Max Kohl Aktiengesellschaft

Manufacture and Magazine of Physical Apparatus

Chemnitz

Germany.

Telegraphic address:
Physik, Chemnitz.

ABC - Code
5th Edition used.

Gentlemen,

We herewith beg to recommend ourselves as manufacturers of

Phyiscal Apparatus

and beg you to kindly adress yourselves to our firm, when you contemplate buying such apparatus.

Annexed we have pleasure in sending you some

specimen-pages of our price-list № 50

vol I—III

which will enable you to judge the great variety of our manufacture.

Our catalogue 50 vol I—III consisting of 1130 pages and containing about 6000 illustrations is sent, free of charge, to all larger schools cultivating education in Physics.

In case no copy of our catalogue should have been sent to you or it should no more be at your disposal, kindly let us know and we shall gladly send you a copy.

Owing to our large stock in physical apparatus we are in a position to execute even important orders in a short delay.

We shall be glad to hear from you soon and to be favoured with your esteemed orders, which will at all times have our best attention.

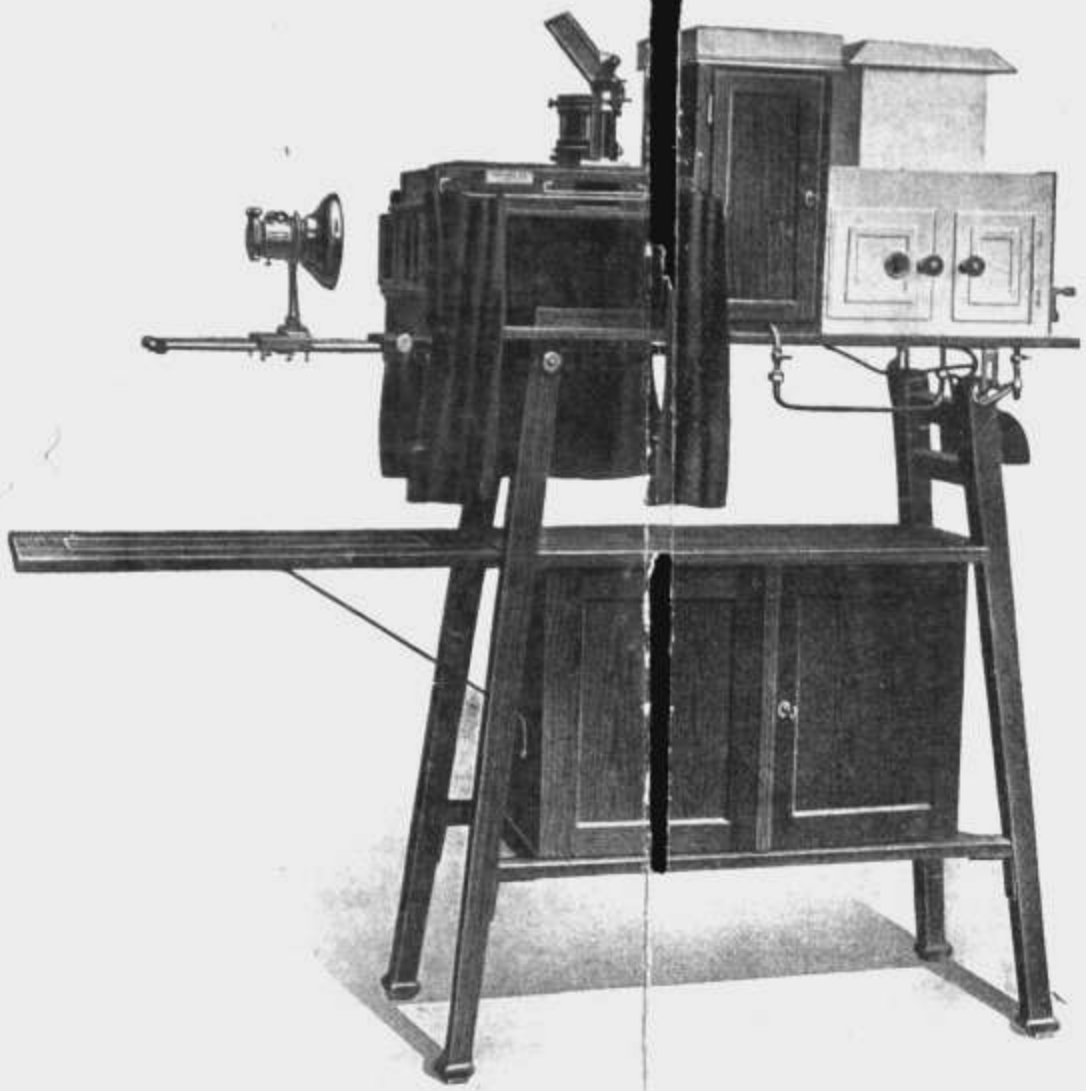
We are, dear Sirs,

Yours very faithfully

Chemnitz, date of the postmark.
Germany.

Max Kohl Aktiengesellschaft.

.. 87. e.



63750. 1 : 16.

	£ s. d.
63 750. **Megadiascope,** model A, for projecting diapositives up to 9 × 12 cm and opaque illustrations up to 17 cm diam. projector arc lamp, handregulated, **for direct current** of 25 to 30 amperes, parabolic mirror 200 mm in diameter **cooled with water,** achromatic projection objective of 150 mm focal length, focussing being secured by rack and pinion, continuous cooling water trough, objective carrier on slider, diapositive change-frame for diapositives $8^1/_2 \times 8^1/_2$ cm, $8^1/_2 \times 10$ cm and 9 × 12 cm, house of oak-wood, projector chamber of metal with air circulation, doors with peep-glasses, stand of pine with case for storing the accessories. The megadiascope is equipped with:	
1 **Horizontal Projection Apparatus** with adjustable plane mirror of first class quality, condenser 150 mm in diameter, projection objective 53 mm in diameter, with tilting erecting mirror silvered on the front in metal mount, and	
1 **Megascope** for projecting book illustrations, drawings and flat opaque objects by means of reflected light, having first quality illuminating mirror in metal mount, a Voigtländer Heliar of 240 mm focal length and 54 mm aperture, fine focussing being secured by rack and pinion	62. 10. 0

Equipment of the Class Rooms of Public Schools and Colleges.

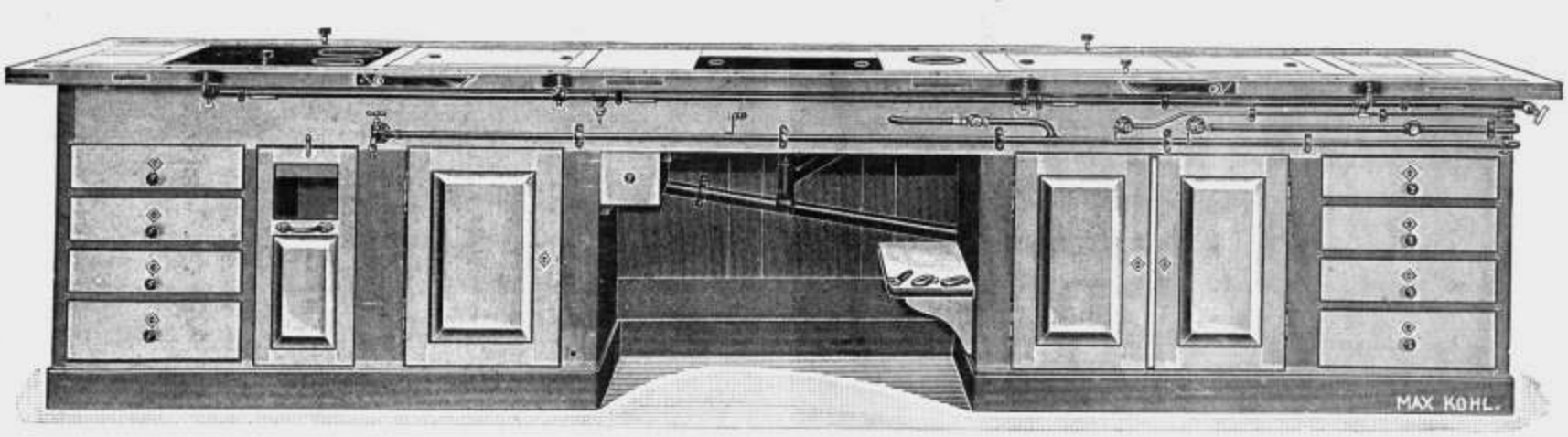
Lecture Tables for Physical and Chemical Instruction.

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 table 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.**



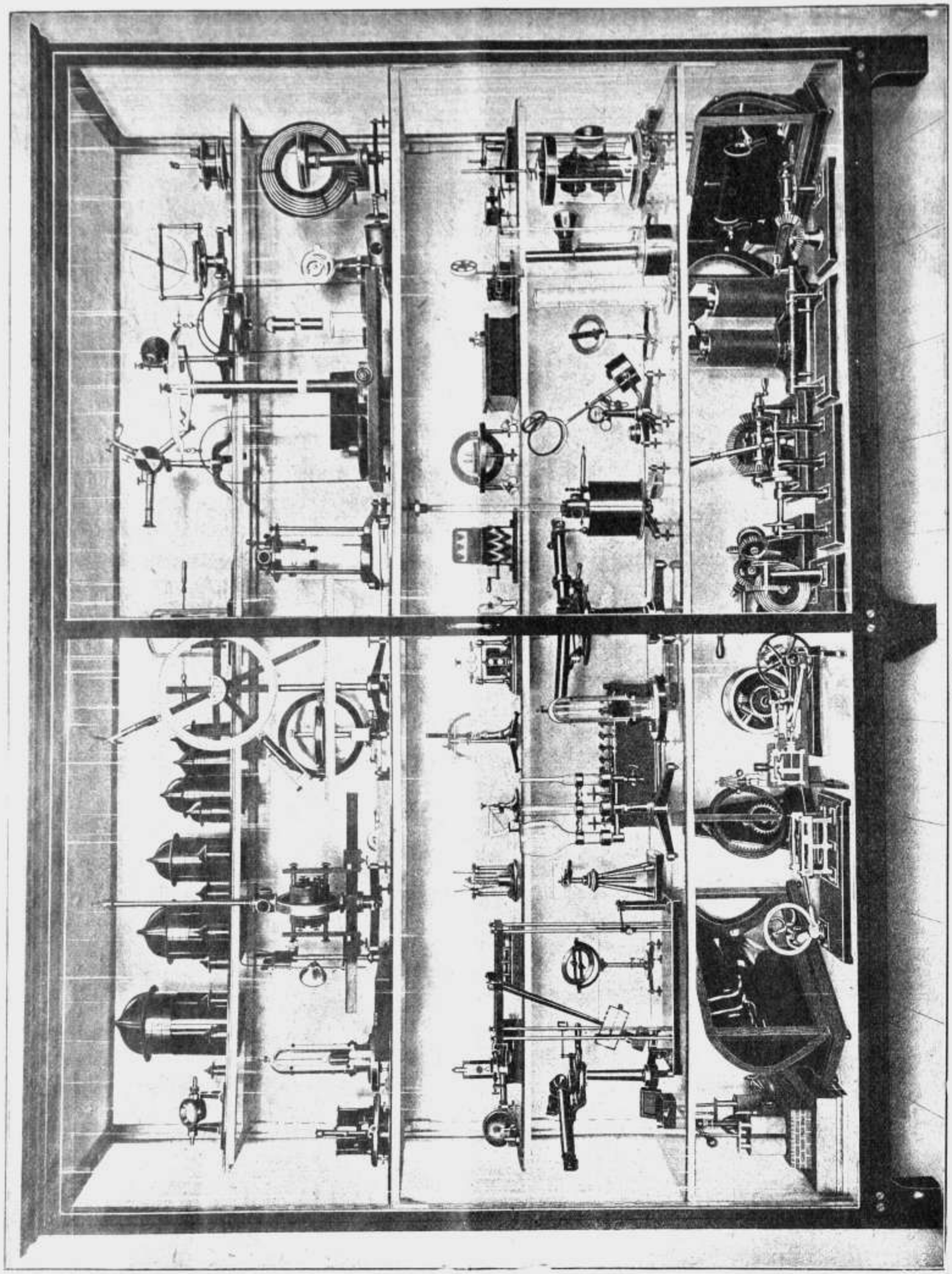
50003. 1 : 22.

Lecture Table (as suggested by Weinhold), 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., Platte III and Figs 13, 14, 15), see Fig. 50,003.

		£ s. d.				
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. Te **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



50,288. **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.

£ s. d.

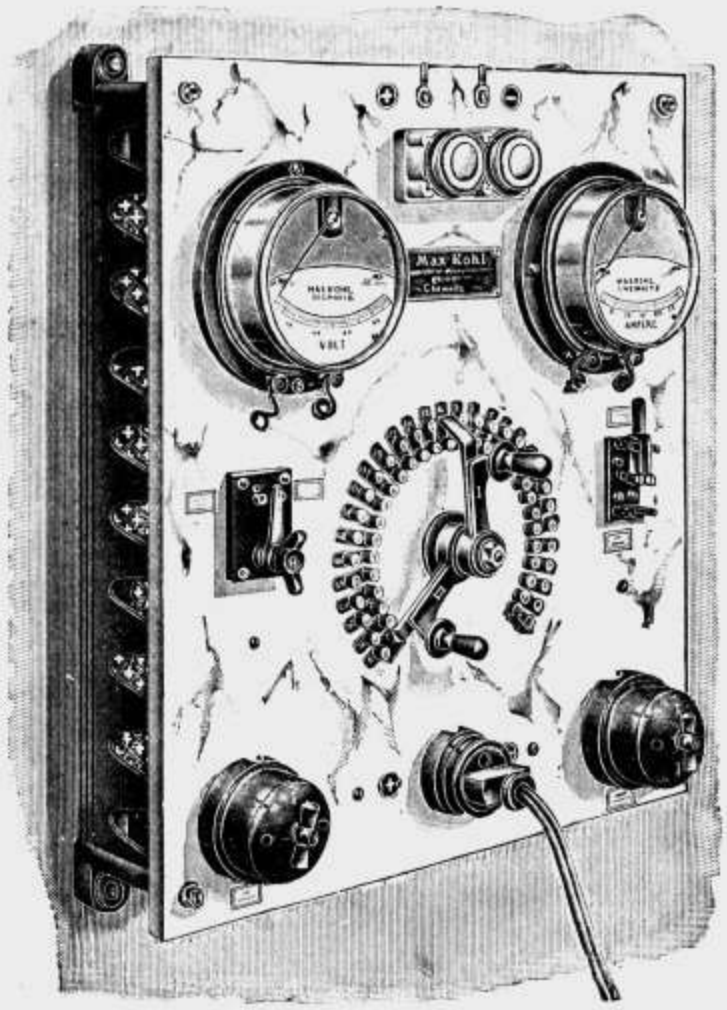
Length 3 m; height 2.5 m; depth 0.6 m . . . . . } Prices on Application

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

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.

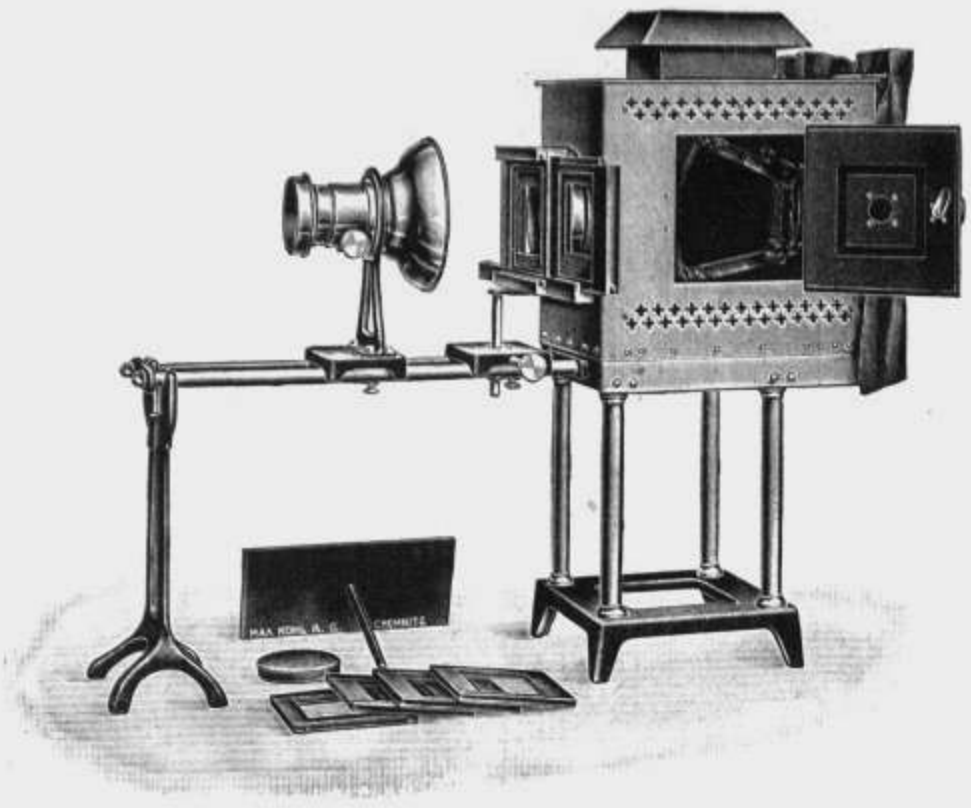
On the other hand, the switchboard should permit of such experiments being made which are only rendered possible by heavy currents, such as the demonstration of the electric arc light, the singing arc, and others.

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 repart 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.



50 735. 1 : 10.

Prices of Projection Apparatus.

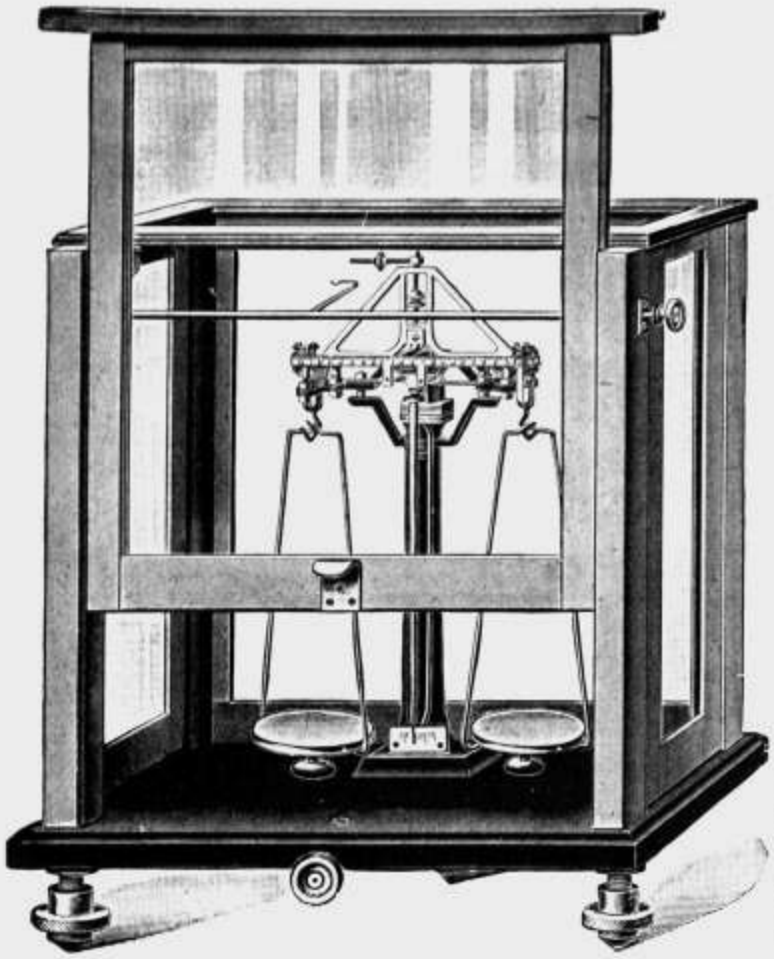
School Projection Apparatus, Model A, Figure 50,735, for projecting apparatus and photographs; with Condenser, Achromatic Objective, Optical Bench, Change Frame with smaller frame inserted for taking diapositives 9 × 10.5 cm, 8.5 × 10 cm and 9 × 12 cm, 1 stage and one movable slider with stand in which 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 Namp, No. 50 932	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

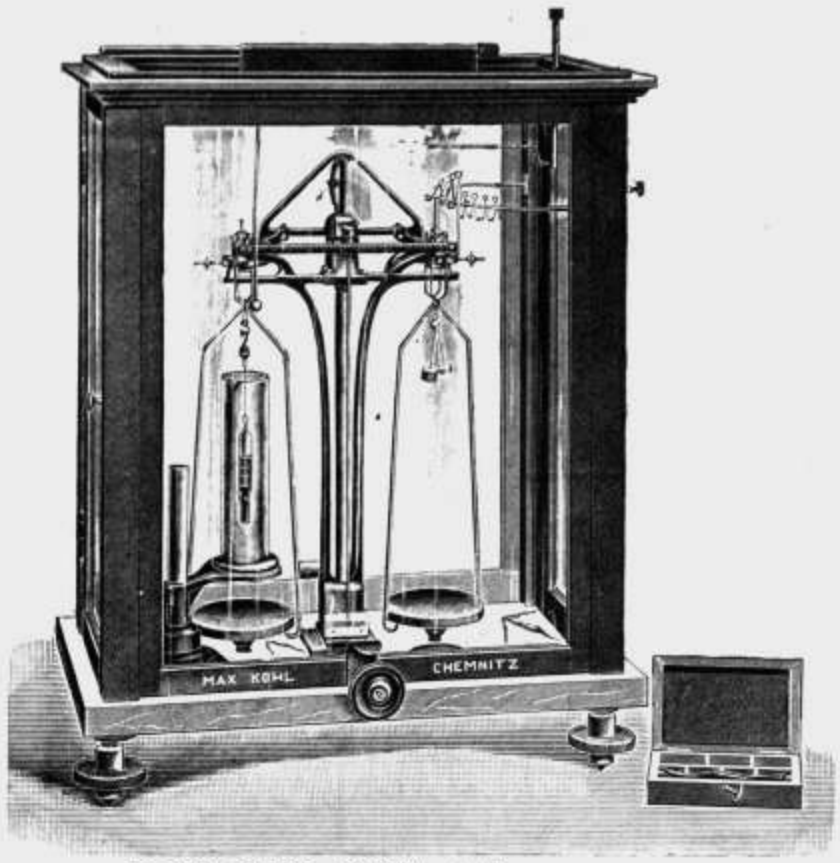
Switchboards see page 169, **Regulating Resistances** for the apparatus with electric arc lamps — see pp. 1226—1228. **Fixed Series Resistances,** Transformers and **flexible triple leads** — see pp. 168 and 169. Better **Optical** and **other Outfits** — see Nos. 50,750—50,767, p. 161.

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



51529. 1:6.



51533 (51537), 51578. 1:8.

Analytical Balance, also suitable for specific gravity determinations, cf. Figure 51,533, with agate planes, gilt or platinised pans, mahogany-glass case with 4 sliding windows, aluminum beam with quick-swing pointer, on white or plack plate glass base, with rider slide when case is closed. The following are not included in the price: the stage, the glass vessel, the Reimann thermometer flask, the rider weights and counterpoises. | £ s. d.

List No.	51,531	51,532	51,533	51,534
To carry	5	50	200	1000 grams
Sensitivity	0.1	0.1	0.2	1 mg
Price £	5. 15. 0	6. 10. 0	7. 15. 0	10. 5. 0

Prices exclusives of Rider Weights. For Sets of Weights and Rider Weights, see pages 241—243.

— The preceding, **without iron or steel parts,** agate axes.

List No.	51,535	51,536	51,537	51,538
To carry	5	50	200	1000 grams
Sensitivity	0.1	0.1	0.2	1 mg
Price £	6. 5. 0	7. 0. 0	8. 10. 0	11. 0. 0

51,539. **Precision Balance for Rapid Work,** Figure on p. 234, for load of 200 g, with lens-mirror reading and two superposed scales, case with sliding windows and side doors, axes and bearings of best agate, mounted on marble slab . . . . . | 9. 10. 0

In order to read the tenth-milligrams direct with this quick-swing balance, a power 5 lens-mirror (achromatic objective with silver coating) is fixed on the pillar magnifies, without reflex or distortion, the whole of an opal glass scale, divided in $^1/_5$ths mm, fitted about 20 mm above the ivory scale.

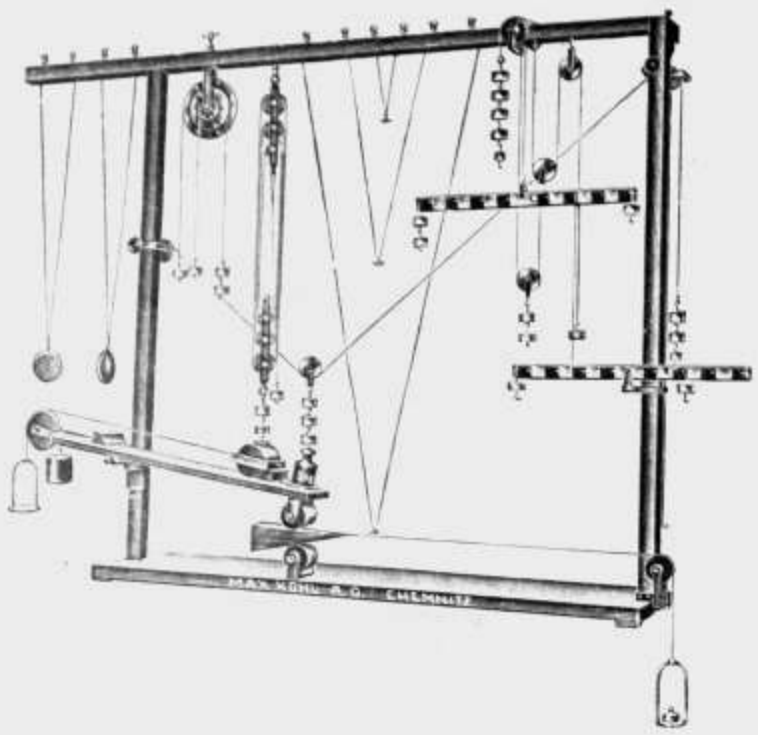
The whole milligrams are read off on the ivory scale; the tenth-milligrams being determined by glancing at the glass scale on the mirror for purposes of confirmation.

As therefore the mirror and the magnification which is read by both eyes is only used at the last moment, the eyes are not in any way strained. The work with both scales is excellent, sure and rapid. The deflection with all loads is, in the mirror, 10° and on the ivory scale 2° per milligram.

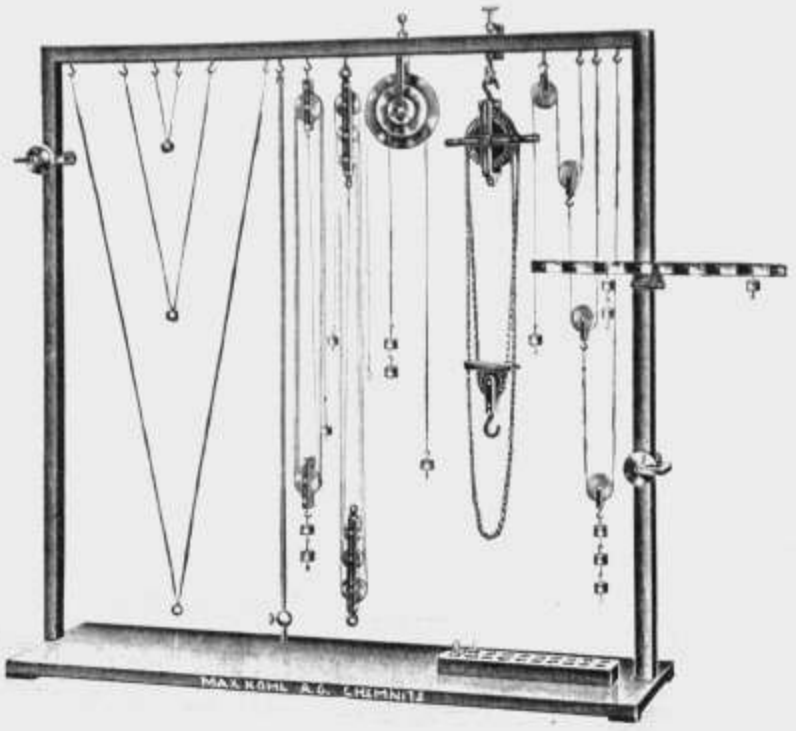
Extra if mounted on glass slab . . . . . | 0. 5. 0

If Microscope Reading is fitted in place of the mirror the balance is increased in cost by . . . . . | 1. 5. 0

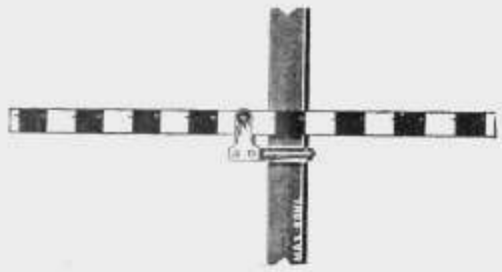
Cl. 5495, 3939.



51 850. 1 : 16.



51 851. 1 : 15.



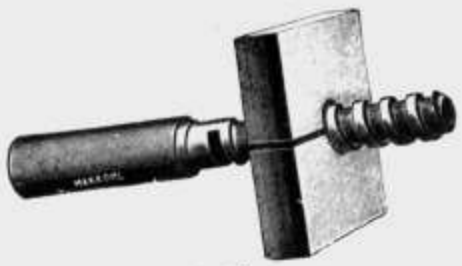
51 851 b. 1 : 8.

Mechanics of Solids (Statics and Dynamics).

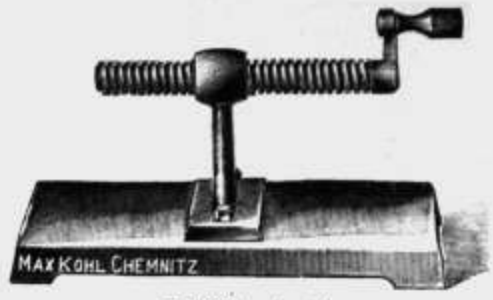
	£ s. d
51,850. **Collection of Apparatus for demonstrating the Laws of Mechanics,** Figure	9. 0. 0
The following are included in the above price: 1 Oak Frame, 1 m high and 1 m wide; 1 Inclined Plane; 1 Wedge Apparatus; 2 Weigh Pans; 2 Aluminium Levers with steel axes and steel pins passing through, one firmly fixed, the other arranged for suspending; 1 Set Pulley Blocks with 2 blocks and 3 pulleys arranged in series; 1 Tackle with 3 pulleys; 1 Arbor Wheel with cramp; 2 Disc-shaped Pendulums of equal length, hanging in various planes, with swivel for adjusting the length; 3 Lenticular Pendulums of 90, 40 and 10 cm length, with swivels for adjusting; 3 Pulleys with cramps (W. D., Fig. 69 A [62 A]; 1 Loose Pulley, of aluminium, with steel axis, brass bow and with 1 hook; 1 Set of Weights with iron weights of 50 g to 5 kg; 1 Set of Double-cheek Weights, each with 20 weights of 100 g and of 50 g.	
51,851. **Collection of Apparatus for demonstrating the Laws of Mechanics,** Figure, consisting of the following apparatus, these pieces of apparatus being also supplied singly at the prices given: a, b, d 1, d 2, e, f, g 1, h—m.	5. 18. 0
(a) **1 Frame, of oack,** 1 m high, 1 m wide, with small hooks screwed in (W. D., Fig. 69 B [62 B])	0. 12. 0
(b) **1 Lever,** of aluminium, with steel axis and with steel pins passing through at equal intervals apart, lacquered in two colours, with metal bow, on cramp, Figure . . .	0. 8. 0
(c) **Pulleys,** aluminium, with steel axis and brass bow:	
1) With 1 hook . . . . . Each	0. 2. 0
2) With 2 hooks . . . . . Each	0. 2. 6

Cl. 5713, 5712, 486.

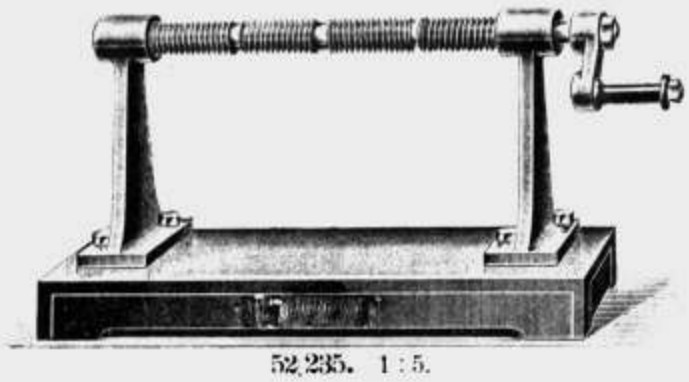
52 233. 1 : 5.



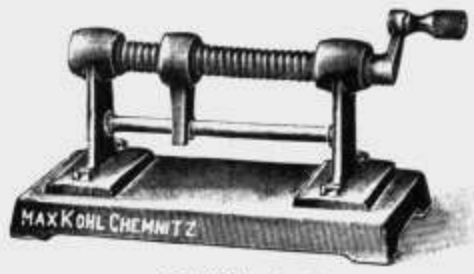
52 234 1 : 4.



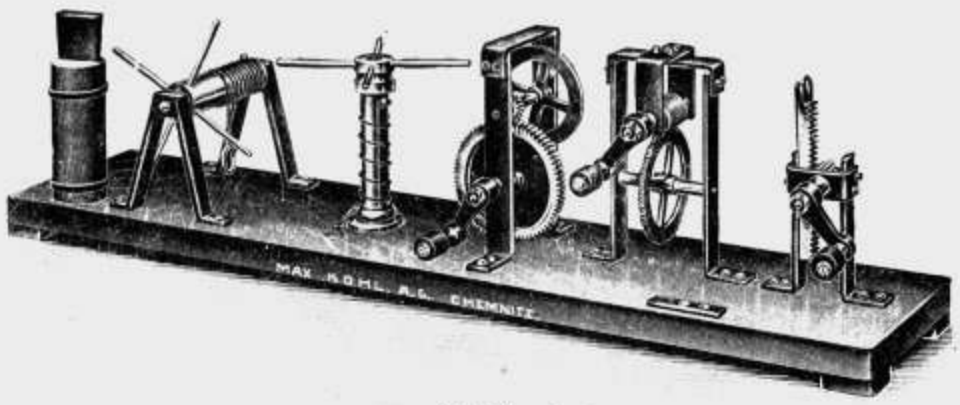
52 237. 1 : 6.



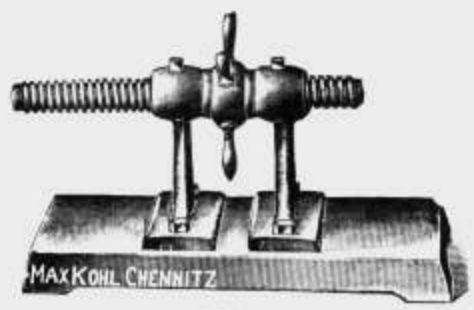
52,235. 1 : 5.



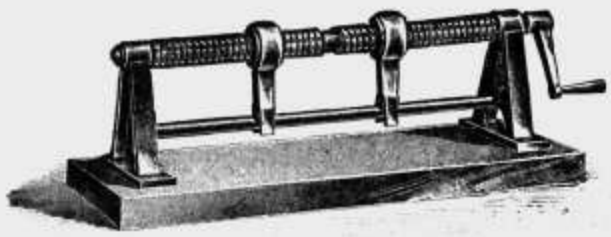
52 238. 1 : 6.



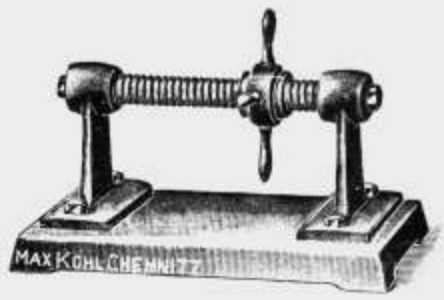
52 236. 1 : 8.



52 239. 1 : 6.



52 241. 1 : 6.



52 240. 1 : 6.

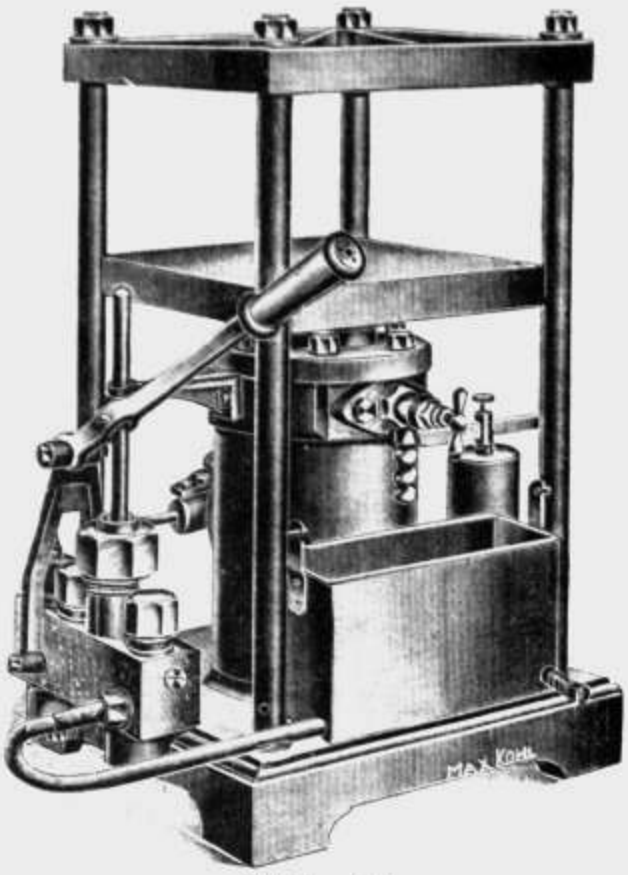
	£ s. d.
52,233. **Triangular Screw Thread with Nut cut through,** Figure, of wood	0. 2. 6
52,234. **Square Screw Thread, with Nut cut through,** Figure, of wood	0. 3. 0
52,235. **Model of Screw** with 4 threads of different shape and pitch, without nuts, of metal, Figure.	1. 10. 0
52,236. **Simple Machines,** Figure. Wedge, Windlass, Capstan, Toothed Gearing with fly-wheel, Worm Gearing and Screw Jack, mounted on one baseboard	4. 15. 0

Gearing with Screws, Cranks, Links, Rods, Joints and Discs.

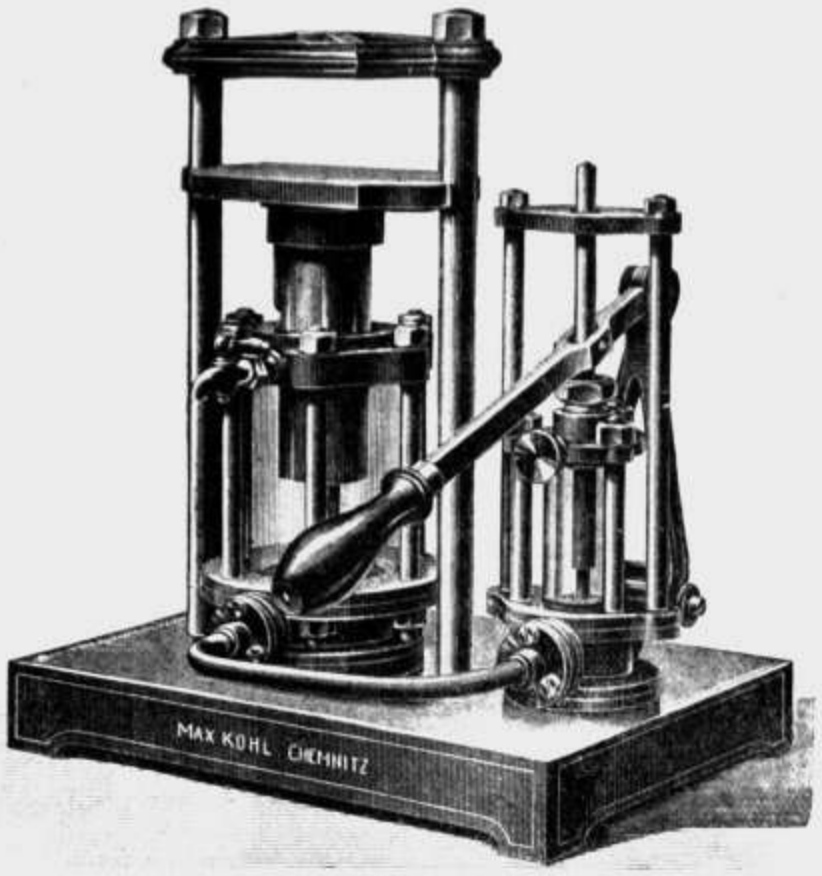
52,237. **Fixed Nut with Rotary Screw Spindle,** Figure, with angular, accurately turned thread, constructed entirely in iron	1. 0. 0
52,238. **Fixed Screw Spindle, with Rotary Progressive Nut,** Figure	1. 4. 0
52,239. **Screw Spindle, rotary, resting immovably in its bearings, with straight guided, progressive nut,** Figure	1. 10. 0
52,240. **Rotary Nut, incapable of lateral movement, with straight guided, progressive screw spindle,** Figure	1. 10. 0
52,241. **Screw with Right-and-Left-Handed Thread,** Figure, with nuts	2. 10. 0

Apparatus for showing the **formation and mode of action of the screw,** see No. 51,905—51,910, p. 273.

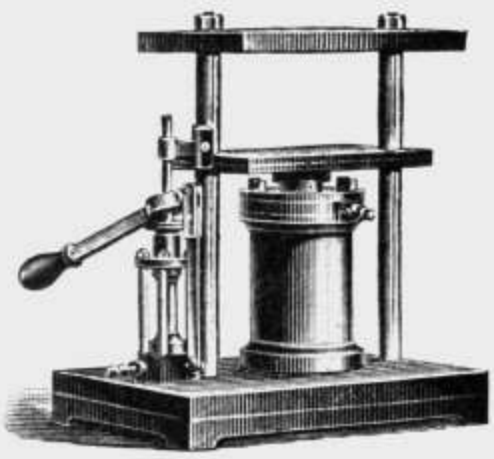
Cl. 518, 519, 3786, 521, 3787, 5805, 3788, 520, 3789.



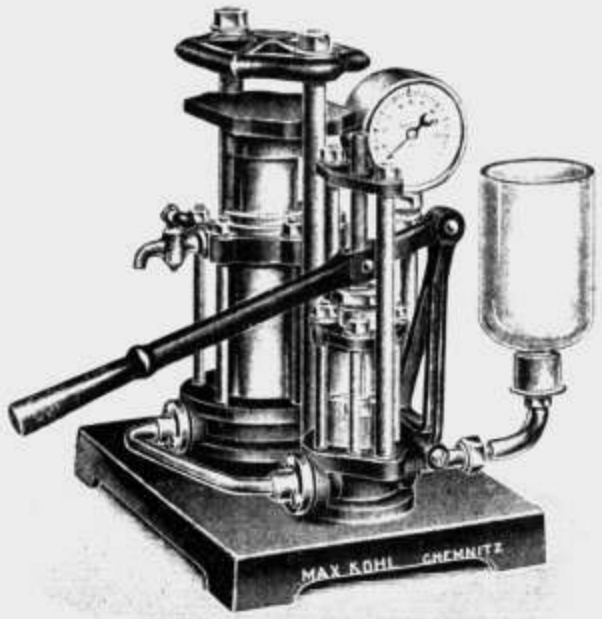
52461. 1:6.



52465. 1:4



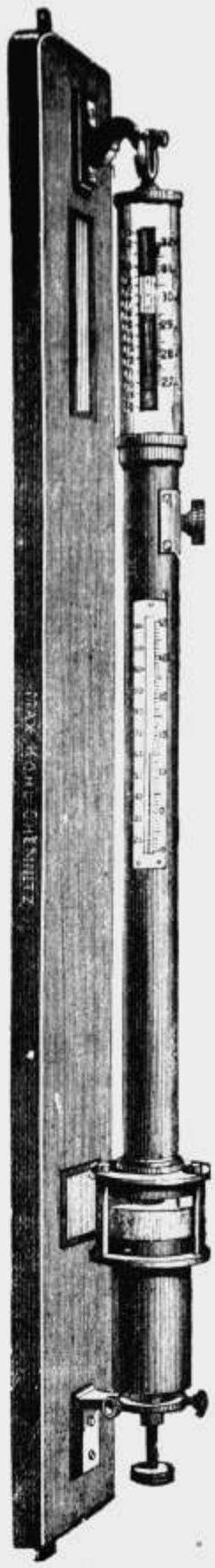
52463. 1:7.



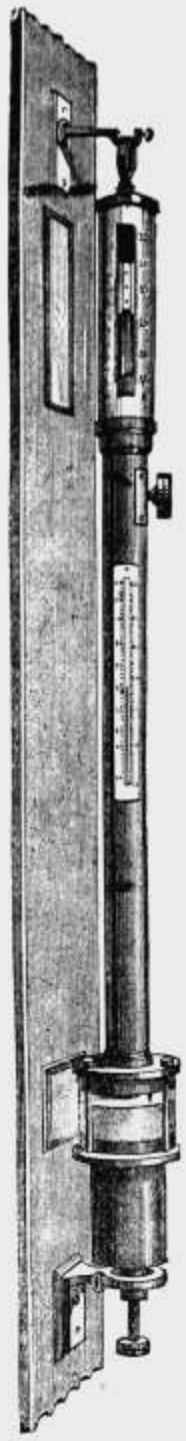
52466. 1:8.

	£ s. d
52,460. **Flat Sheet Iron Box,** for storing the rubber cushion (W. D., page 148)	0. 8. 0
52,461. **Hydraulic Press,** Figure (W. D., Fig. 107 [96]), massively constructed for iron and steel; valves fitted, so as to be detachable, in special valve chambers, giving 3000 kg pressure, with safety valve for 60 atmospheres	12. 0. 0
The ram has a cross-section of 50 sq. cm; each atmosphere of pressure thus corresponds to a 50 kg pressure. The press has an efficiency of 60 ats., which is equivalent to 3000 kg pressure.	
52,462. — idem, **with Pressure Gauge**	14. 10. 0
52,463. **Hydraulic Press,** of metal, for a pressure of 1500 kg, Figure	8. 10. 0
52,464. — idem, **with Pressure Gauge**	11. 0. 0
52,465. **Hydraulic Press with Glass Cylinder** and visible valves, Figure, with safety valve for 25 Atm., for preventing bursting of the cylinder, for 500 kg pressure	8. 0. 0
52,466. — idem, **with Pressure Gauge,** Figure	10. 10. 0

Cl. 707, 709, 708, 5119.



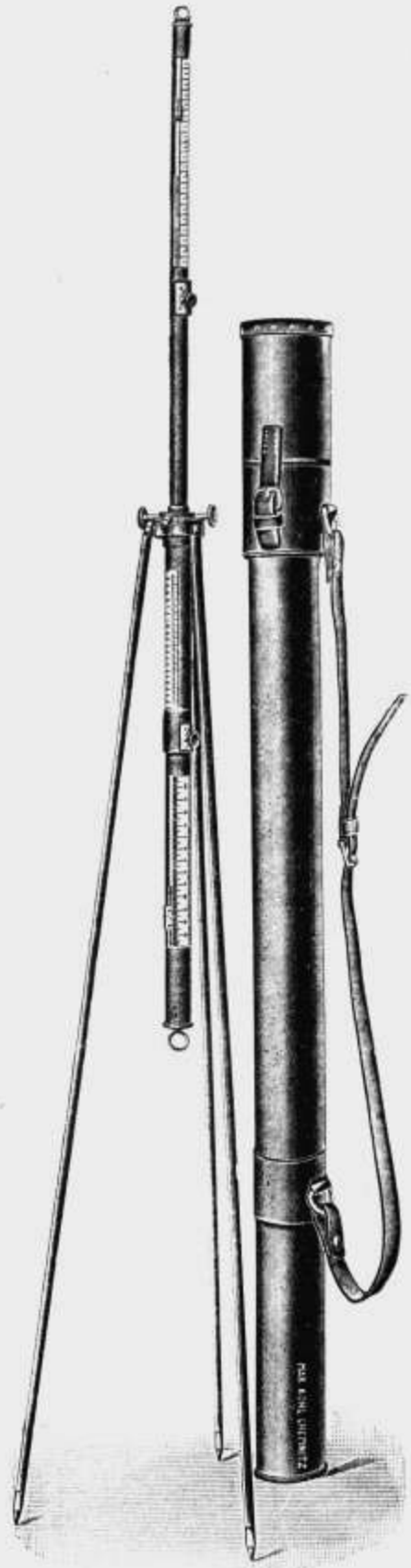
52 786. 1 : 7.



52 787. 1 : 9.

52 788. 1 : 7.

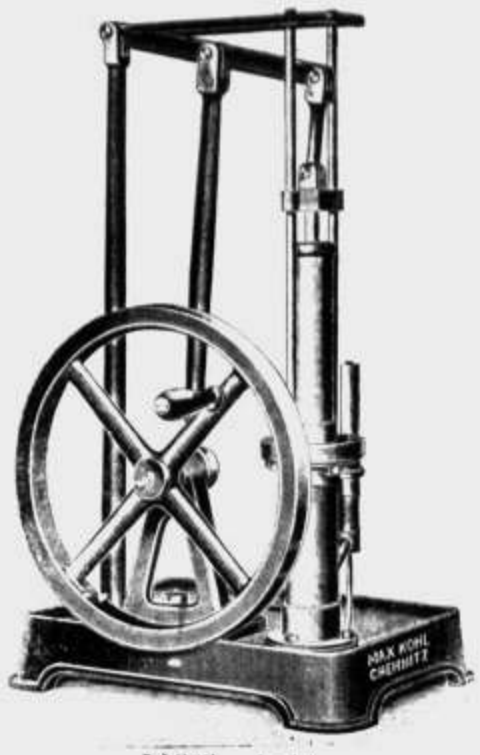
52 789.
1 : 10.



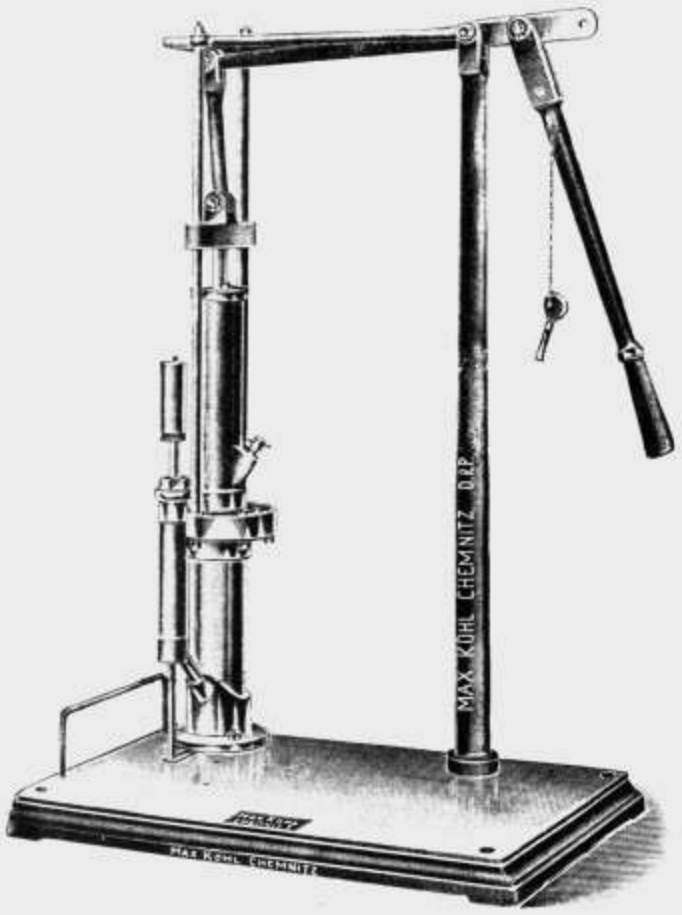
52 790. 1 : 7.

	£ s. d.
52,786. **Fortin Station Barometer,** Figure, in metal case, **tube 19 mm internal width,** vernier reading to $^1/_{10}{}^{th}$ mm and movable with rack; reading of vernier and level facilitated by mirror illumination. The thermometer is in direct contact with the barometer tube and can be read from the outside. The instrument is suspended on a hook and can be centred at the lower end	18. 10. 0
52,787. — idem, **with tube 12.5 mm wide,** Figure	10. 0. 0
52,788. **Travelling and Altitudinal Barometer,** after Fortin, Figure, with tube 10 mm width, vernier giving $^1/_{10}{}^{th}$ mm, with thermometer, **Stand** and **Universal Suspension,** also **leather case**	7. 10. 0
52,789. — idem, **Station Barometer,** on wood board, Figure	6. 0. 0

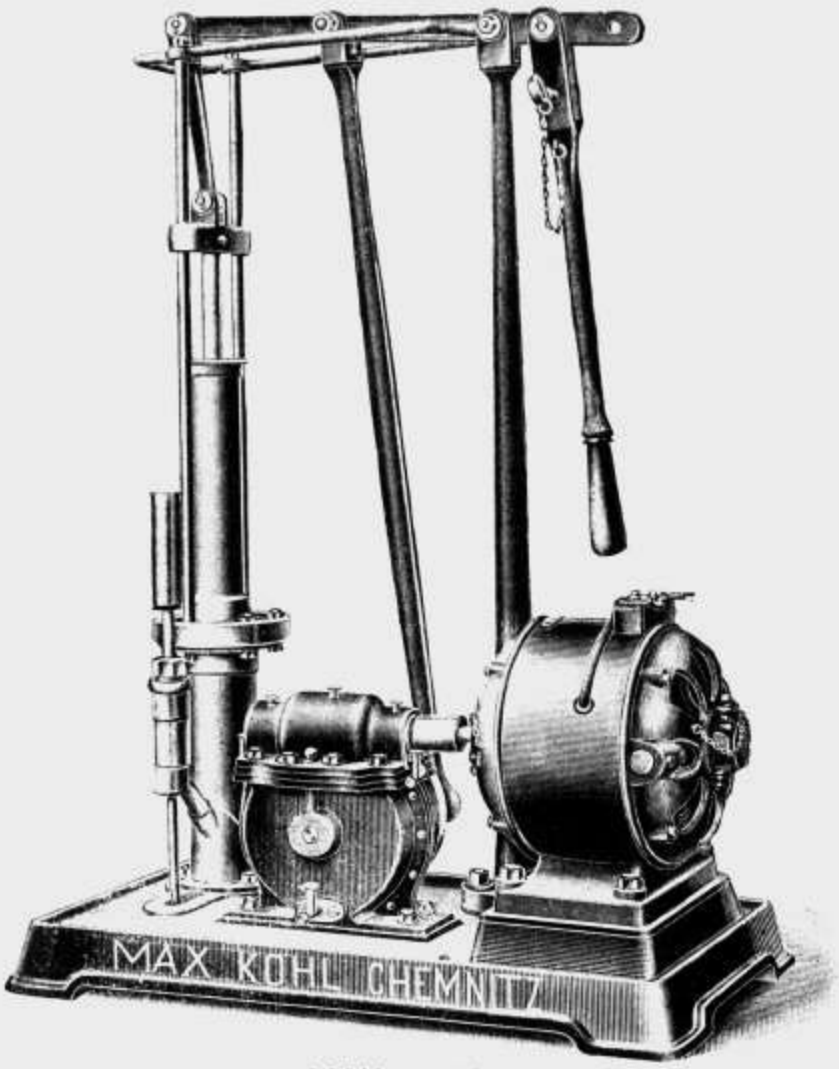
52 904. 1 : 10.



52 909. 1 : 10



52 907. 1 : 9.

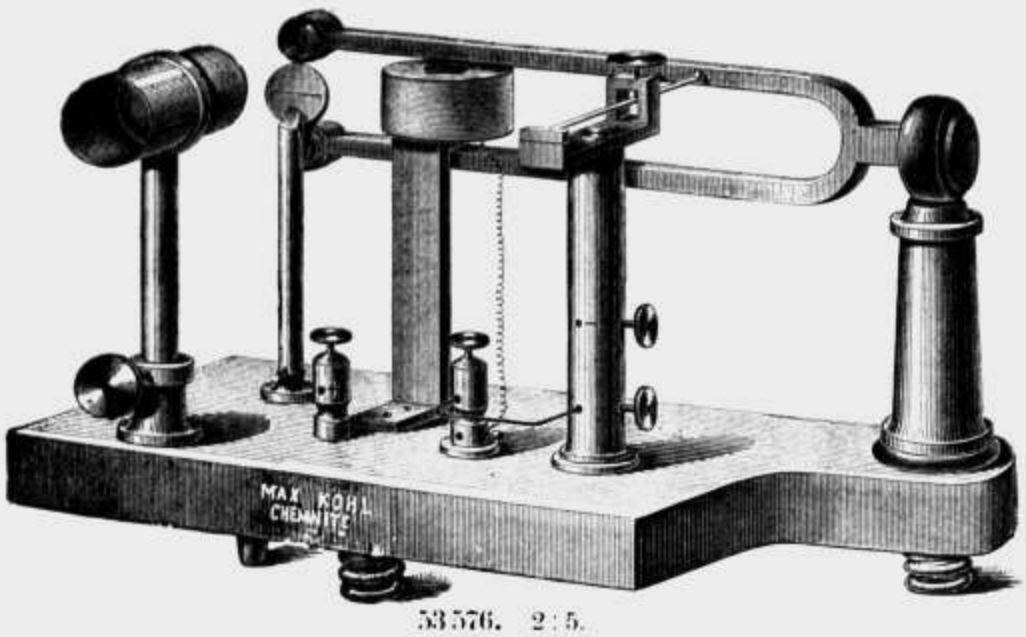


52 911. 1 : 10.

	£ s. d.
52,908. **Vacuum Pump with Oil-packed Piston** and oil non-return valve, Kohl's system, German Patent; with Hand Lever and with **Plate** 240 mm diameter and **Barometer Gauge** 200 mm high	11. 0. 0
52,909. — idem, with Fly-wheel, for Hand and Power Drive, without Plate, Figure . . .	10. 0. 0
52,910. — idem, with Fly-wheel and with **Plate** 240 mm de diameter and **Barometer Gauge** 200 mm high	12. 10. 0
Largest **Receiver** for use with above: No. 53,013	0. 4. 9
52,911. — idem, **driven by a $^1/_6$th H. P. Electric Motor** with worm gearing, motor for **110 volt** Direct Current, with Starter, without Plate, Figure	22. 10. 0

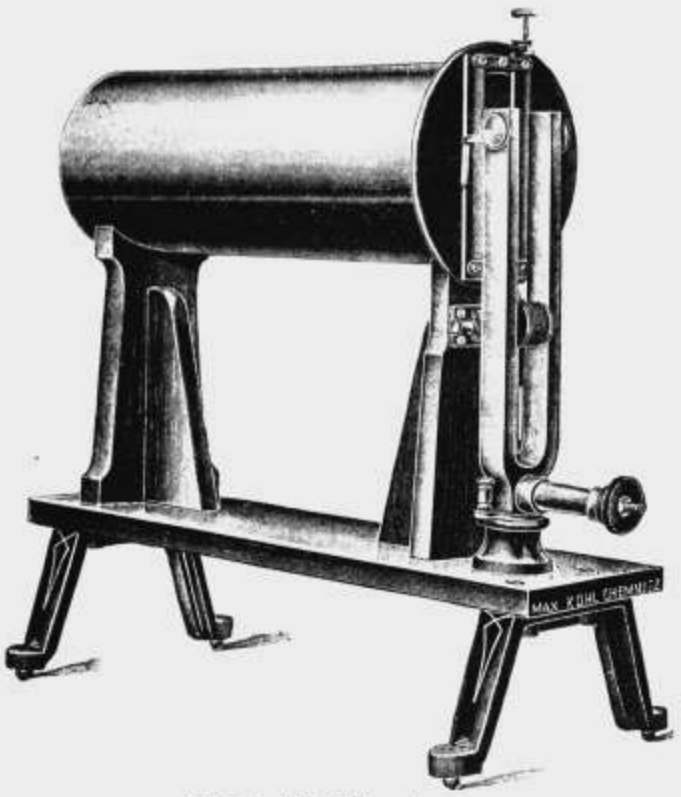
Vacuum Pumps No. 52,903–52,910 are specially intended for rapid work in laboratories.

Cl. 943, 3652, 4711, 4713.

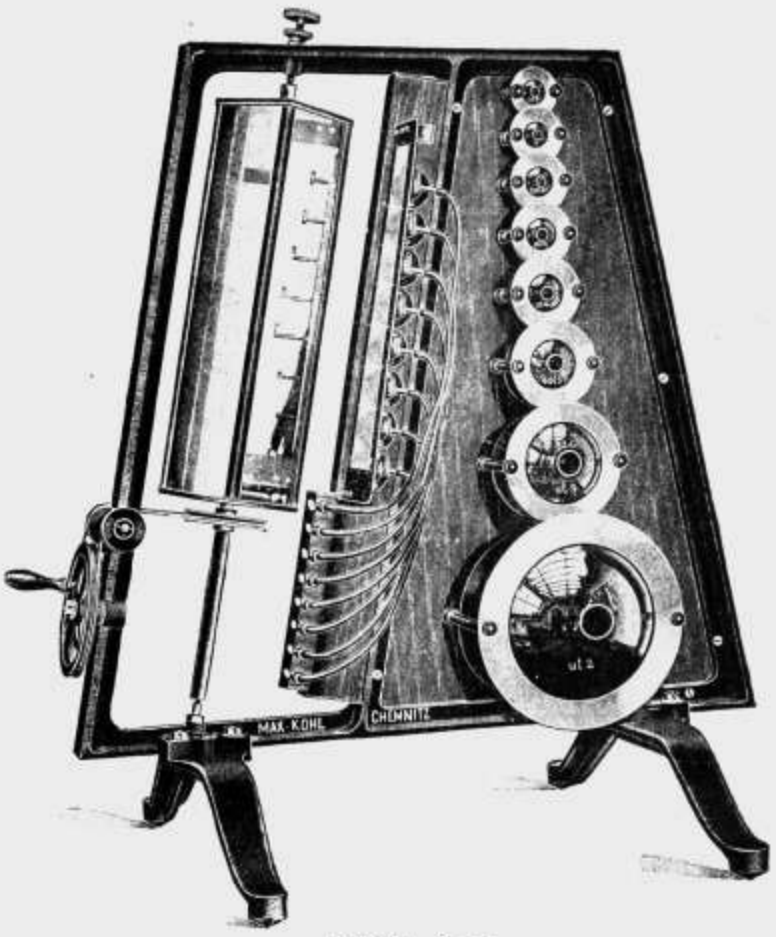


53576. 2 : 5.

53584. 1 : 18.



53577 (53578). 1 : 8.

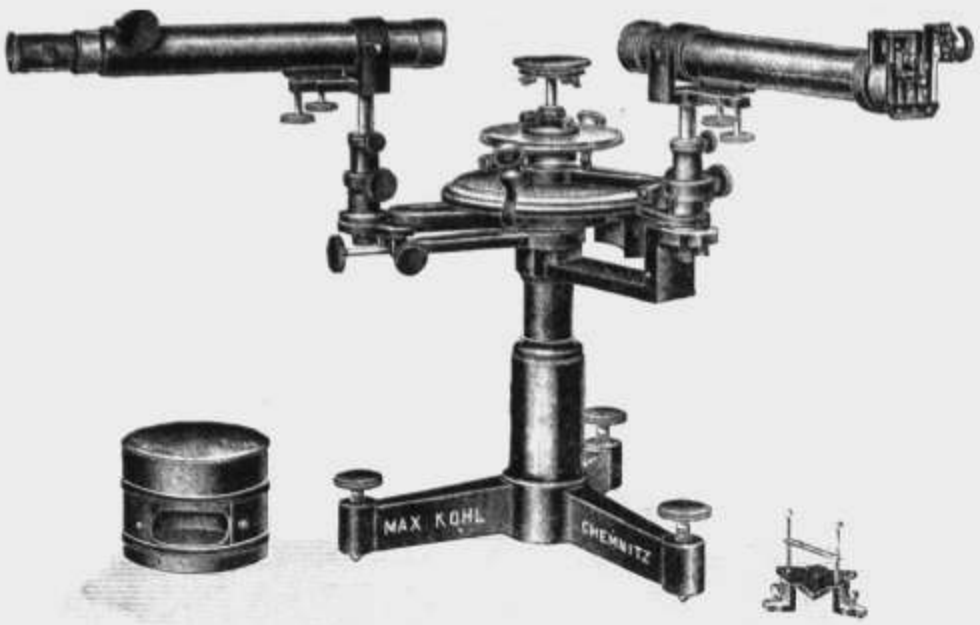


53583. 1 : 11.

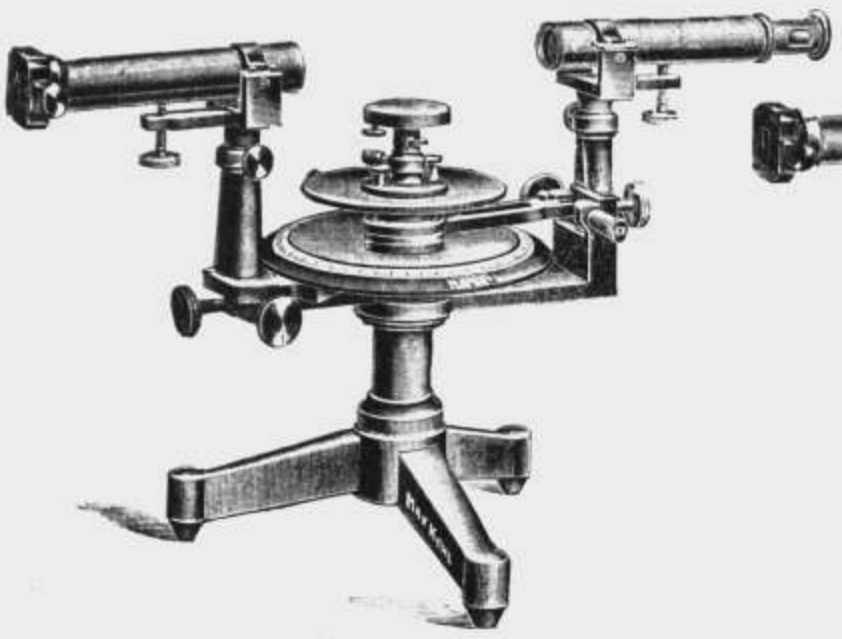
	£ s. d.
53,576. **Vibration Microscope,** after Weinhold, Figure (W. D., Fig. 239 [225]), can be used at same time as a Töpler Vibroscope	6. 0. 0
* 53,577. **2 Massive Tuning Forks on Stand** for the tone $c_0 = 128$ compound vibrations $ut_2 = 256$ v. s.); the pitch of one can be varied by filling with mercury; both with steel mirror and large resonator, Figure (Pogg. Ann. d. Phys. u. Chemie, Vol. 157, 1876, p. 621), for producing any phase differences and impact tones, also for Lissajous's Figures	27. 10. 0
One of the two tuning forks has both limbs bored out and is provided at the yoke with a screw press by means of which mercury can be forced into te limb. In this manner the frequency can be altered by 8 compound vibrations (= 16 v. s.). The resonator of each fork is provided with a gap which can be increased or decreased by means of a screw so as to suit its tone to that of the fork. The forks have electro-magnetic drive.	
53,578. **Variable Tuning Fork** $c_0 = 128$ compound vibrations **alone** ($ut_2 = 256$ v. s.), Figure, on stand and with variable resonator	19. 5. 0
53,579. **2 Tuning Forks with Resonators,** same pattern as No. 53,577, but **smaller**, for the tone $c_1 = 256$ compound vibrations ($ut_3 = 512$ v. s.)	21. 0. 0
53,580. **Variable Tuning Fork** $c_1 = 256$ compound vibrations ($ut_3 = 512$ v. s.), **alone,** on stand with variable resonator	15. 10. 0

* Can be used with the Projection Apparatus.

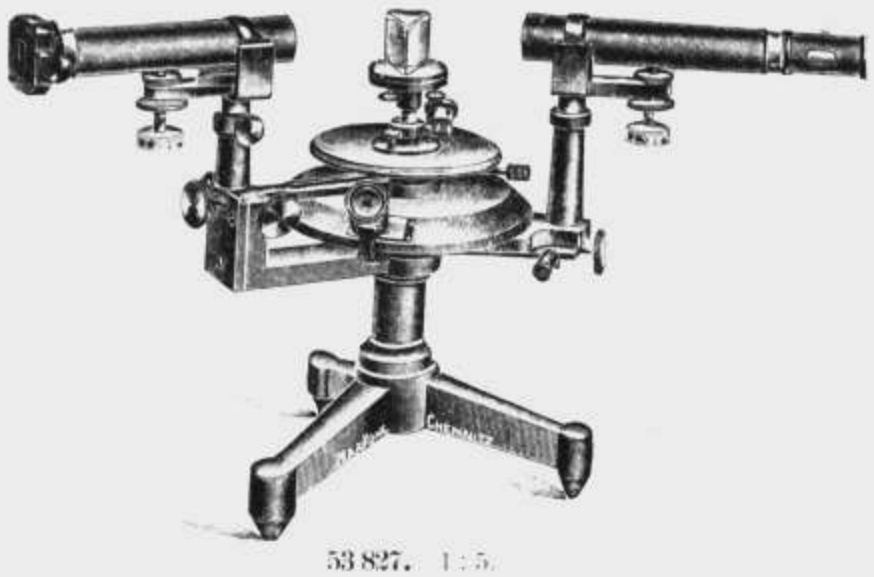
Cl. 1172, 5814, 1175, 3381.



53823. 1 : 6.



53826. 1 : 5.



53827. 1 : 5.

53,822. **Large Reflecting Goniometer** with circle 230 mm diameter, with concealed graduation on silver, objective aperture 31 mm, reading by magnifying glass with 2 verniers for 10 seconds, with **Centering Apparatus** . . . . . £ 50. s. 0. d. 0

The circle and observing telescope have independent motion about the central axis, with screw motion. The measurements can be taken either by firmly clamping the circle carrying the crystal, and by turning the alidade along with the telescope, or by clamping the alidade with the telescope and rotating the circle with the crystal. The instrument has two oculars and a number of slots for the collimator; the observing telescope is provided with an extra objective, thus facilitating the focussing of the objects under test. Illustration on application.

53,823. **Reflecting Goniometer**, can also be used as a **Spectroscope,** Figure, with circle 150 mm diameter, concealed, on silver, with reading by means of magnifying glass, to 20 seconds; objective aperture 27 mm. **Without Centering Apparatus** 27. 10. 0

53,824. **Reflecting Goniometer for the Laboratory**, with circle 150 mm diameter, graduated in $^1/_3{}^0$, with telescope having and objective aperture of 22 mm. with magnifying glass, reading to 30 seconds. **Without Centering Apparatus** 19. 0. 0

53,825. **Centering Device** for the crystals, fitting the two preceding goniometers. 3. 15. 0

53,826. **Reflecting Goniometer, smaller,** without magnifying glass reading, Figure, practical model for laboratories; telescope of 19 mm aperture, graduated in $^1/_2{}^0$ and with vernier for reading to 1 Minute 13. 0. 0

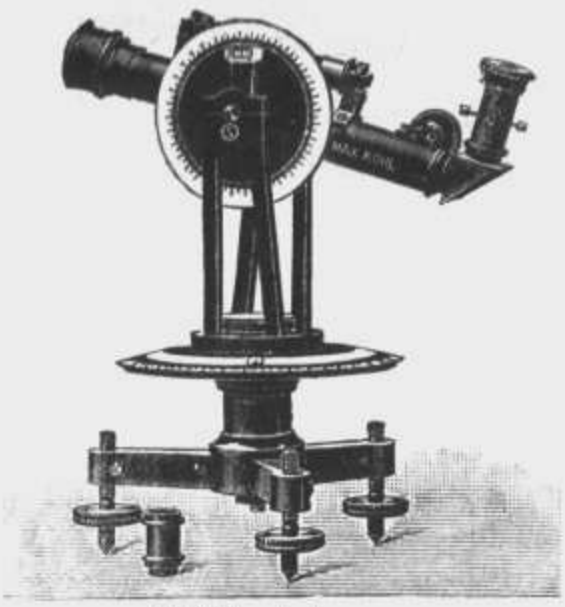
53,827. — idem, Figure, with **concealed Divided Circle** and 2 magnifiers for reading, without prism illustrated in figure 16. 0. 0

This pattern can be highly recommended as the graduation cannot be touched by the fingers.

53,828. **Model of a Mirror Sextant,** of wood, Figure 2. 0. 0

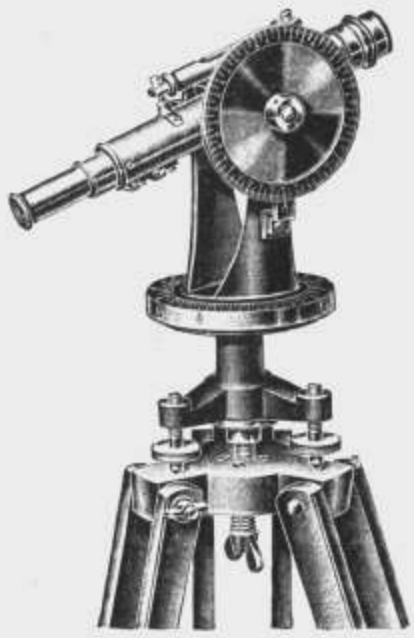
Contact Goniometers and Survey Goniometers: see p. 229.

Cl. 5081, 1248, 1249.



54 382. 1 : 5.

54 380. 1 : 5.



54 385. 1 : 6.

54 386, 54 386 b, 54 386 d, 54 386 f, 54 386 h. 1 : 5.

54,380. **Model Theodolite,** Figure, of metal, with level and cross-wires, can be used as a sight. The circles are divided in 360 ° and verniers permit of reading to $^1/_{10}{}^{th}$ °. Circle rotary for repetition, telescope without lenses . . . . . £ 4. 0. 0

54,381. — idem, **with Telescope,** ocular movable by rack and pinion . . . . . £ 6. 0. 0

54,382. — idem, Figure, **with Telescope, Ocular Prism, and Sun Glass,** for astronomical observations (M. T., page 26) . . . . . £ 6. 12. 0

54,383. **Stand for Model Theodolites** Nos. 54,380/2 (W. D., Fig. 29), with stem screw . . . . £ 1. 10. 0

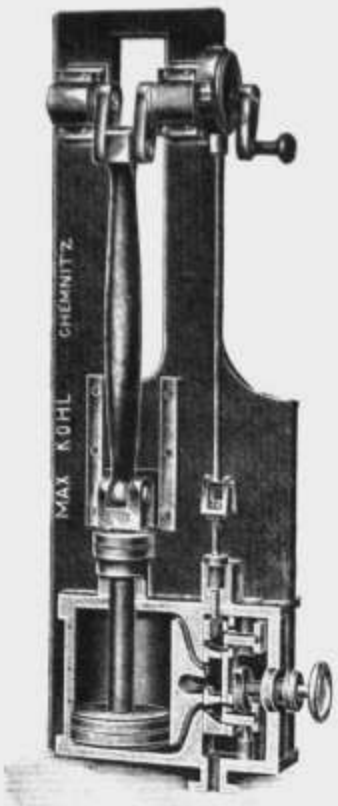
54,384. **Carrying Case** for Model Theodolites Nos. 54,380/2, for use in field work . . . . . £ 1. 6. 0

54,385. **Model Theodolite for Students' Exercises,** Figure, with **Telescope** and **Carrying Case, Folding Stand, Measuring Chain,** and folding **Measuring Stave** 3 m long. The horizontal circle is 10 cm diameter and the altitudinal circle 9.5 cm . . . . . £ 8. 0. 0

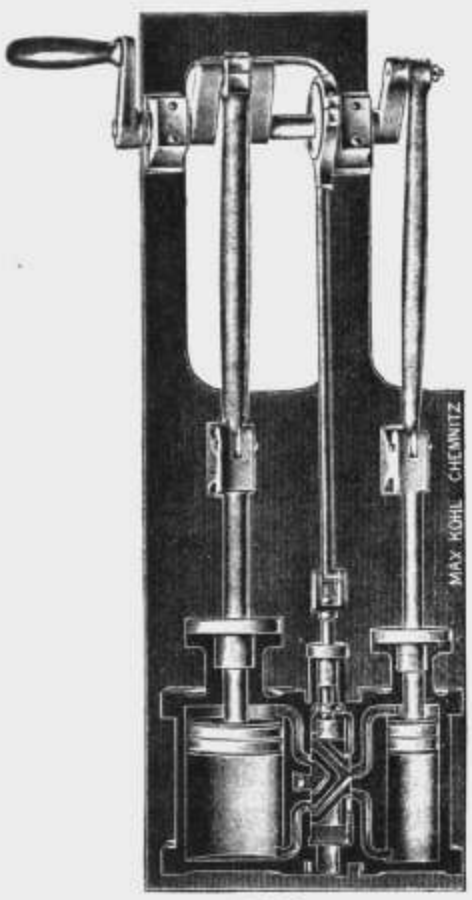
54,386. **Theodolite,** cf. Figure, horizontal circle 120 mm diameter divided in $^1/_2$ °, verniers giving 1′, graduated on brass, silvered, uncovered. Reading by means of hand glass; telescope 200 mm focal length, power 20, inclusive of bolts and stand with tribrach . . **£ 12. 10. 0**

Extras: (a) for repetition **£ 2. 0. 0**; (b) for telescope axis having clamp and fine adjustment **£ 1. 5. 0**; (c) for rotary magnifying glasses **£ 1. 4. 0**; (d) levelling bubble **£ 1. 4. 0**; (e) for graduating the horizontal circle on German silver **£ 0. 15. 0**; (f) for spherical stand with tribrach instead of the bolting stand **£ 0. 10. 0**; (g) for graduating the horizontal circle on silver in $^1/_3$ °, verniers giving 30 ″ covered, with rotary magnifiers, **£ 4. 5. 0**; (h) for adaption of a altitudinal circle in $^1/_2$ ° on brass and silvering, verniers giving 1′, **£ 3. 0. 0**; (i) for telescopes arranged for throwing back, with adjustable carrier **£ 1. 7. 0**.

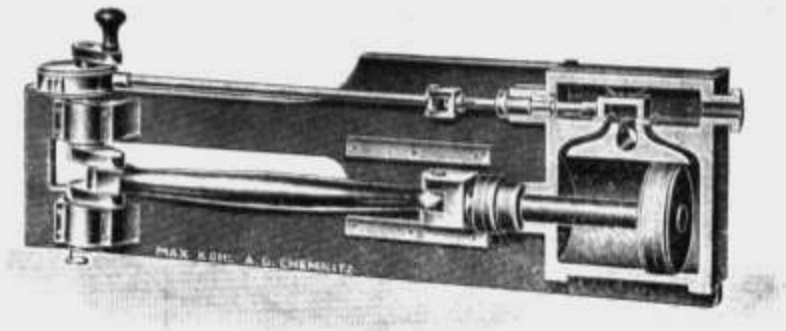
Cl. 1528, 1527, 6098, 1529.



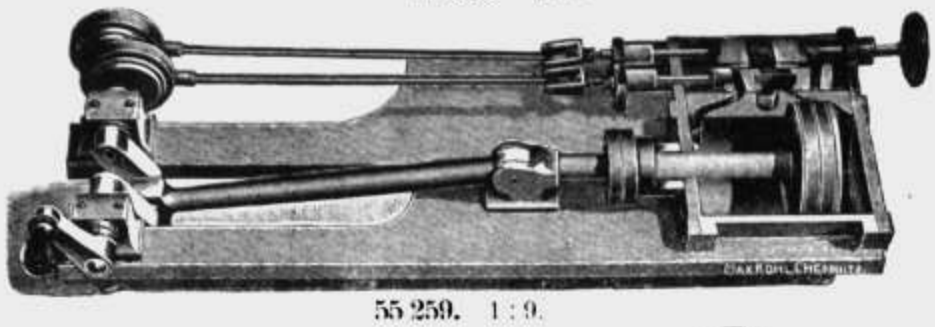
55 257. 1 : 10.



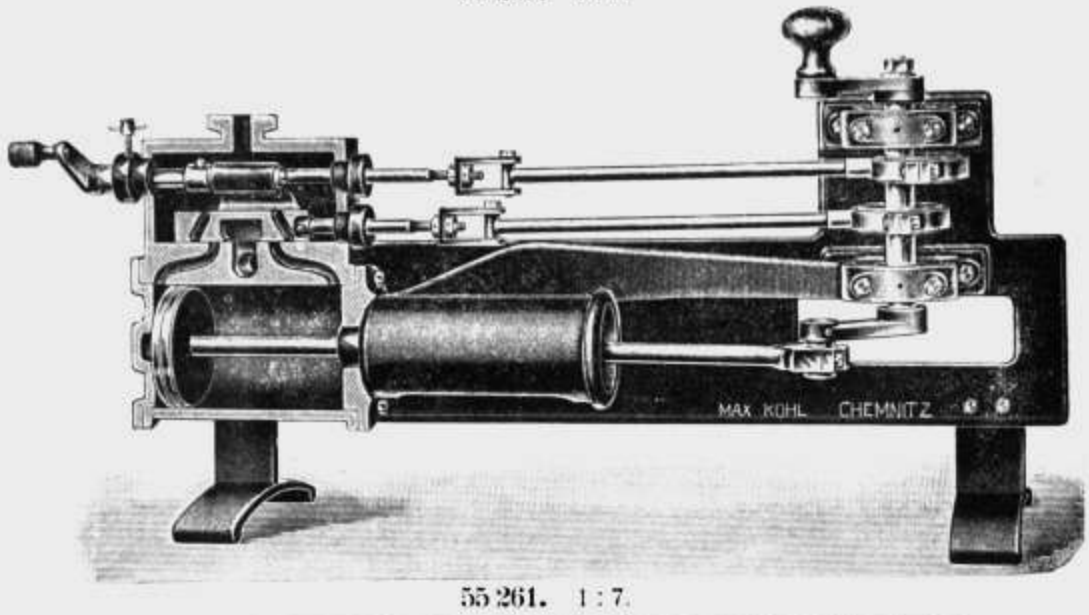
55 262. 1 : 9.



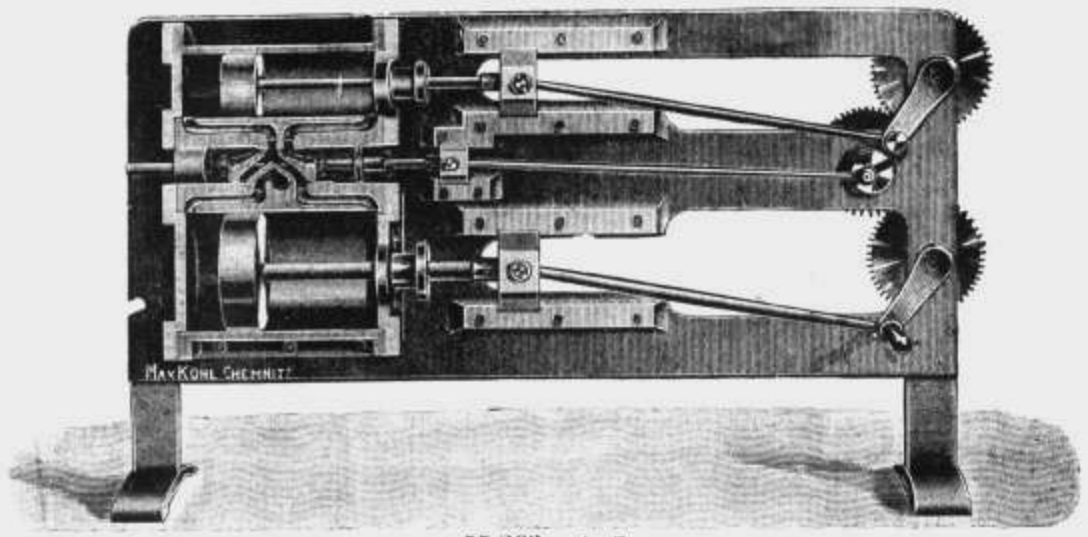
55 256. 1 : 9.



55 259. 1 : 9.



55 261. 1 : 7.

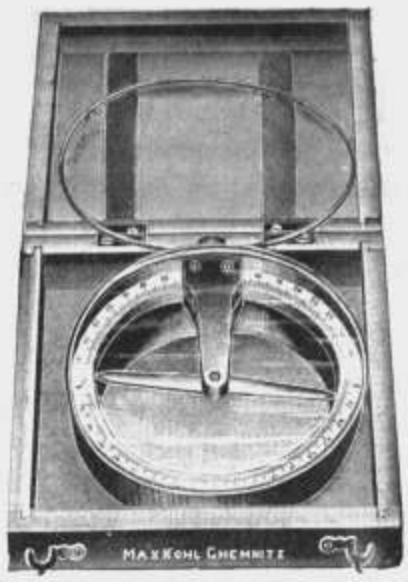


55 263. 1 : 7.

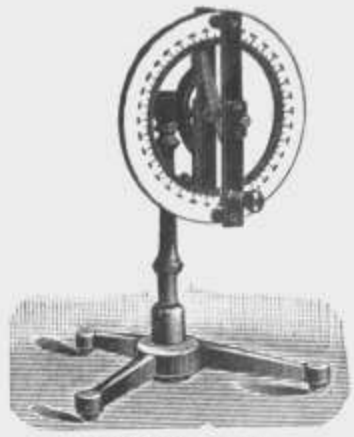
	£ s. d.
55,256. **Sectional Model of a Cylinder** with simple Slide Valve, Figure, of wood	5. 0. 0
55,256a. — idem, of iron, smaller, about $^3/_5$ the size	8. 0. 0
55,257. — idem, **with Farcot Slide Valve,** Figure, of wood	7. 0. 0
55,258. — idem, **of iron, smaller,** about $^3/_5$ the size	12. 0. 0
55,259. — idem, **with Meyer Compound Slide Valve,** Figure, of wood	7. 0. 0
55,260. — idem, of iron smaller, about $^3/_5$ the size	12. 0. 0
55,261. — idem, **with Rider Slide Valve,** Figure, of iron	12. 0. 0
55,262. — idem, **with Woolf Slide Valve,** Figure, of wood	6. 0. 0
55,262a. — idem, of iron, smaller, about $^3/_5$ the size	8. 0. 0
55,263. — idem, different pattern, Figure, of iron	13. 0. 0

Cl. 6217, 4899, 1893, 3891, 3691, 1894.

60 096. 1 : 3.



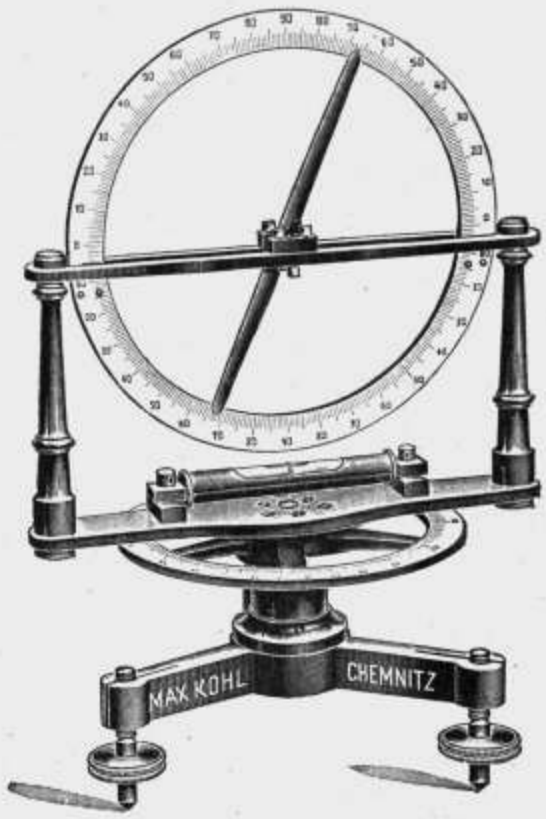
60 097. 1 : 4.



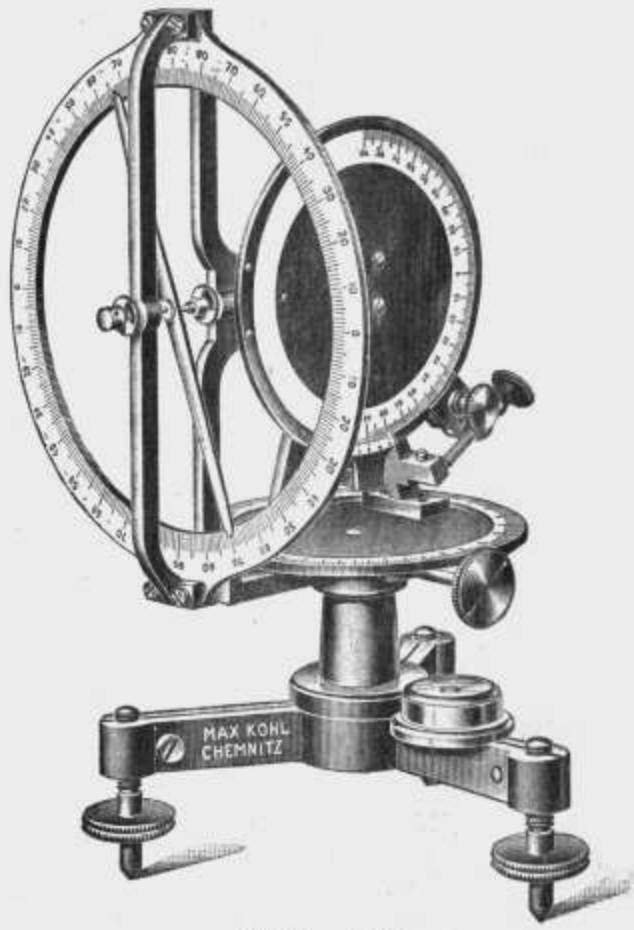
60 098. 1 : 5.

60 100. 1 : 5.

60 101. 1 : 5.



60 102. 1 : 4.



60 103. 2 : 5.

60,098. **Dip Circle,** can also be used as galvanoscope, Figure, with carefully balanced magnetic needle, column turning in base, divided circle, movable on hinge . . . . . £ s. d. 2. 8. 0

60,099. **Dip Circle,** Figure 60,064, p. 787, can also be used for the fundamental magnetic experiments (see under No. 60,064) 5. 10. 0

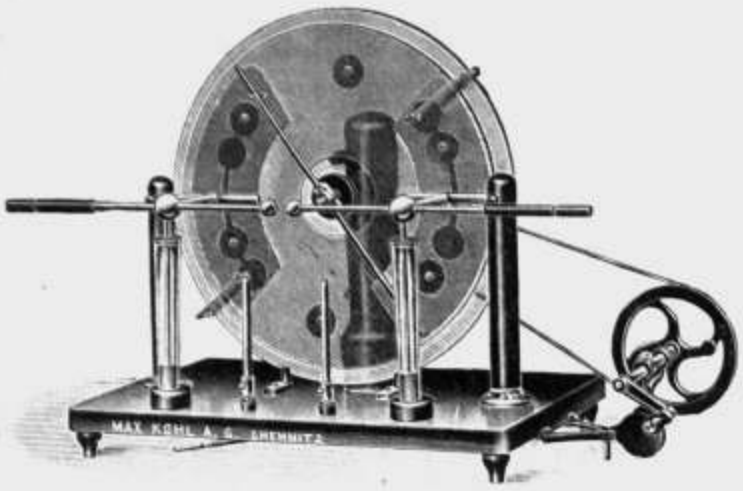
60,100. **Dip Circle,** Figure, with horizontal and vertical circle, on tripod with levelling screws, the needle works in agate bearings. The vertical circle is movable, being 110 mm in diameter. 3. 10. 0

60,101. — idem, larger, Figure, vertical circle 150 mm, horizontal cercle 100 mm diameter, with round spirit level 7. 10. 0

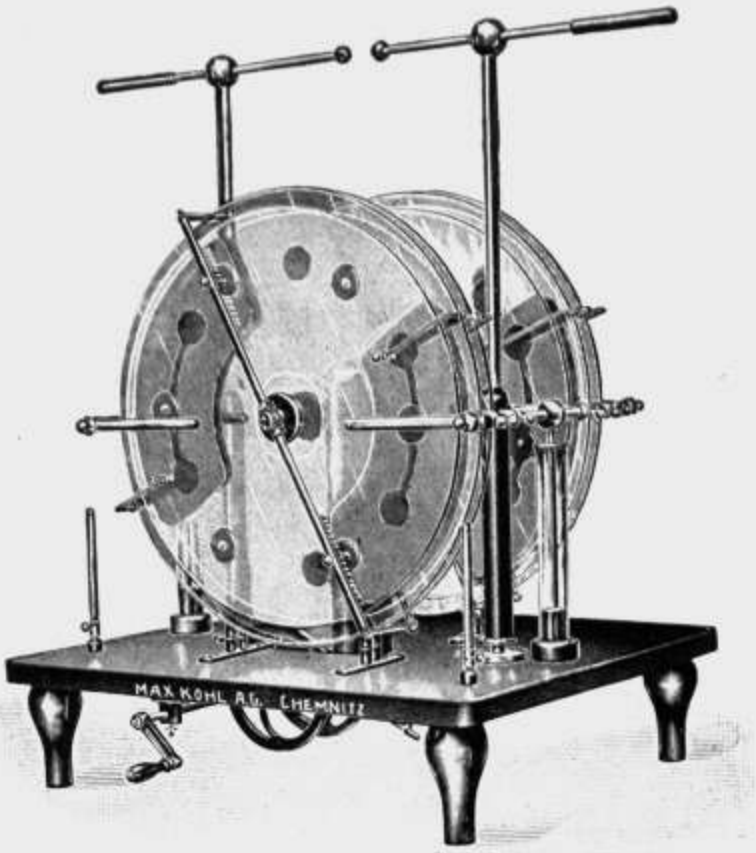
60,102. **Dip Circle,** large type, Figure (M. P., 9th edn., III, Fig. 35; Gan.-Man. Fig. 611; Gan.-Rein. Fig. 703), with detachable needle working in carnelian bearings, vertical circle 190 mm diameter. The instrument gives accurate data . . . . . 12 .10. 0

60,103. **Dip Circle,** Figure, with vernier reading for the circle and with micrometer adjustment of the vertical circle; diameter of upper circle: 180 mm 11. 0. 0

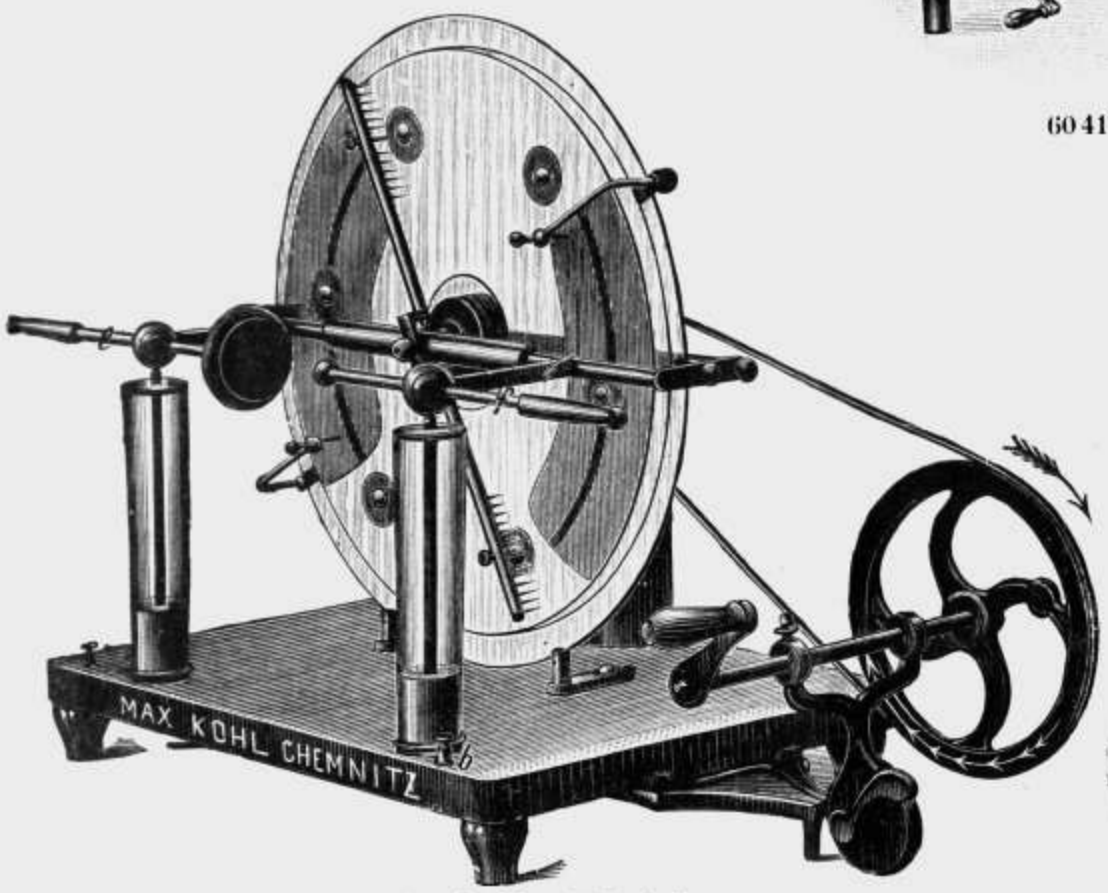
Cl. 5753, 2037, 2038, 5750, 2040, 2041, 2042.



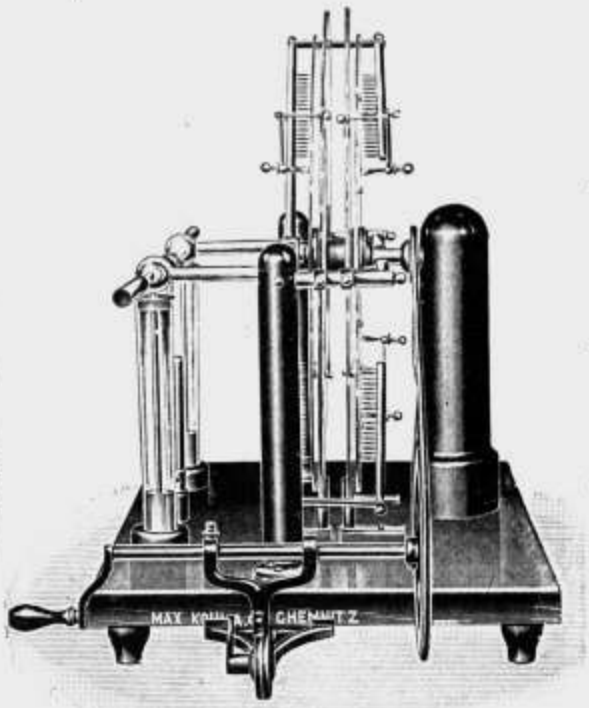
69 397–60 406. 1 : 6 – 1 : 24.



60 417–60 424. 1 : 11 – 1 : 27.



60 425–60 430. 2 : 7 – 1 : 7.



60 407–60 416. 1 : 8 – 1 : 27.

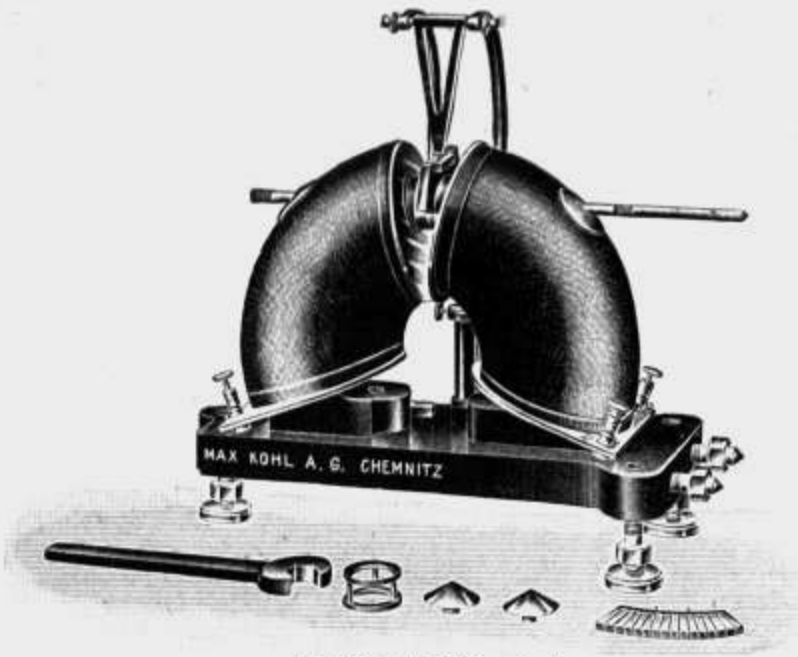
Self-Exciting Influence Machine, as suggested by Töpler, with 1 fixed and 1 rotating plate, Figure, with massive ebonite pillars on which the discharging combs are placed, in order to be able to remove the plates forth; with stand of polished mahogany. £ s. d.

List No.	60,397	60,398	60,399	60,400	60,401	60,402	60,403	60,404	60,405	60,406
Diameter of rotating disc.	26	31	36	41	47	52	57	62	75	90 cm
£	3.10.0	4.10.0	6.0.0	7.5.0	9.5.0	10.10.0	15.15.0	20.0.0	27.0.0	30.0.0

Self-Exciting Influence Machine, as suggested by Töpler, Figure, with 2 fixed and 2 rotating plates, base and pillars of mahogany, discharging combs fixed on ebonite pillars, very neatly constructed and producing twice the quantity of electricity as those with only two plates.

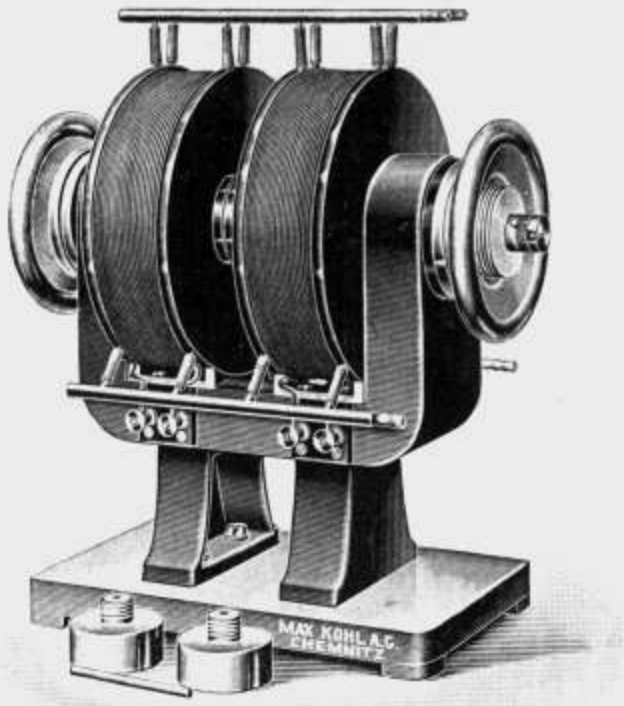
List No.	60,407	60,408	60,409	60,410	60,411	60,412	60,413	60,414	60,415	60,416
Diameter of rotating plates	26	31	36	41	47	52	57	62	75	90 cm
£	6.15.0	8.10.0	11.0.0	13.10.0	17.5.0	19.0.0	25.0.0	29.5.0	32.10.0	41.5.0

Cl. 5707, 5599, 2134, 5709.



62 299, 62 302. 1 : 7.

62 306. 1 : 4.



62 308. 1 : 7,5.

	£ s. d.
62,299. **Small Half-Ring Electromagnet** after du Bois, Figure, with one pair cylindrical and one pair conical pole pieces, one distance piece for 1 mm pole distance of the conical pole pieces, Stand and Spanner (Ztschr. f. Instrumentenkunde, 1899, p. 363)	36.5.0

This magnet is constructed in similar manner to No. 62,292 but is of only half the linear dimensions. The winding is arranged for 8 amps, and when the coils are in series the resistance is approximately 4 ohms; the apparatus can therefore be conveniently connected up to 32 volts.

Accessories for preceding Electromagnet.

62,300. **One Pair Cylindrical Pieces** for making additional pole pieces, of dynamo steel. . . .	1.10.0
62,301. **Universal Slider,** cf. Fig. 62,294	4.15.0
62,302. **v. Waltenhofen's Pendulum**	3. 0.0
62,303. **Flat Induction Coil,** cf. Fig. 62,296	3. 0.0
62,304. **Polarisation Apparatus** with divided circle and **Faraday's Glass Block**	7. 5.0
62,305. **Holder** for a Bismuth Spiral	0.10.0
62,306. **Bismuth Spiral** after Lenard, Figure, for determining the Field Density of Magnetic Fields by the change in the Conducting Resistance which bismuth undergoes in the field; in case, with calibration curve; approx. 20 mm diameter	3. 0.0
62,307. — idem, 5 to 6 mm diameter	3. 0.0

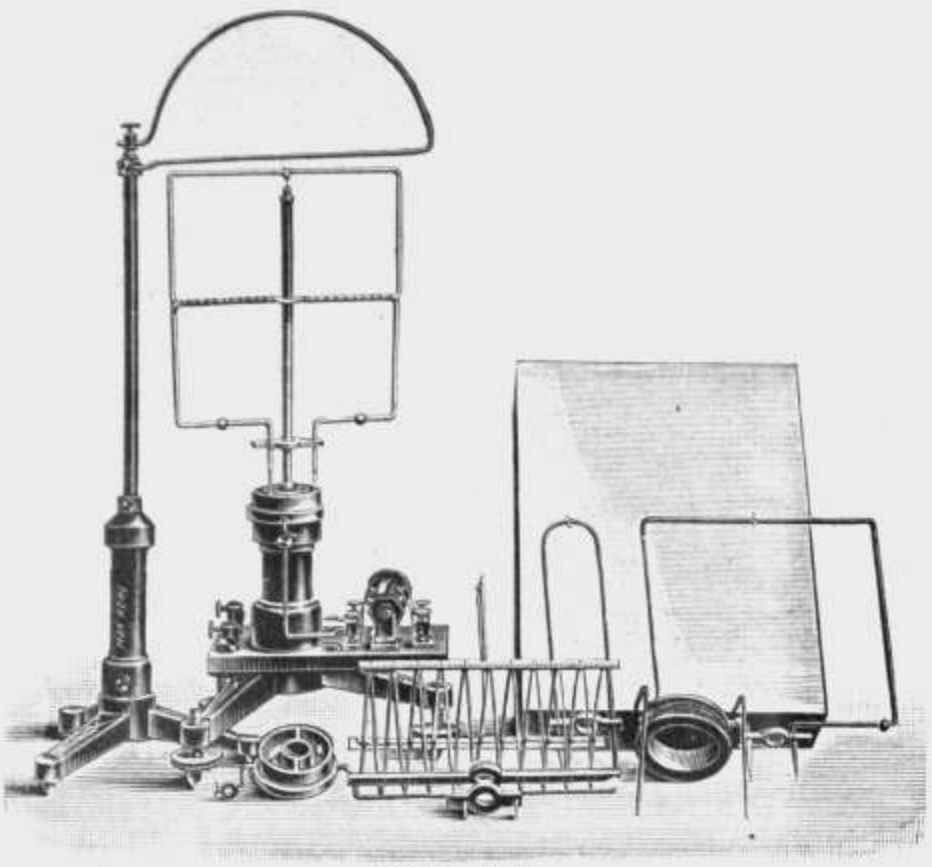
The bismuth spirals afford a very convenient means of measuring the field-densities by means of a resistance measurement with a Wheatstones Bridge. The thickness of the spirals is only about 1 mm so that they can be introduced into very narrow fields, e. g. between armature and pole pieces of a dynamo. An average change of resistance of 5 % is produced by 1000 lines per sq. cm; accurate data can be obtained from the calibration curve supplied with each spiral.

62,308. **Electromagnet** after Prof. P. Weiss, with coils for water cooling which can be loaded twice as much as in the case of air cooling; Figure; diameter of pole pieces 100 mm; with one pair cylindrical and one pair conical pole pieces; on stout wood board	87.10.0

The pole pieces can be adjusted by a micrometer motion. The coils are arranged as near as possible to the pole pieces and the cross section of the iron increases steadily from the pole pieces up to the centre of the magnetic circuit, so that leakage is avoided as much as possible and a very high degree of magnetization attained. Unless otherwise requested the winding is dimensioned for 120 volts. A great advantage lies in the fact that the entire apparatus remains quite cool.

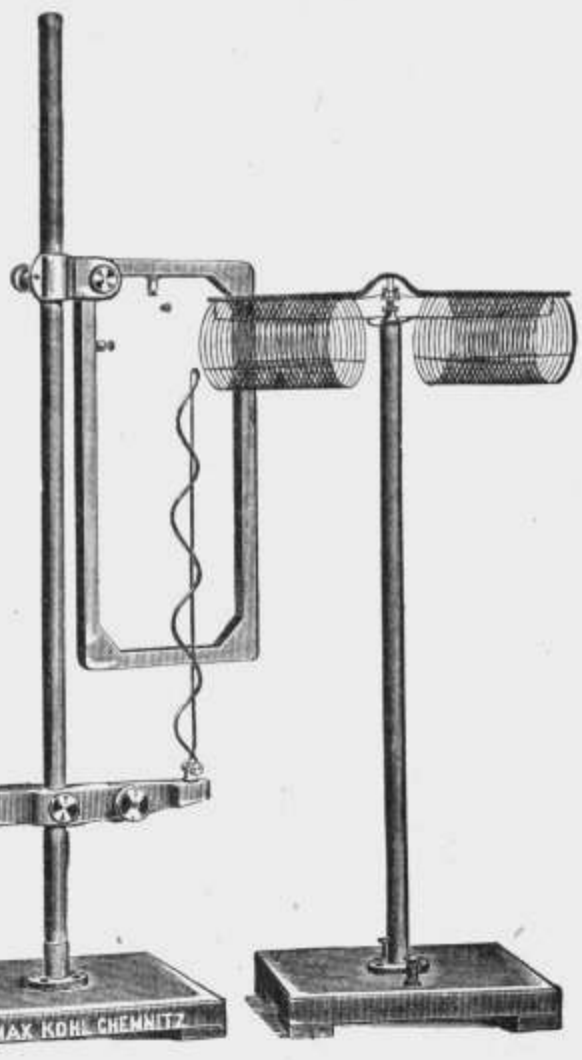
62,309. — idem, arranged to rotate on iron base so that the magnet can easily be placed in any position, with horizontal divided circle	105.0.0
62,310. **Electromagnet** after Prof. Weiss, as No. 62,308, but with pole pieces 92 mm diameter	73.10.0
62,311. — idem, on tripod, as No. 62,309	85. 0.0

Cl. 5430, 5986, 69 F.

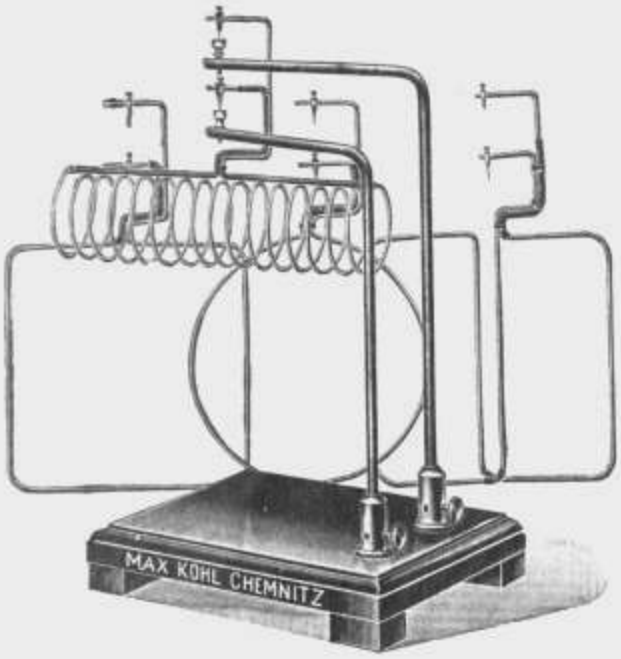


62 383. 1 : 6.

62 382. 1 : 8.



62 386. 1 : 10.



62 387. 1 : 5.

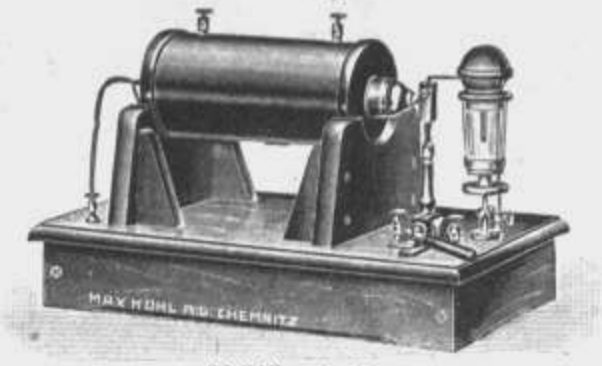
62,382. **Demonstration Apparatus for the Magnetic Field of a horse-shoe Electromagnet,** after Götze, Figure . . . . . £ 1. 10. 0

62,383. **Ampere's Stand,** Figure, reliable pattern, with separate stands; main stand on metal tripod with levelling screws, rotary and fixed in position by screw; wire figures of aluminium with silver points. The following appertain to above: 1 solenoid (W. D., Fig. 536 [509]), 1 simple rectangle (W. D., Fig. 532 [505]), 1 double (astatic) rectangle (W. D., Fig. 534 [507]), 1 wire stirrup with wire coil (W. D., Fig. 535 [508]), 1 boxwood bowl with 2 concentric rings, 1 boxwood bowl with partition wall. Also adapted for experiments as suggested in Gan.-Man., Figs. 739, 740, 746, 751; Gan.-Rein., Fig. 891, 893, 877 . . . . . £ 4. 4. 0

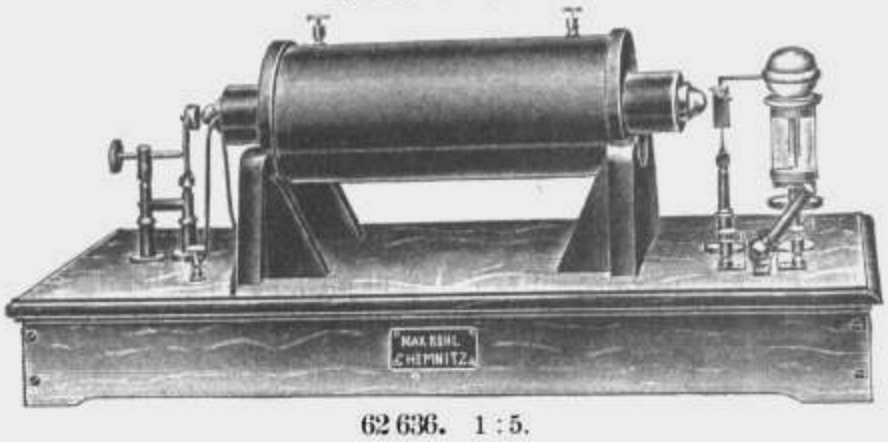
This pattern enables the experiments to succeed with ease. The primary condition is that absolutely pure and dry mercury should be emp oyed. This we supply if desired at a charge of **£ 0. 8. 0.** per kilo. A current density of 15—20 amps. is necessary. Precise instructions for use are given in.

62,367. **Wire Coil Ampere's Stand** (W. D., Fig. 537 [510]), Figure on p. 962 . . . . . £ 0. 8. 0

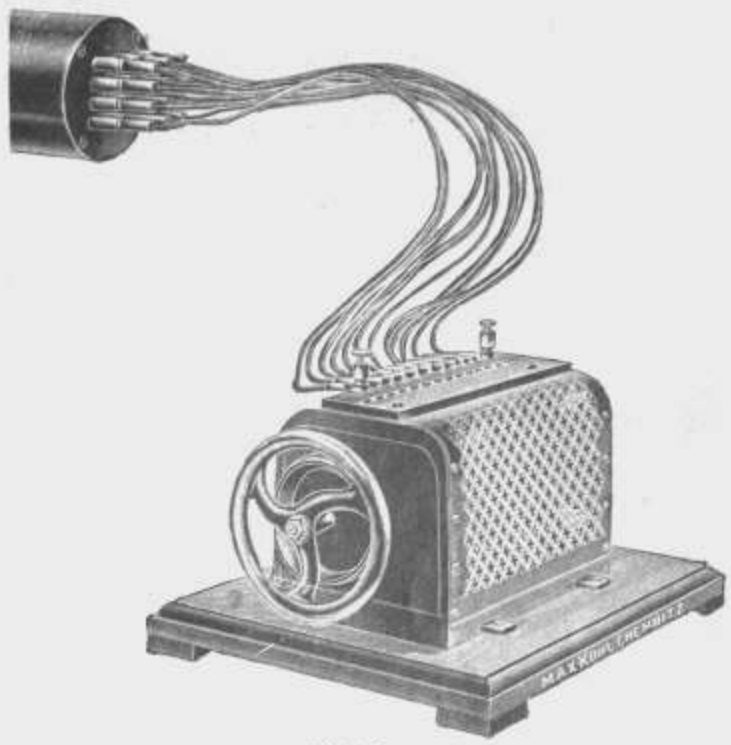
Cl. 2673, 3879, 2675, 267.



62 613. 1 : 10.



62 636. 1 : 5.



62 607. 1 : 8.

Induction Coil without Interrupter, Type A, B, C, D and E, on Table Stand.

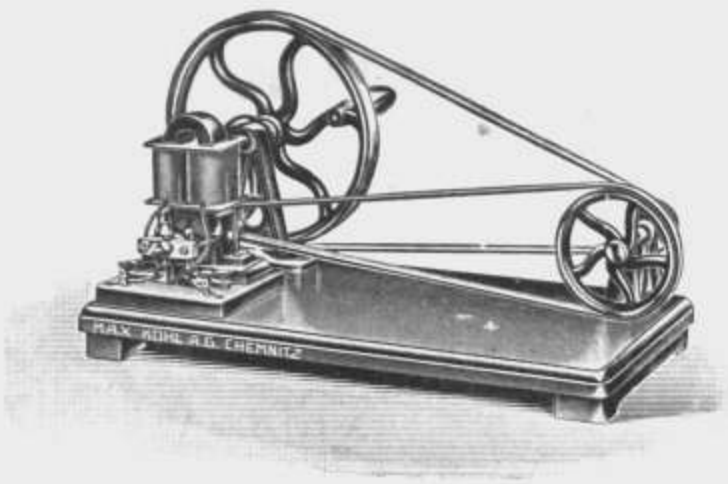
Spark-length with Wehnelt-Interrupter	Size	For Wehnelt Interrupter				For Wehnelt and Motor Interrupters				For Motor Interrupters		Spark-length with the Motor Interrupter
		Type A **Without** Condenser, Primary Coil with Pachytrope, cf. Fig. 62533		Type B **Without** Condenser, Primary Coil with Plug Commutation, cf. Fig. 62513		Type C **With** Condenser, Primary Coil with Pachytrope, cf. Fig. 62533		Type D **With** Condenser, Primary Coil with Plug Commutation, cf. Fig. 62513		Type E **With** Condenser, Primary Coil without Commutation, cf. Fig 62571		
mm		List No.	£ s. d.	List No.	£ s. d.	List No.	£ s. d.	List No.	£ s. d.	List No.	£ s. d.	mm
I. Standard Secondary Winding.												
—	2	—	—	—	—	—	—	—	—	62559	8. 0.0	90
—	3	—	—	—	—	—	—	—	—	62560	10. 0.0	120
—	4	—	—	—	—	—	—	—	—	62561	12. 0.0	150
250	5	62491	16.10.0	62508	15.10.0	62525	18.10.0	62542	17.10.0	62562	15. 0.0	200
300	6	62492	20. 0.0	62509	19. 0.0	62526	22. 0.0	62543	21. 0.0	62563	18.10.0	250
350	7a	62493	26. 0.0	62510	25. 0.0	62527	28.10.0	62544	27.10.0	62564	25. 0.0	300
350	7b	62494	30. 0.0	62511	26. 0.0	62528	32.10.0	62545	28.10.0	—	—	300
400	8	62495	37. 0.0	62512	33. 0.0	62529	39.10.0	62546	35.10.0	62566	32.10.0	350
450	9	62496	44. 0.0	62513	40. 0.0	62530	47. 0.0	62547	43. 0.0	62567	40. 0.0	400
500	10	62497	54. 0.0	62514	50. 0.0	62531	57. 0.0	62548	53. 0.0	62568	50. 0.0	450
550	11	62498	65. 0.0	62515	60. 0.0	62532	68.10.0	62549	63.10.0	62569	60. 0.0	500
600	11a	62499	75. 0.0	62516	70. 0.0	62533	78.10.0	62550	73.10.0	62570	70. 0.0	550
650	12	62500	85. 0.0	62517	80. 0.0	62534	88.10.0	62551	83.10.0	62571	80. 0.0	600
700	12a	62501	95. 0.0	62518	90. 0.0	62535	99. 0.0	62552	94. 0.0	62572	90. 0.0	650
750	13	62502	105. 0.0	62519	100. 0.0	62536	109. 0.0	62553	104. 0.0	62573	100. 0.0	700
800	13a	62503	115. 0.0	62520	110. 0.0	62537	119. 0.0	62554	114. 0.0	62574	110. 0.0	750
850	14	62504	125. 0.0	62521	120. 0.0	62538	129. 0.0	62555	124. 0.0	62575	120. 0.0	800
900	14a	62505	135. 0.0	62522	130. 0.0	62539	140. 0.0	62556	135. 0.0	62576	130. 0.0	900
950	15	62506	150. 0.0	62523	145. 0.0	62540	155. 0.0	62557	150. 0.0	62577	145. 0.0	950
1000	15a	62507	165. 0.0	62524	160. 0.0	62541	170. 0.0	62558	165. 0.0	62578	160. 0.0	1000
II. Low Resistance Secondary Winding.												
350	RJI	62579	34. 0.0	62581	30. 0.0	62583	36.10.0	62585	32.10.0	62587	29.10.0	350
400	RJII	62580	41.10.0	62582	37.10.0	62584	44. 0.0	62586	40. 0.0	62588	37. 0.0	400

Sizes 5—7a for Wehnelt Interrupter have double, 7b—10, quadruble, and 11—15a, sextuple commutation of the Primary Coil.

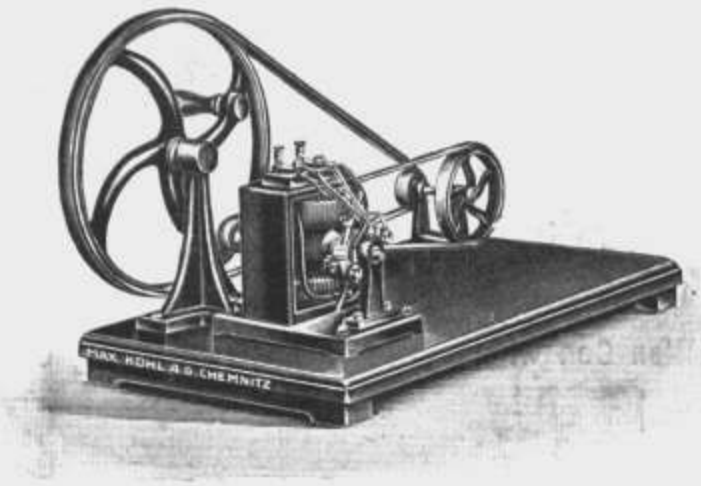
	£ s. d.
62,589. **Sparking Pillars** on Stand for firmly fitted on the wall bracked, for sizes 2—5	1. 0. 0
62,590. — idem, for sizes 6—9	1. 16. 0
62,591. — idem, „ „ 10—12	2. 10. 0
62,592. — idem, „ „ 12a—15a	4. 0. 0

Cl. 6024, 2843, 2839.

Dynamos
for Generating Direct, Alternating and Three-phase Current; also Accessories.



62767. 1 : 8.



62777. 1 : 12.

62,767. **Direct Current Dynamo,** Figure, with crossed armature and commutator in four sections, driving frame on polished wood board, with compound gearing for turning by hand . . . . . £ s. d. 3. 15. 0

62,768. **Machine alone,** can also be used as Motor 2. 10. 0

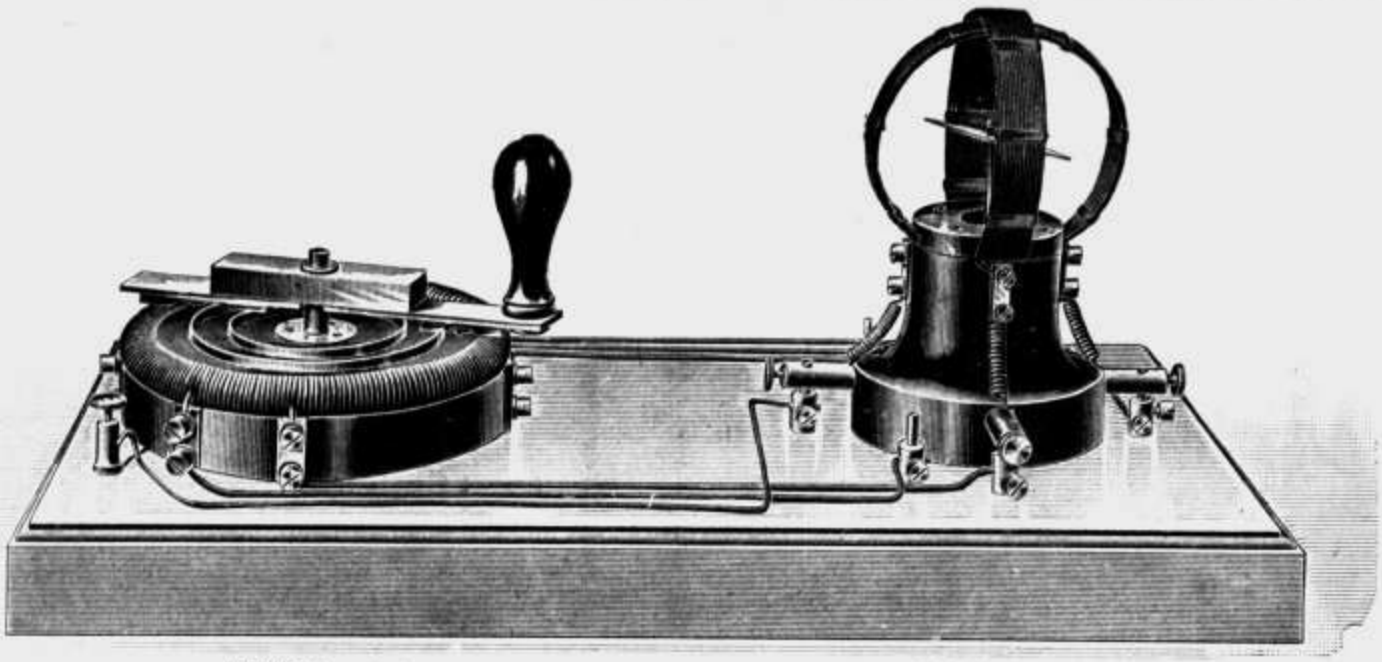
The Machine is constructed as a shunt dynamo; it gives 15 volts and 2 amps., feeds 2–3 small glow lamps or self-regulating arc lamp No. 62,815. It is possible to fuse a steel wire 0,15 mm thick and 8 cm long.

Shunt Dynamos for Direct Current, cf. Fig. 62,774; also constructed as Universal Dynamos, with 4 slip rings, for Direct, Alternating and Three-phase Current, with Drum Armature (cf. Gan.-Man., Fig. 806).

Approx. D. C. output		Approx. r. p. m.	Single-phase A. C. voltage	Three-phase pressure approx.	Approx. power required	Melts a Steel Wire		Feeds Glow Lamps		Feeds Arc Lamp No.	Without Driving Stand, cf. Fig. 62774		With Driving Stand, cf. Figs. 62777 and 62782	
Volts	Amps.		approx. Volts	approx. Volts	HP	Length mm	Diam. mm	No.	Hefner C. P.		List No.	£ s. d.	List No.	£ s. d.
(a) For Direct Current only.														
20	3	3000	—	—	0,25	120	0,15	4	3	62815	62770	4. 10. 0	62777	6. 0. 0
35	4	2800	—	—	0,33	250	0,2	5	8	62816	62771	8. 0. 0	62778	10. 0. 0
50	4	2200	—	—	0,5	300	0,2	5	12	62816	62772	10. 0. 0	62779	12. 10. 0
65	5	2200	—	—	0,8	400	0,3	7	16	62816	62773	12. 10. 0	62780*	22. 10. 0
(b) For Direct Current, Monophase A. C., Three-phase Current and Dissymetrical Two phase A. C.														
20	3	3000	14	12	0,25	120	0,15	4	3	62815	62774	5. 15. 0	62781	7. 5. 0
35	4	2800	24	20	0,33	250	0,2	5	8	62816	62775	9. 5. 0	62782	11. 5. 0
50	4	2200	34	30	0,5	300	0,2	5	12	62816	62776	11. 10. 0	62783	14. 0. 0
65	5	2200	44	38	0,8	400	0,3	7	18	62816	62776a	14. 0. 0	62783a*	24. 0. 0

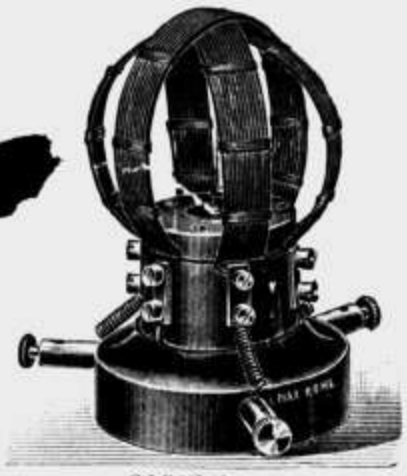
The Machines are of the two-fold type, provided with Drum Armature and are also suitable for continuous

* The Driving Stand for Nos. 62,780 and 62,783 a is constructed in accordance with Fig. 62,783 b. Cl. 6045, 6046.

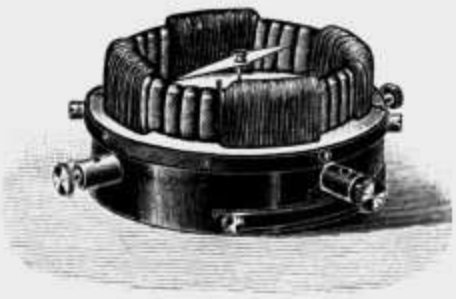


62 902 A. 1 : 3.

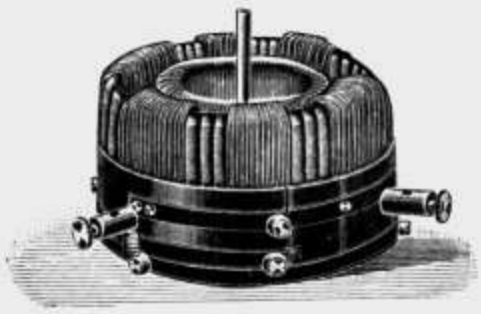
62 902 B. 1 : 3.



62 902 C. 1 : 3.



62 902 D. 1 : 3.



62 902 E. 1 : 3.

62,901. **Lantern Slides for Explaining the Connections and Mode of Action** of Generator No. 62,896, of A. C. Motor Model No. 62,898 and of the Demonstration Apparatus for rotary field experiments, No. 62,902 (W. D., Figs. 579—581, 583—587, 596 and 598) . . . . . Each | £ s. d. 0. 1. 6

(a) Alternator (Fig. 579),
(b) Magnetic Axis of the Alternator (Fig. 580),
((c) Stator Winding of the Three-phase Machine I (Fig. 581),
d) Curve for Mono-phase A. C. (Fig. 583),
(e) Curve for two-phase A. C. (Fig. 584),
(f) Curve for three-phase Current (Fig. 585),
(g) Star and Delta Connection (Fig. 586),
(h) Stator Winding of three-phase machine II (Fig. 587),
(i) Connections used as three-phase motor (Fig. 596),
(k) Connections used as mono-phase motor (Fig. 598).

62,902. **Demonstration Apparatus for Rotating Field Experiments (Battery A. C. Apparatus),** after Weinhold, Figs. A—E (Ztschr. f. d. phys. u. chem. U., **6,** p. 7; W. D., Fig. 582) . . . . . | 5. 10.

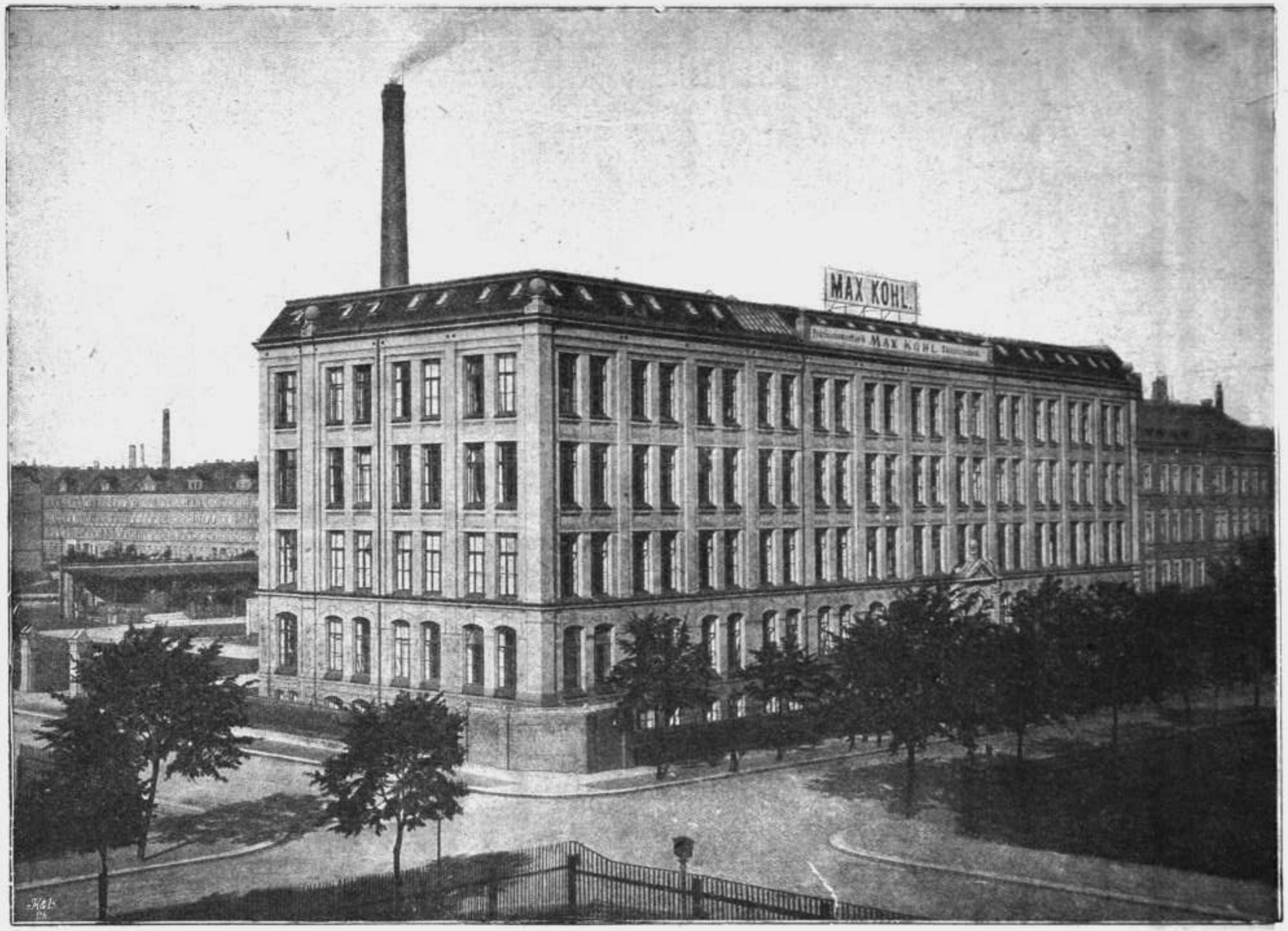
The complete apparatus consists of: **current distributing apparatus,** Fig. A; Ferraris Double Coil Fig. B; **Ferraris triple coil,** Fig. C; **4-coil iron ring,** Fig. D; **6-coil iron ring,** Fig. E; **magnetic needle** and **sheet-iron disc** with agate cap; **squirrel-cage rotor; glass disc** with iron filings.

The apparatus permits of carrying out the Alternating and Three-phase Current experiments in a convenient and practical manner. The following pertain to the apparatus: 1—2 Bunsen cells or an accumulator the current of which is transformed into Alternating or Three-phase Current by the distributing apparatus, Fig. A. This current flows through double or triple crossed different-coloured wire rings, Fig. B or C, in which a magnetic needle or an iron disc can be inserted. The bodies inserted in the coils rotate under the influence of the rotating field. Instead of these iron rings an iron ring can be attached consisting of four or six coils and wound with covered wires of different colour (Tesla Ring), Figs. D and E; with these it is possible to obtain synchronous rotation by inserting a magnetic needle or an iron disc; or asynchronous rotation may be produced by an iron ring wound with copper wire (short-circuited rotor). It is possible to show the migration of the lines of force of the field in a very pretty manner by means of a glass disc over which iron filings have been strewn.

62,903. — idem, but with Weinhold Coils, for the Horizontal Projection Apparatus, instead of the crossed coils after Ferraris (W. D., Fig. 592) . . . . . | 6. 0. 0

62,904. **Glow Wires** for above (W. D., Fig. 591), consisting of three marble sockets, one with one wire, one with two wires in star connection, and one with three wires connected in delta, with protecting caps . . . . . | 0. 15. 0

Cl. 2721, 2722, 2723, 2724, 2725.



Offices and Manufacture.