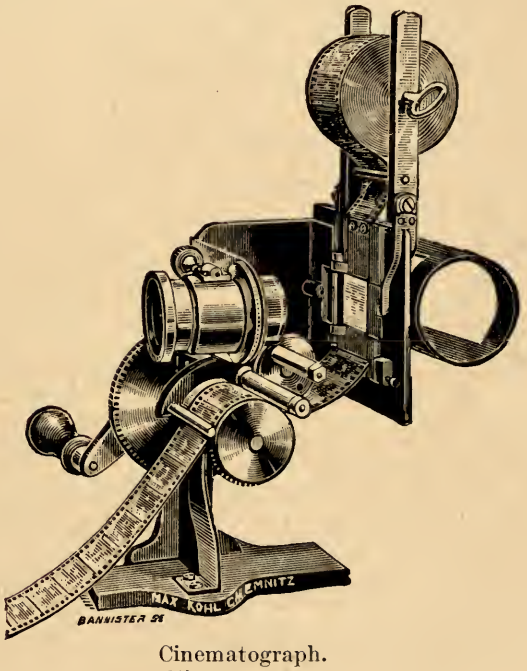
The Ives trichrome apparatus (Fig. 23), which is specially arranged for the megadiascope, is placed on the optical bench. By combining the three plain images a beautifully coloured image is obtained on the screen.

12. Projection in natural colours by means of the Diffraction Chromoscope (German Design) (Fig. 24).

In this method of producing coloured images, the images are obtained by the aid of diffraction gratings. Small surfaces with gratings of various shape and width of line are arranged alongside each other in such manner that when illuminated the images (e. g., of baskets of fruit, butterflies, etc.) are reproduced in their true natural tints. The colour reproduction is additive; no light filter is employed, and all mixed colours are arrived at by the superposition of spectral tints. The plates containing the image are obtained photographically and are therefore correct.



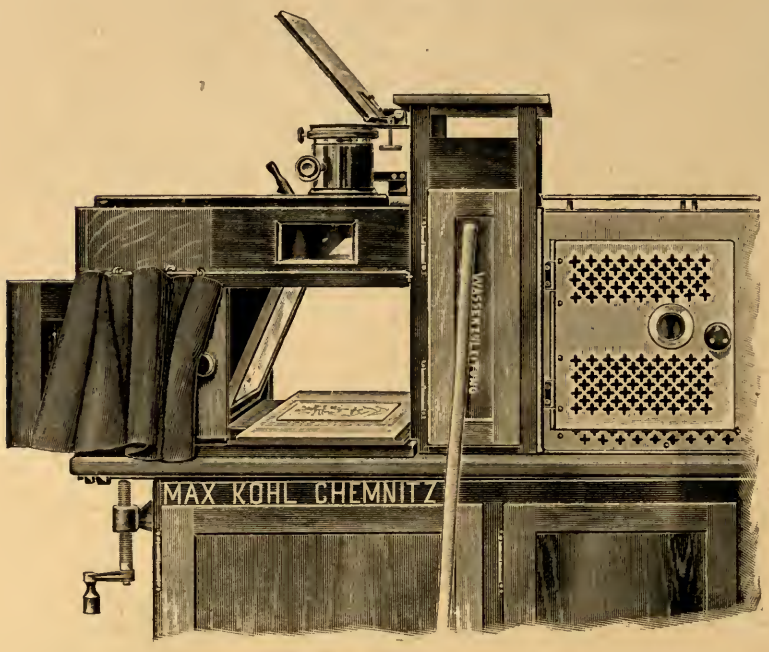
Diffraction Chromoscope
Fig. 24. 1 : 12.



Cinematograph.
Fig. 25. 1 : 4.

In reproducing the images the light shading box (Fig. 24) is placed on the optical bench in front of the projection lens, the horizontal slit of the box being turned towards the projector. The following are also erected on the bench: a bi-concave lens with diaphragm, a slit adjustable as regards height by rack and pinion, and having a diaphragm; and an achromatic objective also adjustable for height (see the illustration, Fig. 24). By means of the bi-concave lens a sharp image is obtained, on the diaphragm of the slit, of the slit arranged on the shading box. If now a "grating" image produced by Wood's process is placed in the change frame at the front end of the box, a number of diffraction spectra appear on the diaphragm of the slit in addition to the brilliant image of the slit. The slit (adjustable as regards height) is now placed at the position of the diffraction spectrum immediately adjacent to the slit-image, and a sharp image is cast on the projection screen by means of the achromatic objective; this is the coloured image. By raising and lowering the diaphragm of the slit and altering the width of the slit itself the tinting of the image is varied until the correct tones are arrived at. For showing the course of the rays in the light-shielding box and proving that box contains no other auxiliary apparatus, it is provided with Flap doors on the two longitudinal sides, and these can be easily opened; an unimpeded view is then possible.

A complete descriptive catalogue of the Diffraction Chromoscope will be forwarded if desired.



Projection by reflected light of wood-cuts, drawings and flat objects (Megascope). Fig. 26.

Projection by reflected light with long focus Objective. Fig. 26a.

13. Projection with the Cinematograph.

As the einematograph has come into general use for depieting events, and, more reeently, for demonstrating medical operations and scientific proeesses, no deseription of the apparatus is necessary. A eomparatively simple apparatus sueh as that shown in Fig. 25 will suffiee for the purpose. The cinematograph is plaeed on the optieal beneh in front of the eondenser, and by turning a handle the photo strips are fed baekwards in front of the objeetive and are at the same time intermittently illuminated. Very clear images are obtaincd.

b) Employing reflected Light.

14. Projection of Wood-cuts, Drawings and flat Objects (Fig. 26).

Fig. 26 shows the arrangement for this method of projeetion. The megaseope is plaeed upon the megadiaseope after the wood cover with the eurtains has been removed. The illuminating mirror is let down by depressing the spring held by the lever. The ereeting mirror is plaeed on the mount of the objeetive if this is not already firmly eonneeted to the base plate. The image is focussed on the sereen by raising and lowering the objective by means of the actuating mechanism of the objeetive mount. At a distanee of 4,5 m. from the sereen extraordinarily bright and sharp images 2×3 m. in size are obtained, the size of the original image being 13×18 em. The remarks on page 1204 as to size of image at other distanees apply in this case also. With the megascope illustrated in Fig. 26 a (the objeetive of whieh is **a Zeiss Tessar of long focus,** 500 mm.) just as large an image can be obtained at a **distance of 10 m.** Printed writing appears eorreetly and not reversed. By shifting the position of the arc lamp or the parabolie mirror as the ease may be, a smaller diameter ean be more brilliantly illuminated. **In no case are the images on the screen inferior to those given by other apparatus either as regards brilliancy or sharpness.**

Butterflies, beetles, coins and other flat objeets ean be projeeted in a very beautiful manner. Coloured view eards can also be enlarged very well. Good wood-euts give the best images, glossy photographs and illustrations produced by autotypography not being so well adapted for reproduetion.

15. Production of a narrow Pencil of Light for the Lissajous Curves, the Oscillograph, etc.

In order to demonstrate the Lissajous eurves objeetively use is made of a narrow peneil of light whieh is direeted on to the mirror of the tuning forks. Sueh a pencil results when a diaphragm

with a fine hole ($^1/_2$ millimeter) is placed in front of the megadiascope. With the aid of a lens of about 7 ins. focus a sharp, magnified image of the fine aperture is obtained on the 9.84 to 13.12 ft. distant screen.

If the tuning fork apparatus is placed in the path of the ray of light issuing from the lens in such manner that the ray is cast from the first mirror on to the second, and thence on to the screen, the image appears on the screen. Since the path of the ray of light is lengthened on account of the repeated reflection, the image must be focussed carefully again by sliding the lens. On the forks being vibrated the Lissajous figure appears on the screen.

Instructions for using Kohl's Megadiascope.

The arc lamp must on no account be switched on unless the trough has previously been completely filled with water or else the glass panes of the trough will crack.

The water is led into the trough on the side containing the cock. The latter is connected to the water main by a length of hose: the outlet to the trough being connected by a second length of hose to the sink or basin of the water supply.

The carbons should be introduced only when the arc lamp is switched off and not under current. If it be desired to carry out this operation while the lamp is hot from use, the remaining carbon is removed with the wood tongs and the key for loosening the clamping screws given with the apparatus.

Before inserting the carbons, see that the carbon holders are drawn apart.

A series resistance must be put in series with the network line. This can be adjusted so as to be invariable, i. e., for the normal current of the arc lamp (25, 30 or 50 amperes) or it can be adjustable, so as to regulate the current within certain limits. The latter arrangement is preferable.

The current is regulated in the following manner: While the arc lamp and the coils of the rheostat are cold the contact handle is placed on "Weak", and after some minutes to the contact before the last. If should then be observed whether the lamp (after the arc has increased in size by the burning away of the carbons) regulates properly. If this is not the case, the contact handle must be moved one contact back by way of experiment, and if this does not help it should then be moved two contacts forward, i. e., on the last or "strong" contact. As a rule the lamp burns best when the handle is on the last contact but one.

It often happens that a molten peak forms on the thinner carbon. The lamp then emits a hissing sound and does not give a bright light. After a short while this peak burns off of itself: it can however be broken off by means of the wood tongs. **It is advisable to separate the carbons before switching on the current.** This considerably reduces the chances of the formation of the peak mentioned, if not eliminates it altogether.

The arc lamp must be connected to the source of supply in such manner that the thin carbon is connected to the negative and the thick carbon to the positive pole of the network. Alongside the switch are affixed small labels bearing the signs + (positive) and — (negative), in accordance with which the connections should be made. The polarity of the network is ascertained by the aid of **pole finding paper.** A small strip of this paper is moistened with the finger and laid upon a table or a clean wood board, the leads the polarity of which it is desired to determine being placed on the moistened part of the paper about 3 cm. The pole finding paper is coloured red at the negative (—) pole.

The 220 volt rheostats have in addition to the terminals for 220 volts a third terminal for 110 volts so as to render it available for networks of the latter voltage. This third terminal is marked "110 volts" while the terminal to be employed for 220 volts is marked "220 volts". One terminal is the same for both voltages and is marked "110 and 220 volts".

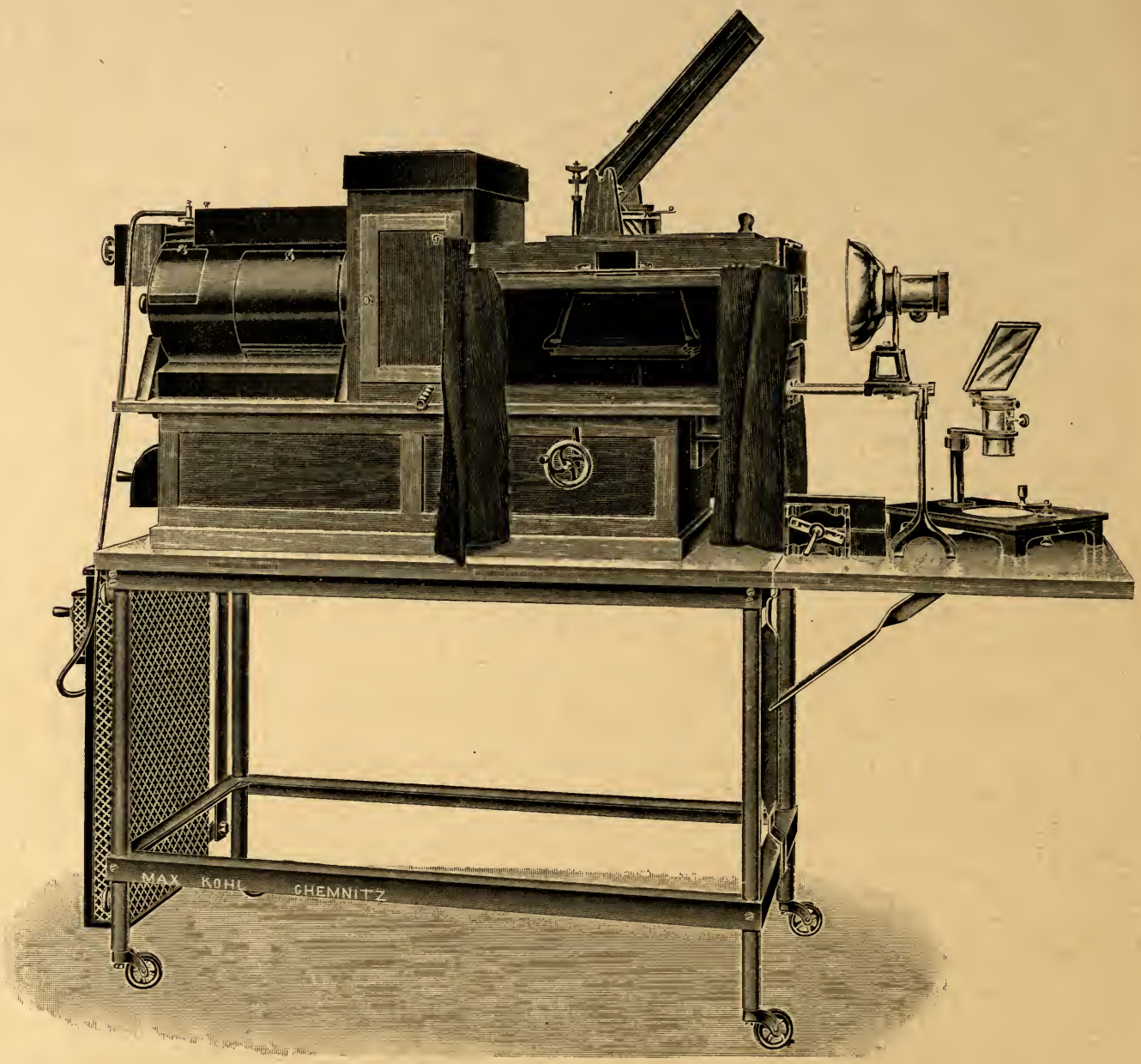


Fig. 27. No. 9500 with Nos. 9529 and 9638. 1 : 15.

Price List.

Megadiascope, large Model, 30—50 amperes Direct Current.

		£ s. d.
9500.	**Kohl's Megadiascope** (German Design), **large Model,** Fig. 27, **with arc lamp for 30 to 50 amperes Direct Current** with **hand regulation, for diapositives up to 9×12 cm. and opaque illustrations up to 18×24 cm. with Horizontal Projection Apparatus and Megascope,** and with size 1 optical outfit. Price, exclusive of Table or Regulating Resistance	66. 0. 0

For prices of the Megadiascope with other Optical Outfits, see Table on p. 1220.

This megadiascope has a projector arc lamp, handregulated, for direct current of 30 to 50 amperes; parabolic mirror 280 mm. in diameter; condenser 170 mm. in diameter; achromatic projection objective with rack and pinion focussing; continuous cooling water trough, with cock, and arranged for filling with ferrous ammonium sulphate; adjustable stage on slider; objective carrier on slider; extensible optical bench with upright for supporting same; diapositive change-frame for size $9 \times 10^1/_2$ cm.; oak chamber with peep-holes of dark glass, and curtains; oblique adjusting arrangement for the **superstructure** of the house by means of a screw; metal projection chamber with air-circulation; doors with peep-glasses, together with double-pole switch, wood tongs and key for the carbons; a **Horizontal Projection Apparatus,** Fig. 6,

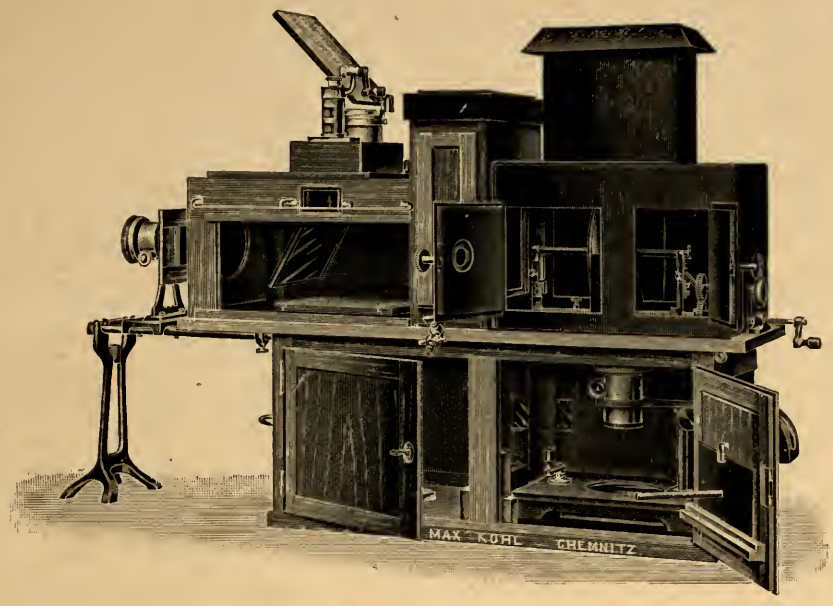


Fig. 28. No. 9510. 1:15.

with adjustable plane mirror, condenser 150 mm. in diameter, column fitted with rack and pinion, projection objective 53 mm. in diameter, with tilting erecting prism silvered on the front in metal mount; also with **Megascope for projecting book illustrations,** drawings and flat **opaque objects by means of reflected light,** having first quality illuminating mirror in metal mount, diaphragms, adjustable object stage and pressing device for firmly clamping the books, drawings, etc., erecting mirror silvered on the front, in wood mount with cover, a **Voigtländer Heliar** of 240 mm. focal length and 54 mm. aperture (£ 13), fine focussing being secured by rack and pinion. £ s. d.

In the Megascope, **periodicals,** etc., up to 36 × 26 cm. high and across can be placed and from all parts of this surface illustrations can be projected by the Megascope, even though the illustrations be not in the centre of the page.

If a water service is not at hand for cooling the trough we can supply two **interchangeable troughs** mounted on castors. These absorb about 1 ° C. of heat per minute, and can thus be used for 30 minutes; they are then changed for a freshly filled trough. The extra price for these troughs is **£ 1. 10. 0.**

9505. The foregoing Megadiascope, but with **auto-regulating Arc Lamp** for 30 or 50 amperes, with Standard Optical Outfit Size 1 . . . . . 73. 0. 0

For prices of the Megadiascope with other Optical Outfits, see Table on p. 1220.

Megadiascope, small Model, 25—30 amperes Direct Current.

9510. **Kohl's Megadiascope** (German Design), **small Model,** Fig. 28, **with Arc Lamp for 25—30 amperes Direct Current, with Hand Regulation, for Diapositives up to 13×18 cm. and opaque illustrations up to 9×10½ cm. with Horizontal Projection Apparatus and Megascope,** together with standard Optical Outfit Size 1. Price, exclusive of Table or Regulating Resistance . . . . . 51. 0. 0 £ s. d.

For prices of the Megadiascope with other Optical Outfits, see Table on p. 1220.

This Megadiascope comprises projector arc lamp, with hand regulation, for 25—30 amperes Direct Current; parabolic mirror 200 mm. in diameter; condenser 122 mm. in diameter; achromatic projection objective 43 mm. in diameter and 120 mm. focal length with rack and pinion focussing; continuous-cooling water trough, with cock, arranged for filling with a solution of ferrous ammonium sulphate; adjustable stage on slider; objective carrier on slider; extensible optical bench with supporting upright; diapositive change-frame for size 9 × 10½ cm.; oak house with dark glass peep-holes and curtains; tilting device with screw for the **superstructure** of the house; metal projector chamber with air circulation, doors with peep-glasses, with double-pole switch, wood tongs and key for the carbons; also with a **Horizontal Projection Apparatus,** Fig. 6, with first-quality plane mirror, condenser 155 mm. in diameter, pillar with rack and pinion, projection objective 53 mm. in diameter, with tilting erecting mirror silvered on the front side, in metal mount with cover; The apparatus also includes a **Megascope** (Fig. 26) **for**

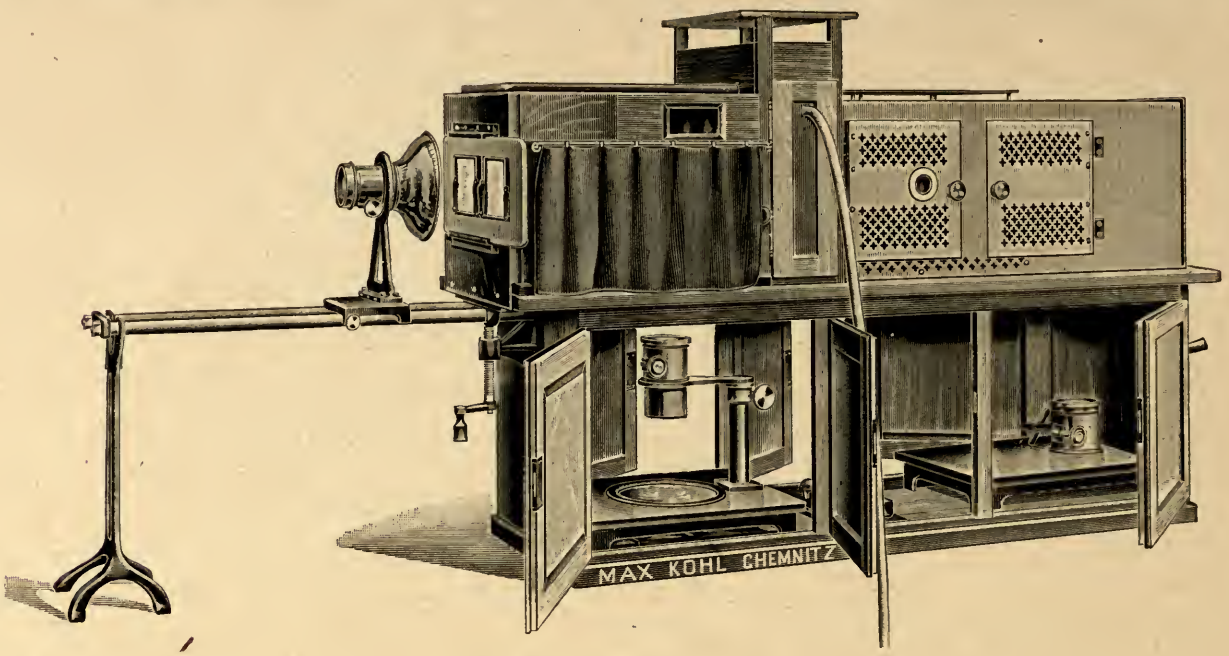


Fig. 29. No. 9515. 1:10.

projecting book illustrations, drawings and flat opaque objects by reflected light; with first-quality illuminating mirror in metal mount; a **Voigtländer Heliar** of 240 mm. focal length and 54 mm. aperture (£ 13), fine focussing of the objective being secured by rack and pinion. £. s. d.

If a water service is not available for cooling the trough, we can supply two **interchangeable troughs** mounted on castors. These absorb about 1° C. of heat per minute and can thus be used for 30 minutes, after which they must be changed by a freshly filled trough. Extra price £ **1. 10. 0.**

9515. The foregoing Megadiascope but with **automatically regulating Arc Lamp** for 25 amperes Direct Current and with the Standard Optical Outfit Size 1, Fig. 29 (see also Fig. 31) 55. 10. 0

Prices of the Megadiascopes with various Optical Outfits.

Large Model, 30—50 amperes Direct Current.

Standard Optical Outfit[1])	Size	1	2	3	4	5
Projection by **Transmitted Light:** Petzaval Projection Objective	Focal length, mm.	120	150	180	210	240
Projection by **Reflected Light:** Voigtländer Heliar, f = 1 : 4.5 . .	Focal length, mm.	240	300	360	420	480
Megadiascope, large Model, Arc lamp with **hand regulator**	No.	9500	9501	9502	9503	9504
	£	**66. 0. 0**	**73. 10. 0**	**81. 0. 0**	**88. 10. 0**	**96. 0. 0**
Megadiascope, large Model, Arc lamp with **automatic regulator**	No.	9505	9506	9507	9508	9509
	£	**73. 0. 0**	**80. 0. 0**	**88. 0. 0**	**95. 10. 0**	**108. 0. 0**

Small Model, 25—30 amperes Direct Current.

Standard Optical Outfit[1])	Size	1	2	3	4	5
Projection by **Transmitted Light:** Petzaval Projection Objective	Focal length, mm.	120	150	180	210	240
Projection by **Reflected Light:** Voigtländer Heliar, f = 1 : 4.5 . .	Focal length, mm.	240	300	360	420	480
Megadiascope, small Model, Arc lamp with **hand regulator**	No.	9510	9511	9512	9513	9514
	£	**51. 0. 0**	**57. 10. 0**	**66. 0. 0**	**73. 10. 0**	**81. 0. 0**
Megadiascope, small Model, Arc lamp with **automatic Regulator**	No.	9515	9516	9517	9518	9519
	£	**55. 10. 0**	**63. 0. 0**	**70. 10. 0**	**78. 0. 0**	**85. 10. 0**

[1]) For data relative to the **size of the image** on the screen when employing the various optical outfits, and at various distances between Megadiascope and screen, **see Table** p. 1204.

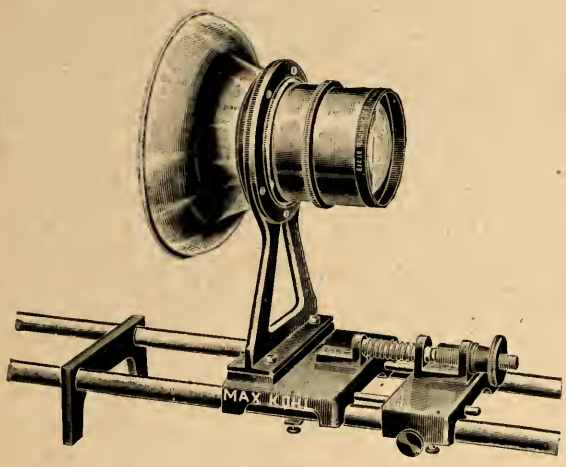


Fig. 30. No. 9525. 1:6.

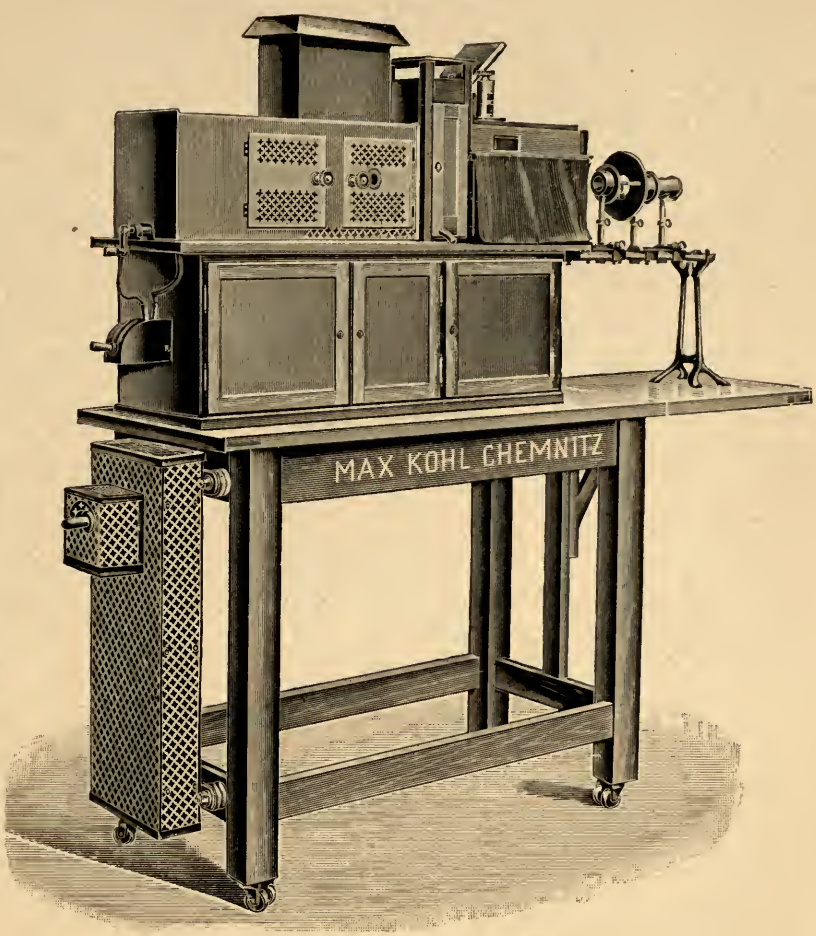


Fig. 31. No. 9515 with Nos. 9530 and 9646. 1:20.

Special Optical Outfits for Transmitted Light.

The increases in price shown in the following table take place when one of the objectives there mentioned is employed instead of the Petzaval Projection Objective:

Special Optical Outfit [1]	Size	1	2	3	4	5
a) Steinheil **Group Antiplanet**, f = 1:4.5	Extra price £	3. 10. 0	4. 0. 0	4. 10. 0	5. 0. 0	6. 0. 0
b) Zeiss **Tessar**, f = 1:6.3	„ „ „	5. 10. 0	6. 10. 0	7. 5. 0	8. 10. 0	11. 10. 0
c) Zeiss **Tessar**, f = 1:4.5	„ „ „	—	7. 5. 0	8. 5. 0	10. 0. 0	16. 0. 0
d) Voigtländer **Heliar**, f = 1:4.5 . .	„ „ „	6. 5. 0	7. 15. 0	8. 5. 0	—	13. 0. 0

Special Optical Outfits for Reflected Light.

If one of the following objectives be employed in lieu of the Voigtländer **Heliar** f = 1:4.5, the prices are increased or decreased as shown in Table:

Special Optical Outfit [1]	Size	1	2	3	4	5
e) Zeiss **Tessar**, f = 1:4.5	Increase £	3. 0. 0	4. 10. 0	—	2. 10. 0	12. 10. 0
f) Zeiss **Tessar**, f = 1:3.5	„ „	7. 0. 0	7. 0. 0	—	—	—
g) Petzaval Projection Objective. . . .	Decrease „	13. 0. 0	—	—	—	—

The sizes for which no prices are given are not constructed.

Accessories.

Switchboards, Regulating Resistances and Projection Screens (see pp. 1226—1229).

Change Frames	List No.	**9520**	**9521**
	For Plates	8,5×10	9×12 mm.
	Price	8 s. 0 d.	8 s. 0 d.

[1]) For data relative to the **size of the image** on the screen when employing the various coptical outfits, and at various distances between Megadiascope and screen, **see Table** p. 1204.

	£ s. d.
9522. **Diapositive Holder** with change frame for plates	1. 5. 0
9523. **Sliders with upright,** for mounting nicols, lenses, etc. on the optical bench . Each	0. 10. 0
9524. — do., the column adjustable laterally by screw motion	0. 18. 0
9525. **Objective Holder** with fine focussing, Fig. 30, without lenses	1. 10. 0
9526. **Special carbons** for the projector of Megadiascope, **for 25 amperes.** Price per 10 pair	0. 2. 6
9527. — do., **for 30 amperes** Price per 10 pair	0. 4. 0
9528. — do., **for 50 amperes** Price per 10 pair	0. 6. 0
9529. **Portable Iron Table for the Megadiascope, large model** (see Fig. 27), with oak top and extending leaf	8. 15. 0
The rheostat for the lamp can be placed on this and the following table, as shown in the one illustrated.	
9530. **Portable Table for the Megadiascope, small model** (Fig. 31) with extending leaf. Price exclusive of Megadiascope and Rheostat	3. 0. 0

Special Outfits.

For all experiments five sliders with uprights No. 9523 and one slider No. 9524 are necessary.

Microprojection with the Projection Microscope.

	£ s. d.
9531. **Projection Microscope** (Fig. 7 and 7a) on slider, with coarse adjustment by rack and pinion and fine focussing by micrometer screw; **with stage cooled by flowing water,** object holder, insertion tube for the objectives and revolving diaphragm	5. 10. 0
9532. **Ocular Tube** for above	0. 5. 0
9533. **Revolving Collar for 3 objectives**	1. 2. 0
9534. **Revolving Collar for 2 objectives**	0. 16. 0
9536. **Insertion Tubes for the objectives.** Each	0. 3. 0
9537. **Hartnack Objectives:** No. 2 3 5 7 / Price: 18 s. 1. 7. 0 1. 13. 0 1. 18. 0	
Zeiss, Leitz or **Winkel objectives** can also be supplied, and we will gladly submit prices.	
9538. **Huyghen Oculars:** No. 2 3 4 / Price: 5 s. 5 s. 5 s.	
9539. **Box for storing the Projection Microscope, revolving collars, objectives and oculars**	0. 16. 0
9540. **Object Micrometer,** photographed on glass, 2 mm = 200 divisions	0. 3. 6
9541. **Collection of Microscopical Preparations for school use,** 50 preparations in calico case (Fig. 7b) with complete text	1. 15. 0
This collection contains: mole's hair, fishbone, bone; scale of eel; spider's foot; spinning wart; proboscis of fly, bee and butterfly; feeler of beetle; eye of fly; spiracle; foot of fly; paunch of ruminants; sting of wasp; gnat's wing; scale of butterfly; silk; corn thrips; phylloxera; louse of domestic hen; trichina; joint of tape-worm; radula; anchor-body of sea-cucumbers; moss corals; polypus; calcareous spicules of corals; mail-coat animalcule; sponge; parenchyma; prosenchyma; cork; spiral duct; dicotyledons; epidermis; scale of leaf; crystals; sporangia; pollen; cotton; starch; peat-moss; corn mildew (black rust); smut; bunt; conferva; seaweed; diatoms; marl-slate.	
9542. — do., 25 objects in case	1. 0. 0
Larger collections and single preparations as per separate list.	

Micro-Projection with a Stand Microscope.

	£ s. d.
9543. **Microscope Stand for Projection and Microphotography,** Fig. 8, with microphotographic stage and the usual condenser, collapsible, Price, without lenses	20. 15. 0
Instead of being fitted with microphotographic stage, the stand can also be fitted with large transverse stage at the same price, if desired.	
9544. **Above Microscope Stand, with folding condensers**	22. 0. 0
9545. **Clomplete Optical Outfit for Microscope Stands Nos. 9543 or 9544**	81. 3. 6
This complete outfit contains: **4 apochromatic objectives,** focus 16 mm., num. aperture 0.3 (£ **4**); focus 8 mm., aperture 0.65 (£ **5**); focus 4 mm., aperture 0.95 (£ **7**); focus 3 mm., aperture 1.30 (£ **15**); **2 achromatic objectives** for projection without the use of an ocular, focus 26 mm., aperture 0.17 (£ **1. 7. 0**); focus 17 mm., aperture 0.3 (£ **1. 10. 0**); **5 Zeiss Microplanars,** ratio of aperture 1 : 4.5, focus 20 mm. (£ **5**), focus 35 mm. (£ **5**), focus 50 mm. (£ **5**), focus 75 mm. (£ **6**), focus 100 mm. (£ **6**);	

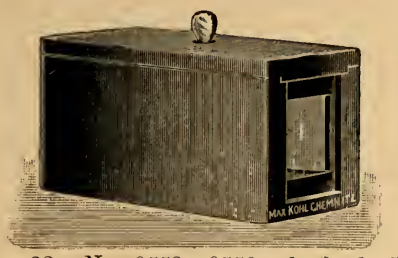


Fig. 32. No. 9553—9558. 1 : 2—1 : 5.

Fig. 33. No. 9559. 1 : 4.

2 projection oculars, two-fold magnification, with iris diaphragm (£ 3); four-fold magnification, without iris diaphragm (£ 2); **4 compensating oculars** with four-fold magnification (£ 1), with eight-fold magnification (£ 1. 10. 0), with 12 fold magnification (£ 1. 10. 0), with 18-fold magnification (£ 1. 5. 0); **1 achromatic condenser,** centrable, in holder (£ 3. 15. 0); **2 spectacle lens condensers:** double-lens, in extension tube (6 s. 0 d.), single-lens (4 s. 0 d.); **1 slider objective changer** with 8 objective sliders in holder (tube slider, 8 s.; objective sliders, each 8 s.; mount, £ 1 [£ 4. 12. 0]); **5 insertion tubes** for rapidly changing the system of projection and microplanars (each 2 s. 6 d. [12 s. 6 d.]); **insertion tube** for microscope objectives, with support for ocular screwed on (4 s. 0 d.); **2 insertion supports** without thread, intended for oculars only, in order to facilitate the change from projection without ocular to that employing an ocular (8 s. 0 d.).

Smaller and simpler optical outfits quoted for on application.

9546. **Sliders, with bridge pieces,** for erection of microscope on optical bench (Fig. 9) . . 0. 15. 0

If it be desired to work with the microscope vertical, the following are essential:

9547. **Arrangement** for permitting of the microscope being placed higher on the optical bench (Fig. 10) 1. 4. 0

9548. **Illuminating Mirror,** in mount 0. 6. 0

9549. **Erecting Mirror** for fastening on the tube of the microscope stand 2. 0. 0

9550. **Small reversing prism,** only to be used with oculars 1. 0. 0

Observation of Solid and Liquid Crystals during their Existence.

We supply **apparatus for the subjective observation of solid, fluid and liquid crystals,** Projection microscopes with heating, cooling device and arrangement for supplying electric current **in accordance with special prospectus,** sent post free on application.

Projection of the Spectrum.

9551. **1 Adjustable slit** with **micrometer screw,** Fig. 12 . . . . . 1. 7. 0

9552. **1 Collimator lens** with diaphragm and handle, Fig. 12 . . . . . 0. 17. 0

Wernicke Liquid Prisms (Fig. 32):

List No.	**9553**	**9554**	**9555**	**9556**	**9557**	**9558**	
Free Aperture	20×20	27×27	34×34	41×41	45×45	50×50	mm.
£	2. 15. 0	3. 0. 0	4. 0. 0	5. 0. 0	8. 0. 0	13. 0. 0	

Holders for above (Fig. 33):

List No.	**9559**	**9560**	**9561**	**9562**	**9563**	**9564**
	6 s.	6 s. 6 d.	7 s.	7 s. 6 d.	8 s.	8 s. 6 d.

9565. **1 Direct vision prism,** consisting of 3 crown and 2 flint glass prisms, 38×41 mm. side, 180 mm. long, in mount, with handle (Fig. 12) 8. 15. 0

9566. **Absorption Vessel,** 55×35×10 mm. internal diameter 0. 3. 6

For spectral projection 3 sliders with stand, No. 9523, are indispensable. For all experiments a total of 5 sliders with stands, No. 9523, and 1 slider, No. 9524, are necessary.

Polarisation-Projection with the Projection-Polarisation Apparatus.

9567. **Projection-Polarisation Apparatus** (Fig. 13, p. 1212), with large column of glass plates (the plates being of the finest white, thin plate glass), with 20 mm. nicol, and with arrangement for clamping preparations 7. 0. 0

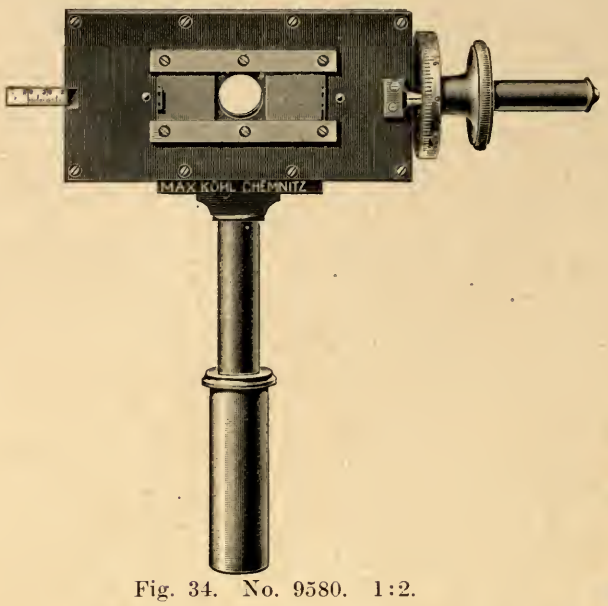


Fig. 34. No. 9580. 1:2.

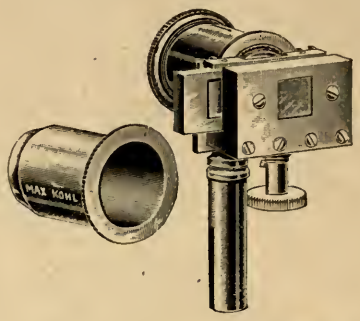


Fig. 35. No. 9581. 1:3.

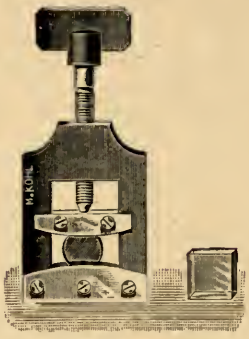


Fig. 36. No. 9586. 1:3.

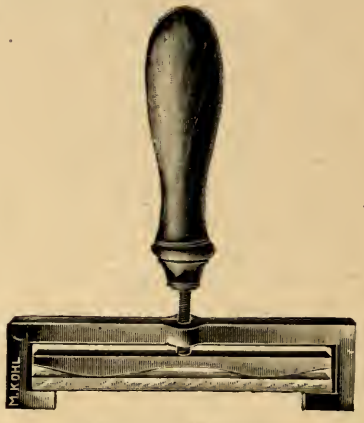


Fig. 37. No. 9587. 1:3.

Fig. 38. No. 9589. 1:4.

Polarisation-Projection in the open by Paalzow's Method.

		£ s. d.
9568.	**Bi-concave lens** (Fig. 17) with diaphragm and holder, for obtaining parallel rays	1. 5. 0
9569.	**1 open objective** (Fig. 17)	1. 10. 0
9570.	**1 Rotary object holder** (Fig. 17)	1. 5. 0
9571.	**2 Condensers for obtaining strongly converging rays of light,** Fig. 16, one of these being fitted with rotary object holder. Price together	4. 0. 0
9572.	**2 Nicol Prisms in brass mount** (Fig. 17), polariser 30 mm., analyser 24 mm. 1st Quality	18. 10. 0
	or: 2nd ,,	15. 0. 0
* 9573.	— do., polariser 25 mm., analyser 22 mm. 1st ,,	12. 10. 0
	or: 2nd ,,	11. 0. 0
9574.	— do., polariser 25 mm., analyser 20 mm. 1st ,,	10. 0. 0
	2nd ,,	8. 15. 0
	The prices of above nicols are subject to fluctuations.	
9575.	**2 Bearings for the nicols** (Fig. 16)	0. 15. 0
* 9576.	**Dark Mirror,** in mount (Fig. 18)	0. 11. 0
* 9577.	**Glass Plate Column,** in mount (Fig. 18)	1. 2. 0
9578.	**1 Delezenne Analyser,** consisting of 1 black and 1 silvered mirror, in mount, with holder	1. 11. 0
* 9579.	**2 Double refracting Prisms** (Fig. 19), 13,5 mm. diameter, with mount	2. 5. 0
* 9580.	**Complete wedge-compensation device (Babinet's)** for elliptic polarisation, Fig. 34, in mount	4. 5. 0
9581.	**Complete wedge-compensation device (Soleil's),** Fig. 35, in mount	4. 5. 0
* 9582.	**Right and left handed rotating quartz plate,** mounted in cork	0. 17. 0
* 9583.	**Nicol with sharp edges for producing the Lippich polariser,** in mount with holder	1. 8. 0
* 9584.	**Observing tube**	0. 6. 0
* 9585.	**Small window,** half red half blue glass	0. 7. 0
9586.	**Glass press** (Fig. 36), with 2 glasses, for demonstrating that glass becomes double refracting when pressure is applied to it	1. 2. 0

The items with an asterisk are absolutely necessary for carrying out the experiments.

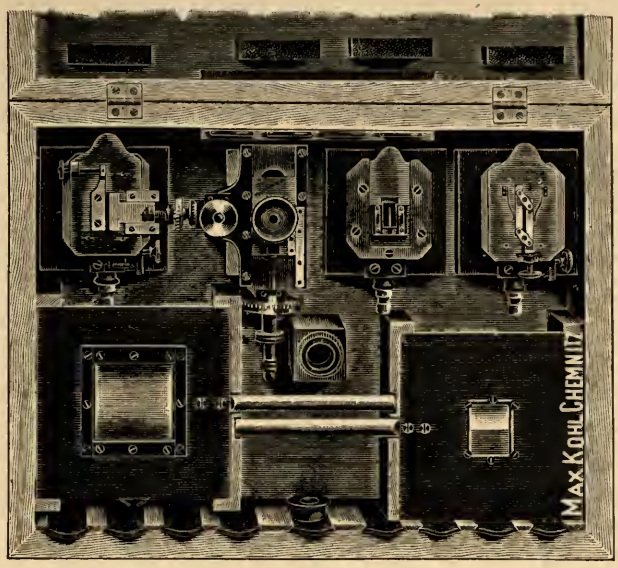


Fig. 39. No. 9598. 1:6.

		£ s. d
* 9587.	**Press,** for bending glass, Fig. 37, with **2 glass strips,** for demonstrating that glass becomes double refracting by bending	1. 2. 0
* 9588.	**Fresnel's Press,** for showing that glass becomes double refracting when pressure is applied to it (M. P. II, 1, Fig. 734)	2. 15. 0
* 9589.	**8 rapidly-annealed glass sheets** of different shapes (Fig. 38)	3. 0. 0
* 9590.	**Crossed Glass shape** (annealed), composed of two single pieces of glass mounted in cork	0. 10. 0
* 9591.	**Rock Crystal**	0. 6. 0
* 9592.	**Aragonite**	0. 8. 0
* 9593.	**Calcapar**	0. 6. 0
* 9594.	**Gypsum** with movable hyperbolae	0. 7. 0
* 9595.	**2 gypsum plates** for complementary colours, mounted in cork . Price each 3 s. 6 d.	0. 7. 0
* 9596.	— do., $^1/_4$ wave-length . . . . . Price each 4 s. 0 d.	0. 8. 0
* 9597.	**Gypsum figures** (star, **10 s.,** butterfly, **17 s.**)	1. 7. 0

For polarisation-projection by Paalzow's method 6 sliders with stands, No. 9523, or 5 sliders, No. 9523 and 1 slider No. 9524 are necessary.

Interference and Diffraction.

9598. **Complete Outfit for Interference and Diffraction Experiments,** Fig. 39 . . . . . 16. 10. 0

The outfit consists of the following: 1 cylindrical lens, 1 interference prism, 1 Fresnel ocular micrometer, Fig. 22, p. 1214, for measuring the wave-length, with red illuminating glass; 1 doubly adjustable, rotary micrometer slit, 1 rotary slit with screw adjustment, 1 rotary double grating on glass, 3 screens for taking 12 diaphragms of various form of aperture and gratings and slits of different width. All auxiliary apparatus are placed in a handsome case (Fig. 39). The set of diaphragms which we supply with this outfit comprise: 1 diaphragm with sharp edge, 1 diaphragm with needle, 1 diaphragm with hair, 1 diaphragm with a thick opaque thread, 1 diaphragm with a small round aperture, 1 diaphragm with a large round aperture, 1 diaphragm with aperture half covered with mica, 1 diaphragm with rhombic aperture, 1 diaphragm with triangle of holes, 1 diaphragm with two holes, 1 diaphragm with mesh of holes, and 1 ditto with a row of holes.

9599.	**Interference Mirror** (Fresnel's), Fig. 20, p. 1214, with parallel micrometer motion, micrometer screw with drum and graduations, on stand, of first-rate construction	7. 0. 0
9600.	— do., without parallel micrometer motion	4. 15. 0
9601.	**Fresnel Interference Mirror,** with two black polished mirrors, reciprocally adjustable by means of micrometer screw, size 40×50 mm.	2. 5. 0

The items with an asterisk are absolutely necessary for carrying out the experiments.

	£ s. d.
9602. **Interference Prism,** with diaphragm and holder	0. 16. 6
9603. **Fresnel Ocular Micrometer,** alone, Fig. 22, p. 1214, for measuring the Interference bands, on stand	5. 0. 0
9604. **Short-focus lens,** on stand, for observing the interference bands	0. 15. 0

For setting up the apparatus 2 sliders with stands, No. 9523, and 1 stand, No. 9524, are necessary.

Projection in Natural Colours by Ives's Method.

9605. **Projection Chromoscope** (Ives's) arranged for the Megadiascope, for showing photographs in natural colours. Fig. 23, p. 1214	13. 0. 0

The mode of working of the apparatus is, that three diapositives which correspond to the fundamental tints red, green and blue-violet of the object photographed, are combined on the screen into an image with the original colours, by the apparatus in question. The apparatus can also be used for a number of other experiments such as the demonstration of the mixed and complementary tints, absorption phenomena, etc., etc.

9606. **Photographs,** 3 diapositives on one plate	0. 7. 0

List of photographs on application.

Projection in Natural Colours by Diffraction.

9607. **Diffraction Chromoscope,** Fig. 24 on p. 1215, for obtaining coloured images by means of trichrome photographs produced from diffraction gratings by Wood's process. The apparatus is made to suit the Megadiascope. Price, exclusive of optical bench. . .	10. 0. 0

The outfit consists of 1 light-excluding folding box with 1 simple slit; 1 photo holder with change frame, 1 bi-concave lens, 1 slit (with diaphragm) adjustable in height and width, 1 achromatic objective with diaphragm, 2 riders with collar raised and lowered by rack and pinion, and 1 rider with stand: also 6 photographs on plates (size of image 6,5 cm.).

Complete description forwarded on application.

Projection with the Cinematograph.

9608. **Cinematograph** (Fig. 25, p. 1215), new model, well constructed, with objective of 5 cm. focal length	7. 10. 0

The new model differs from that illustrated. At a distance of 5 m. the apparatus gives a picture 1,65 m. wide. The spools are suitable for up to 100 meters (328 feet) film.

9609. **Films,** 16, 24, 32 and 48 m. in length, suitable for the cinematograph listed. Price per 1 meter (3.2 feet).	0. 3. 0

The prices of the individual films differ according to the length. List on application. The price for tinting each meter (3.2 feet) is 2 s.

We can also supply larger cinematographs for spools capable of taking 200 meters (656 feet) film, and shall be pleased to quote prices for these on application.

9610. **Cinematograph,** compactly constructed	4. 10. 0
9611. — do., with arrangement for **taking cinematographic pictures**	8. 5. 0

To this apparatus pertain 3 slides each for 20 meters (65.6 feet) of film, sufficient for an exposure of about 2 minutes. A perfectly firm stand is necessary in this connection.

9612. **Film Strips,** for taking negatives and positives . . . . . Per meter	0. 0. 8
9613. **Firm Tripod Stand**	0. 10. 0

List of Films suitable for use in connection with these cinematographs free on application.

Production of a narrow Cone of Rays

for demonstrating the Lissajous Curves, the Oscillograph, etc.

9614. **Diaphragm,** with fine aperture, and with holder	0. 6. 0
9615. **Lens,** 80 mm. diameter and 170 mm. focal length, with diaphragm and holder. . .	0. 15. 0

Switchboards and Resistances.

	£ s. d.
9616. **Switchboard** for connecting up the Megadiascope, Fig. 40, for **110 Volts** and **30 amperes** maximum, with adjustable series resistance behind the board	9. 0. 0

The switchboard contains: 2 fuses, 1 ammeter, 1 regulating resistance, contact circuit with regulating handle, 1 double-pole switch and 1 plug box. The switchboard consists of an iron framework with a marble slab as front wall. The framework contains the resistance coils of the current regulator. By means of the regulator the current of the electric arc lamp can be regulated between 15 and 30 amperes.

Fig. 40. No. 9616. 1 : 6.

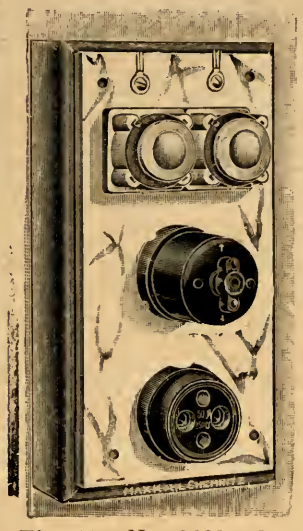


Fig. 41. No. 9621. 1 : 6.

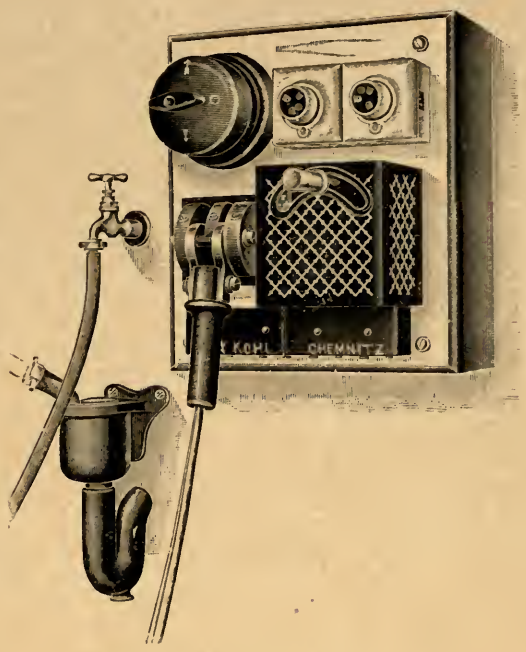


Fig. 42. No. 9622, 9649. 1 : 10.

	£ s d
9617. **Switchboard,** as No. 9616, but for **110 volts** and **50 amperes**	10. 0. 0
9618. — d o., for **220 volts** and **30 amperes**	12. 10. 0
9619. — d o., for **220 volts** and **50 amperes**	14. 0. 0
9620. **Switchboard** for **connecting** the Megadiascope with the **wall,** for 50 amperes maximum. Without series resistance The switch panel, of polished marble, contains a double-pole cartridge fuse, a double-pole instantaneous switch, and a double-pole plug box with plugs and the necessary connections.	2. 10. 0
9621. — d o., for **30 amperes** maximum (Fig. 41)	1. 10. 0
9622. — d o., for **50 amperes, with contact circuit and terminals** for the series resistance (mounted separately), Fig. 42. Price, exclusive of resistance or leads	4. 10. 0
9623. — d o., for **30 amperes**	3. 0. 0
9624. **Switchboard** for connecting the Megadiascope **with the ceiling,** for **30 amperes** maximum This switchboard differs from the preceding in that only the fuse and the switch are mounted on it, while the plug, of special construction, is given separately.	1. 10. 0

Series Resistances, for **50 amperes** maximum, with terminals, for use with Switchboard No. 9622.

List No.	**9625**	**9626**	**9627**	**9628**	
Working Pressure	65	110	150	220	Volts
Prices: £	**3. 10. 0**	**6. 10. 0**	**8. 10. 0**	**10. 10. 0**	

— d o., for **30 amperes,** for use with switchboard No. 9623.

List No.	**9629**	**9630**	**9631**	**9632**	
Working Pressure	65	110	150	220	Volts
Prices: £	**2. 0. 0**	**3. 0. 0**	**4. 10. 0**	**6. 10. 0**	

— d o., for **25 amperes** maximum, for use with switchboard No. 9623.

List No.	**9633**	**9634**	**9635**	**9636**	
Working Pressure	65	110	150	220	Volts
Prices: £	**1. 10. 0**	**2. 10. 0**	**4. 0. 0**	**6. 0. 0**	

Rheostat for 50 amperes, for fixing to the room wall or on to the Megadiascope table, with contact circuit, for use with switchboard No. 9620.

List No.	**9637**	**9638**	**9639**	**9640**	
Working Pressure	65	110	150	220	Volts
Prices: £	**5. 0. 0**	**8. 0. 0**	**10. 0. 0**	**12. 0. 0**	

Fig. 43. No. 9648 a — 9648 d. 1:10.

Fig. 44. No. 9650. 1:33.

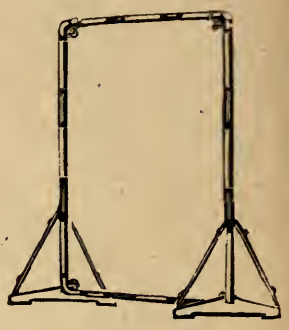


Fig. 46. No. 9657. 1:60.

Rheostat, for placing on the **floor,** Fig. 43. £ s. d.

List No.	9641	9642	9643	9644	
Working Pressure	65	110	150	220	Volts
Prices: £	**6. 0. 0**	**8. 10. 0**	**10. 10. 0**	**12. 10. 0**	

Rheostat, for **30 amperes,** for fixing on the **room wall** or on to the **table of Megadiascope** (see Fig. 27, p. 1218) with contact circuit, for use with switchboard No. 9621.

List No.	9645	9646	9647	9648	
Working Pressure	65	110	150	220	Volts
Prices: £	**4. 10. 0**	**4. 15. 0**	**7. 0. 0**	**9. 0. 0**	

— do., for placing on the **floor** (Fig. 43).

List No.	9648 a	9648 b	9648 c	9648 d	
Working Pressure	65	110	150	220	Volts
Prices: £	**5. 0. 0**	**5. 5. 0**	**7. 10. 0**	**9. 10. 0**	

9649. **Water Inlet and Waste** (Fig. 42), consisting of a water cock for the pipes, and a lead funnel on wall bracket for screwed joint for the waste pipe 0. 13. 0

Projection Screens.

Projection Screens, of prepared pure white fabric, for reflected light, Fig. 44, with roller actuated by cord, for firmly fixing to the wall, to the ceiling, or above the cornice of the blackboard frame; 2,5×3 m. £ s. d.

List No.	9650	9651	9652	9653	9654	9655
Sizes:	2,5×3	3×3	3,5×3,5	4×4	4,5×4,5	5×5 m.
Prices: £	**2. 10. 0**	**3. 0. 0**	**3. 15. 0**	**5. 5. 0**	**7. 0. 0**	**9. 5. 0**

The screens have a dead white surface, are seamless for a length of 3 m., are very durable, and show up the image well. The rolled-up screen is contained under a cornice with wax strips, thereby preventing the access of dust or any damage occuring when not in use.

9656. **NEW! Projection Screen with electric device for rolling up,** Fig. 45, with prepared screen 3×3 m. of white surface surrounded by a black border 25 cm. wide 25. 10. 0

This arrangement is worked by an electric motor with worm gearing on wall bracket. The device can be operated from any part of the room, by switching on the motor by a hand reversing switch, which together with the fuses is contained on a marble panel on the wall. The motor is thrown out of gear by an automatic switch when the screen has reached the two extreme positions.

The device is supplied both for **continuous and three-phase current.** There is an extra charge of **£ 1** if for **three-phase current.**

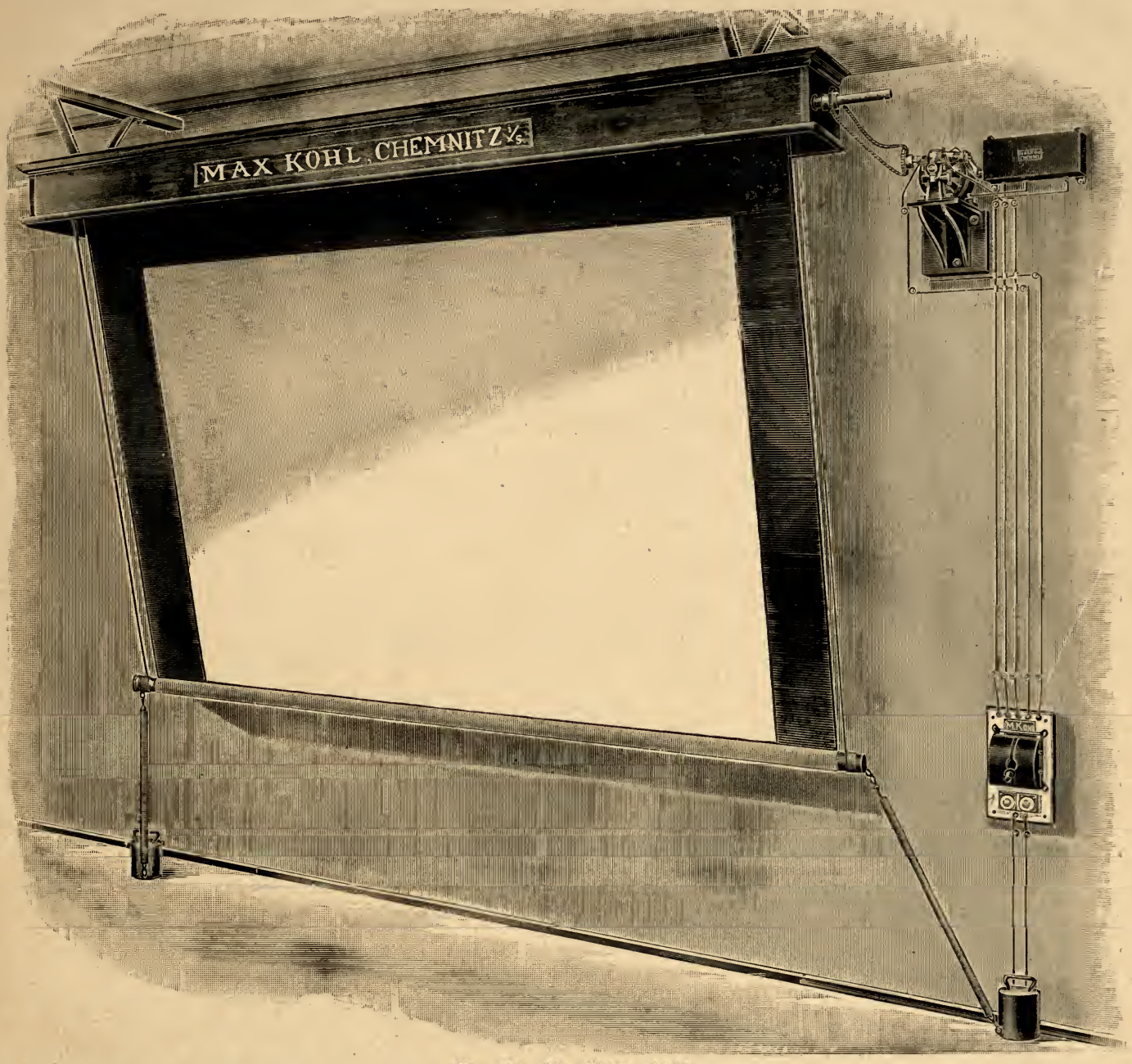


Fig. 45. No. 9656. 1:30.

	£ s. d
9657. **Transportable Stand** (Fig. 46), with projection screen 2,5×2,5 m. of white linen, in carrying bag	2. 5. 0
9658. — do., with screen 3×3 m.	3. 5. 0

Estimates.

9500. **Megadiascope, large model,** arc lamp with **hand regulator,** with Standard Optical Outfit Size 1 . . . . . £ 66. 0.0
9528. 10 Pairs **Special Carbons,** for 50 amperes . . . . . „ 0. 6.0
9620. **Switchboard** for connecting Megadiascope with wall . . . . . „ 2.10.0
9626. **Series Resistance** for 110 volts, 50 amperes . . . . . „ 6.10.0
9649. **Water Inlet and Waste** . . . . . „ 0.13.0
9651. **Projection Screen,** rolling-up device with cord; size 3×3 m. . . . . „ 3. 0.0
9659. Megadiascope, large model, with preceding accessories . . . . . £ 78.19.0
9529. **Portable Iron Table** . . . . . £ 8.15.0

9510. **Megadiascope, small model,** arc lamp with **hand regulator,** with Standard Optical Outfit, Size 1 . . . . . £ 51. 0.0
9527. 10 Pairs **Special Carbons** for 30 amperes . . . . . „ 0. 4.0
9623. **Switchboard,** for connecting up the Megadiascope with the wall . . . . . „ 3. 0.0
9630. **Series Resistance** for 110 volts, 30 amperes . . . . . „ 3. 0.0
9649. **Water Inlet and Waste** . . . . . „ 0.13.0
9651. **Projection Screen,** rolling-up device with cord; size of screen 3×3 m. . . . . „ 3. 0.0
9660. Megadiascope, small model, with preceding accessories . . . . . £ 60.17.0
9530. **Portable Table** . . . . . £ 3. 0.0

Special Outfits.

9661. **Projection of the Spectrum:** 1 adjustable slit No. 9551, 1 collimator lens No. 9552, 1 absorption box No. 9566, 3 sliders[1]) No. 9523 . . . . . £ 3.17.6
9662. **Micro-projection** with the Projection Microscope No. 9531: No. 9537 (Objectives Nos. 2 and 5), 2 insertion tubes No. 9536 . . . . . „ 8. 7.0
9663. **Polarisation-Projection** with Polarisation Apparatus No. 9567 . . . . . „ 7. 0.0

For those with ample Means.

9664. **Interference and Diffraction,** Outfit No. 9598, 2 sliders No. 9523[1]), 1 slider No. 9524 £ 18. 8.0
9665. **Projection in natural Tints** (Ives's Method), No. 9605 and 3 photographs No. 9606 „ 14. 1.0
9666. — do., by diffraction, No. 9607 . . . . . „ 10. 0.0
9667. **Cinematograph** No. 9610 and 3 films (£ 1) . . . . . „ 5.10.0
9668. Production of a **narrow Pencil of light :** diaphragm No. 9614, lens No. 9615, 2 sliders[1]) No. 9523 . . . . . „ 2. 1.0

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[1]) When a number of the items Nos. 9661, 9664 and 9668 are ordered simultaneously a total of 2 sliders No. 9523 only are delivered with these outfits.

Testimonials.

Unter-Barmen, 25th May, 1906.

I beg to inform you that I am satisfied with the Megadiascope supplied.

Direction of the Royal Real Gymnasium, Barmen-Elberfeld.

Duisburg-Meiderich.

The Megadiascope has fulfilled its purpose completely at a school lecture.

H. Hermanni.

Duisburg-Meiderich (Lower Rhine), 10th March, 1907.

It is with pleasure that I am able to confirm that we are completely satisfied with the efficiency of the Megadiascope. It has yielded excellent services in connection with a number of lantern lectures.

Prof. **Hermanni,** Real Gymnasium.

Complete Price Lists relating to the following sent if desired:

Darkening Devices, worked by hand or Electric Motor, for lecture theatres, photographic dark rooms, etc.

Scientific Diapositives in connection with **Astronomy, Meteorology, Physical Geography** and **Physics.**

Scientific Diapositives relating to **Zoology** and **Botany.**

Microscopic Preparations relating to **Zoology** and **Botany.**

Microscopical Preparations relating to **Viticulture, Zymology, Dairy Farming Industry,** and of **Provisions, Starch, Flour, Roots, Fruits, Condiments,** also of **Adulterated Food-stuffs.**

Microscopical Preparations of **Wool, Silk, Textile Fibres, Paper.**

Microscopical Preparations of **pharmocognostic, pathological Articles,** and of **tinged Preparations.**

Physical Apparatus which are set up in front of the Megadiascope or on the optical bench of the same, from all branches of physics.

If desired, we supply samples of **plates of Butterflies, Beetles,** etc. The projection of **alcohol preparations,** etc., which are placed outside the apparatus, can also be arranged for. Price on application.

We carry a special price list relating to **Projection Lanterns for Electric Light, Lime Light, Thorium, Nernst** and **Spirit Glow Light, Acetylene** and **Paraffin Light,** which we shall be glad to submit on application.

References as to Megadiascopes supplied.

Arzberg, Technical Continuation School
Barmen, Kgl. Baugewerkeschule
Berlin, Kaiserin-Friedrich-Haus
Biebrich, Realgymnasium
Bozen (Tyrol), Stadtbauamt
Charlottenburg, Technical High School
Chemnitz, König-Albert-Museum
Cleveland (Ohio), Case School of Applied Science
Dresden, Kunstgewerbeschule mit Museum
Duisburg, Kaiserin-Augusta-Viktoria-Schule
Ekaterinoslav, Société Russe de Fabrication de Tubes
Helsingfors (Finland), Aktiebolaget Akademiska Bokhandeln
Innsbruck (Austria), Commercial Academy
Karlsruhe, Mittelschule a. d. Gartenstr.
Kiel, H. Henstren
Kyoto, G. Shimadzu & Co.
Leipzig, Oskar Schöppe
London, Baker & Startin
Lund, Physical Institute
Madrid, Viuda de Aramburo (3 apparatus)
Magdeburg, Kgl. Maschinenbauschule
Milwaukee (U. S. A.), National German-American Teachers Seminary and German-English Academy
Mittweida, Realschule
Odessa (Russia), Cadet Corps
Prague, Royal Bohemian University
Repcine, Lehrerinnenbildungsanstalt
Ruhrort-Duisburg, Realgymnasium Meiderich
Seville, Ecole supérieure d'Arts et d'Industrie
St. Petersburg, Victor Frantzenn
Friedrich Raum (2 apparatus)
Chinesische Ostbahngesellschaft
Schöneberg (Berlin), Werner-Siemens Realgymnasium
Urbana (U. S. A.), University of Illinois.

Subject Matter Index.

Offices and Workshops.

Cl. 4723.