List of Prices

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MANUFACTURED BY

EDWARD M. CLARKE,

PHILOSOPHICAL INSTRUMENT MAKER,

BY APPOINTMENT,

TO THE ROYAL UNIVERSITY OF CHRISTIANA, NORWAY; AND ZOOLOGICAL SOCIETY OF LONDON;

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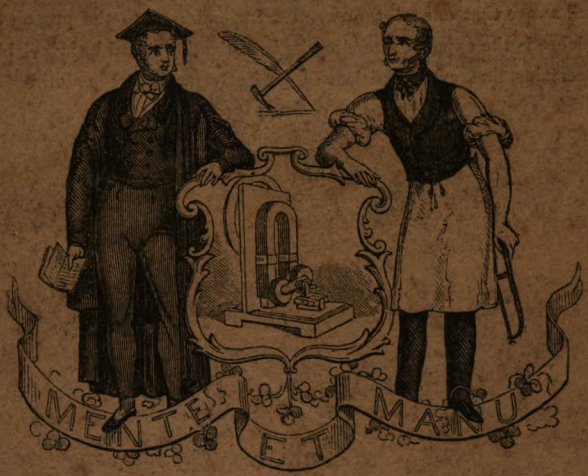

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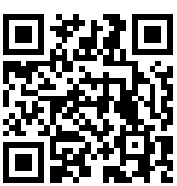
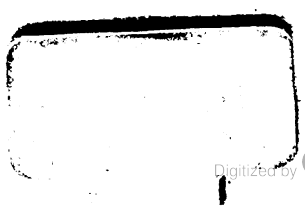


ADVERTISEMENT.

E. M. CLARKE submits the following List of Philosophical Instruments, with their prices, to public inspection; and begs leave to state, that, in addition to a theoretic knowledge of the principles of their formation and application, he possesses the mechanical capability of constructing them with his own hands, and really makes what he sells. His Workshops are at all times open to the inspection of scientific persons who may have any invention in progress of practical development; and he will be happy to afford any experimental assistance (Chemical or Mechanical) that may be required, for which his Laboratory and Workshops offer the most desirable facilities. It has been E. M. CLARKE'S endeavour to make each instrument answer as many experimental purposes as possible; being well aware that one of the greatest impediments to the pursuit of Science is the expense attending its investigations: and he invariably ascertains that every article will perfectly perform the duties for which it is intended, before he delivers it to the purchasers.

ERRATA.

Page 53, No. 56—for "Chronometer," *read* "Electrometer."



CATALOGUE

OF

PHILOSOPHICAL APPARATUS,

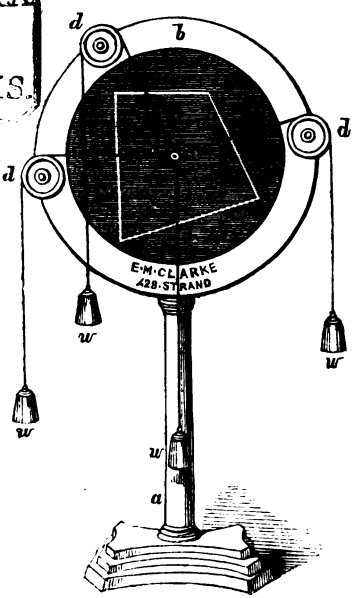
MADE

BY E. M. CLARKE, OPTICIAN,

428, STRAND, LONDON.

MECHANICS.

Fig. 1.



NO.		£	s.	d.
1	E. M. CLARKE's Arrangement of the Apparatus for illustrating the Equilibrium of Forces. This apparatus consists of a metallic ring (*b*) fig. 1, to which are attached the friction wheels (*d, d, d*); *c* is a circular slate for the purpose of drawing the lines and figures required to aid the experiments. The whole is supported on the brass pillar and foot (*a*). By means of this apparatus may be illustrated the parallelogram, triangle, and polygon of forces without the troublesome method of removing the figure boards, and it possesses the advantage of allowing the illustrator to vary the experiments according to his own wishes; including 3 friction wheels . . .	6	6	0
2	Additional Friction Wheels for the above; they are also made to fit on the various apparatus hereafter described, each	0	10	6
3	Sets of Weights, in brass or lead, from $\frac{1}{4}$ oz. to 50 oz., with top and bottom hooks			

NO.		£	s.	d.
4	Pair of Jointed Parallelograms to illustrate the Parallelogram of Forces. One having four equal sides of 12 or 18 inches, the other two sides of 10 or 15 inches, and the other two sides 15 or 20 inches . 14*s.* to	1	1	0
5	Sliding Jointed Parallelogram, made to alter the dimensions of its sides at pleasure . . . . . 1*l.* to	2	2	0
6	Apparatus for illustrating the Laws of Parallel Forces. This apparatus consists of a shallow metal trough for containing water, supported on legs, and having a stop-cock for emptying it when required. A square board, divided into inch squares, and having a small hole at the corner of each square, is placed to float on the surface of the water. Strings are now attached by pins fixed into the holes in the board, these press over friction wheels attached to the trough carrying weights. By this arrangement we easily get rid of the weight of the body, and are able to illustrate the equilibrium of a body acted on by parallel forces in a very marked manner; the centre of parallel pressures, stable, unstable, and neutral equilibrium are shown with equal exactness	4	14	6
7	Apparatus for illustrating the Composition of Forces in several Planes, consisting of two skeleton parallelopipeds, one rectangular, the other oblique, a polygon having its sides in different planes. Six movable friction wheels on adjusting metallic stands, and one stand with mahogany table for holding the parallelopipeds and polygon 6*l.* 6*s.* to	10	10	0
8	Apparatus for illustrating the Equilibrium of a Body moving round an Axis, and acted on by Forces soliciting it in various directions. Consisting of a vertical circular plane, marked with concentric circles 1 inch apart; round these circles holes are made at equal distances for receiving projecting pins: the whole is supported on a pillar and foot. This apparatus is used with the friction pulleys and stands described at No. 7. In mahogany 2*l.* 2*s.*, more correct in metal .	3	17	6
9	Apparatus for illustrating the Method of Finding the Centre of Gravity of various Figures. Consisting of a spring steel forceps, having two axle pins; also a mahogany triangle, parallelogram, trapezium, polygon, semicircle, ellipse, and parabola, having their centres of gravity and the geometrical lines for their determination marked on them. Small size . . . . . 1*l.* 16*s.* large	3	13	6
10	Skeletons of Triangular Pyramids and other Geometrical Solids, showing the method of determining their centres of gravity			
11	Apparatus, consisting of several parallelopipeds, fitting to each other, forming an inclined tower for illustrating the stability and instability of a body, as determined by its base and the line of direction of the centre of gravity, on a horizontal or inclined base	0	12	6
12	Another Apparatus for the same purpose. This consists of a single parallelopiped, having a movable piece near the centre of gravity. When the piece is in its place, the line of direction is within its base; but remove the piece, and the centre of gravity is thrown forward: the line of direction passing beyond the base, the body falls. If the top be now made the base, the line of direction just falls without the base, and consequently the body falls; by now removing the piece stability is restored, in consequence of the centre of gravity being thrown back	1	10	0
13	Apparatus to illustrate the Descent of the Centre of Gravity, while a body is apparently ascending an inclined plane . 7*s.* 6*d.*, 1*l.* 1*s.*	2	2	0
14	Apparatus to illustrate the Three Kinds of Equilibrium, consisting of a cylinder, with means of altering the centre of gravity . 12*s.* 6*d.* to	1	1	0
15	Set of Levers of the first, second, and third order, mounted on stands, with friction rollers and graduated scales. Mahogany . . .	2	2	0
16	Ditto, ditto, in brass			
17	Two Levers on Stands, rectangular and bent, mounted in brass . .			

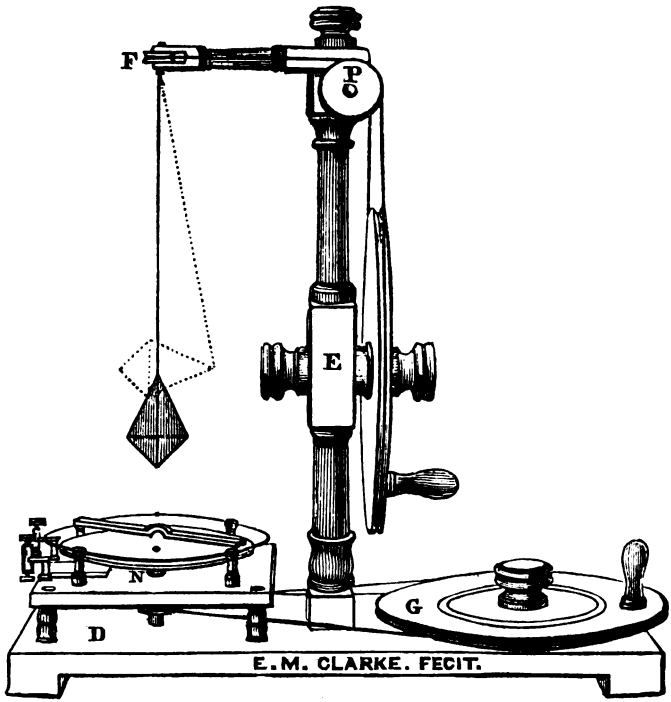
NO.		£	s.	d.
18	Stand, showing a set of Compound Levers in wood			
19	Ditto, ditto, in brass			
20	Model of a Steel Yard			
21	Ditto of the Bent Lever Balance			
22	Ditto of the Danish Balance			
23	Ditto of Bradley's Balance			
24	Ditto of a Balance, with means to show all the Adjustments	3	10	0
25	Apparatus to illustrate the Wheel and Axle 1*l.* 1*s.* to	6	6	0
26	Model of a Capstan and Windlass 2*l.* 2*s.* to	5	5	0
27	A Series of three-toothed Wheels and Pinions, for experimenting on the relation of power to weight, on cross standard 2*l.* 2*s.* to	5	5	0
28	Set of Three Pulleys in Frame, first, second, and third kinds			
29	Set of Three Pulleys in Frame, showing Smeeton's and White's arrangement of the second system, and Spanish burton			
30	Set of Three Pulleys in Frame, showing another kind of Spanish burton, and two combinations of second and third, and second and first systems			
31	Separate Pulleys for making different Combinations, each 3*s.* 6*d.* to	0	10	6
32	Inclined Plane of Mahogany, with roller and arrangement for increasing or decreasing the angle, without any projection 10*s.* 6*d.* to	3	13	6
33	Double Inclined Plane, with Rollers: the weights of the rollers may be altered at pleasure 1*l.* 10*s.* to	8	8	0
34	Apparatus to show the Construction of a Screw	0	5	0
35	Model of a Screw and Nut 8*s.* 6*d.* to	1	10	0
36	Ditto, showing the Action of the Endless Screw 1*l.* 10*s.* to	5	5	0
37	Acting Model of Hunter's Compound Screw	2	10	0
38	Model to illustrate the Manner of Screw-cutting, with and without an original Screw, with equilateral and square threads	6	16	6
39	Model for showing the Construction and Properties of the Arch 3*s.* to	2	2	0
40	Machine showing all the Mechanical Powers combined, on brass pillar and foot	8	8	0
41	Large Mahogany Apparatus to illustrate the Composition of Machines; consisting of a frame, with spur, crown, bevel wheels, pinion, lantern or trundle, universal joint, with falling shaft, endless screw, and worm wheel, wipers, stampers, crank, rack, sector, pulley, and winch. By the winch, motion is communicated to the whole or parts of the machinery, as occasion may require	18	18	0
42	Mahogany Model to illustrate experimentally the Properties of the spur, crown, and bevel gear 6*l.* 6*s.* to	8	8	0
43	Mahogany Standard, with fly-wheel and numerous pieces of machinery to illustrate experimentally *eight* various mechanical arrangements for producing direct and alternate motions of variable and uniform velocities. Standard 4 feet 6 high	9	9	0
44	Model of Two Wheels in close contact, to exhibit the communication of motion by friction 1*l.* 10*s.* to	2	15	0
45	Mahogany Apparatus to exhibit the Mechanical Method of describing the proper Curves for the Teeth of Wheels and the Leaves of Pinions	6	6	0
46	Wooden Models of the Rack and Pinion, and Wheel and Pinion, for showing the most approved form of the teeth of wheels and leaves of pinions 6*l.* 6*s.* to	9	9	0

NO.		£	s.	d.
47	Model of a Carriage with Two Sets of Wheels of different sizes, to illustrate the friction, resistance, &c., of Wheel Carriages	7	7	0
48	The Mechanical Powers, consisting of the different kinds of Levers, the Wheel and Axle; Stand, containing the different systems of pulleys, inclined plane, rolling cylinder, wedge, screw, and nut, and model of the screw. Packed in a lock-up case	24	0	0
49	Ditto, ditto, of a smaller size, most parts made in mahogany and hard wood, except the systems of pulleys; these are brass, without case .	7	10	0
50	Turning Lathe, with 3-inch iron heads, on wood beds 2 feet long, wood standards, iron fly-wheel, and one-throw crank, iron treadle, cast-steel collar and mandril, screw puppet head, three chucks, and one pair of screw tools. Plain or japanned . . . 7*l.* 7*s.* to	10	0	0
51	Ditto, ditto, with 3-inch iron heads on iron beds, 2-feet-long standards, fly-wheel, one-throw crank, and treadle in iron, cast-steel collar and mandril, with screw or cylinder puppet head, three chucks, and one pair of screw tools. Plain or japanned . . . 10*l.* 10*s.* to	15	0	0
52	Ditto, ditto, 4½-inch iron heads, on wood beds 2 feet 6 inches long, wood standards, iron fly-wheel, one-throw crank, iron treadle, cast-steel collar and mandril, screw puppet head, three chucks, and a pair of screw tools . . . . . 9*l.* 9*s.* to	14	0	0
53	Ditto, ditto, 4½-inch iron heads, on iron beds 2 feet 6 inches long, with standards, fly-wheel, plane or conical, one-throw crank, and treadle in iron, cast-steel collar and mandril, cast-iron pulley, cylinder or screw puppet head, iron rest and two T.s, four metal chucks, and one pair of screw tools . . . . . 12*l.* 12*s.* to	20	0	0
54	Turning Lathe, with 5½-inch heads on wood beds 3 feet long, wood standards, iron fly-wheel, one-throw crank, iron treadle, cast-steel collar and mandril, screw puppet head, five metal chucks, and a pair of screw tools . . . . . 11*l.* 11*s.* to	16	16	0
55	Turning Lathe, with 5½-inch heads, iron beds 3 feet long, iron standards, plane or conical iron fly-wheel, one-throw crank, iron treadle, cast-steel collar and mandril, cast-iron pulley with or without dividing plate, cylinder or screw puppet head, cast-iron rest and two T.s, five metal chucks, and a pair of screw tools. Plain or japanned 20*l.* to	31	10	0
56	Compound Slide Rest to suit ditto . . . . . 10*l.* 10*s.* to	15	0	0
57	Turning Lathe, with 6½-inch heads on wood beds 3 feet 6 inches long, wood standards, iron fly-wheel, one-throw crank, iron treadle, cast-steel collar, iron and steel mandril, screw or cylinder puppet head, six metal chucks, and a pair of screw tools . . . . 15*l.* to	21	0	0
58	Ditto, ditto, ditto, on cast-iron beds 3 feet 6 inches long, iron standards, conical or plane iron fly-wheel, one-throw crank, iron treadle, cast-steel collar, iron and steel mandril, iron pulley, with or without dividing plate, cylinder or screw puppet head, iron rest and two T.s, six metal chucks, and one pair of screw tools. Plain or japanned . . . . . 25*l.* to	35	0	0
59	Compound Slide Rest to suit ditto . . . . . 14*l.* to	20	0	0
60	Grinding Stones, set in wood or cast-iron troughs, with crank and treadle foot movement . . . . . 2*l.* 2*s.* to	4	14	6
61	Surface, universal, die, and other chucks			
62	Turning Tools in every variety . . . . . per dozen 12*s.* to	1	10	0
63	Wheel and Pinion, slow motions fitted to lathes			
64	Taps, Dies, Screw-plates, and every variety of Screwing Tackle . .			

DYNAMICS.

NO.		£	s.	d.
1	Atwood's Machine to illustrate the Doctrine of Accelerated Motion, mounted on a stand, escapement, and pendulum for beating seconds, weights, &c.	22	0	0
2	Brass-grooved Wheel, on brass base and uprights, very perfectly balanced, and delicately suspended at the pivots. This apparatus answers all the purposes of Atwood's Machine at a small cost	4	4	0
3	Harris's Apparatus, consisting of a pendulum and levers to beat seconds for ditto	2	2	0
4	Apparatus, with divided Arc and Ivory Balls, suspended to illustrate the laws of collision . . . . . 2*l.* 10*s.* to	3	8	0
5	Clay Balls for ditto . . . . . each 6*d.*	0	1	0
6	Apparatus for illustrating the Composition of Motion, consisting of a square pannelled mahogany board, with sides, and a contrivance for impelling an ivory ball in the direction of either of two sides of the square, and also for giving an impulse in both directions at the same time, so as to cause the ball to describe the diagonal of the square. Mahogany board, 2 feet square . . 2*l.* 10*s.*, 3 feet square	4	14	6
7	Apparatus, consisting of a Fixed Semicircle and Movable Chord, and contrivance for allowing the simultaneous descent of two ivory balls down the chord and diameter, showing that the descents are made in equal times, whatever be the length of the chord . . 2*l.* 10*s.* to	7	17	6
8	Apparatus to illustrate the Curve of Quickest Descent, consisting of a straight line or chord, hyperbola, circular arc, and cycloidal arc 3*l.* 3*s.* to	8	8	0
9	Brass Model of Captain Kater's Pendulum, consisting of a brass rectangular graduated rod, 50 inches long, two movable knife-edges for suspension; and movable bob and clamp, with a steel plate, and clamp for suspending	4	4	0
10	Apparatus to illustrate the Properties of the Cycloidal Pendulum 2*l.* 12*s.* 6*d.* to	4	4	0
11	Apparatus for illustrating the Centre of Percussion. This apparatus consists of a steel rod, having at one extremity a small indentation made at either side for receiving the pointed ends of two screws, one at each side, supported by two uprights: by this means the bar is made to move on an axis, but so that a small pressure will force it out. The bar also rests on a steel support, that moves back and forward on the bottom board. To find the centre of percussion, place the support at any distance from the axis, raise the bar, and let it fall on the support: if it does not drop from the screws at the axis, the support is at the centre of percussion; but should the bar fall from the screw points downwards, then the support is too far from the axis, and *vice versâ*	5	5	0
12	Apparatus for showing the Parabolic Path of a Solid Projectile . .			
13	Ditto for the Parabolic Curve of a Projected Liquid			
14	Whirling Table for demonstrating the Laws of Central Forces, with arrangement for marking time by sound and space, shown by an index	20	0	0
15	Apparatus to illustrate that a Body, rotating rapidly about its axis, if free, will always select the shorter	2	2	0
16	E. M. CLARKE's Combined Apparatus for exhibiting most of the Experiments of No. 14, and all of No. 15. It consists of a strong mahogany bottom board, D, fig. 2; G, a horizontal multiplying wheel for driving the vertical mandril H, the screw of which passes through the top of the table at N. At the centre of the bottom board is			

Fig. 2.



NO.		£	s.	d.
	fixed a strong upright pillar, with a multiplying wheel moving in a notch at E, for driving the revolving pin at F. This apparatus is furnished with a number of figures, to illustrate that a body rotating rapidly about its axis, if free, will always select the shorter, as the double cone suspended from F in outline shows the position of suspension at rest; but on communicating motion to the revolving pin F, by turning E, the string that carries the double cone will gradually deviate from the perpendicular, and the cones revolve, as shown by the dotted figure. Six illustrations of this law are furnished by the apparatus; viz. cone, double cone joined at base, double cone joined at the apex, cylinder, disc, ring, and chain. Also an apparatus for illustrating the cause of the oblate figure of the earth, which screws on the vertical mandril N. For a further detail of the uses this apparatus is applied to, and its other accessories, see *Magnetic Electricity*, Combined Apparatus	8	8	0
17	Apparatus for using with Nos. 14 or 16, consisting of two balls of different weights connected together, for the purpose of placing their centre of gravity over the axis of motion, for showing the equality of their tendencies from the centres of motion . . 2*l.* 2*s.* to	5	5	0
18	Conical Pendulum for illustrating the principle of the Governor to be applied to Nos. 14 or 16 . . . . . 1*l.* 10*s.* to	3	3	0

HYDROSTATICS AND HYDRAULICS.

NO.		£	s.	d.
1	Apparatus to illustrate the Equal Transmission of Liquid Pressure in all directions	5	15	6
2	Apparatus for demonstrating that the Pressures of Liquids are proportional to their Vertical Heights and Areas of Surface pressed upon. Consisting of three glass vessels of different shapes, but having bases of equal areas and same heights, on metal stand, with ground brass rings on the vessels, and ground valve attached to a lever 2*l.* 2*s.*, 4*l.* 4*s.*, and	6	6	0
3	Hydrostatic Bellows or Apparatus to illustrate that Fluids press equally in all Directions and in Proportion to their Perpendicular Depths; consisting of two circular boards connected by a band of caoutchouc cloth: to the bottom board is attached a long vertical tube of glass, having a funnel at top, and a graduated scale; if weights be placed on the upper board, on pouring water down the glass tube, the upper board will be elevated, carrying the weights	4	14	6
4	Bramah's Hydrostatic Press, small size, but with sufficient power to break a bar of cast iron, ¾ by ½ inch	15	15	0
5	Apparatus for showing that Fluids attain the same Level when in communication . . . . . 2*l.* 12*s.* 6*d.* to	6	6	0
6	Model of a Canal Lock, showing a section of the apparatus, with floodgates and sluices for allowing the water to enter or escape from apartments. The front is of glass, so that the operation of lowering and raising a small boat may be distinctly seen	10	10	0
7	Glass Syphons, with or without exhausting tubes . . . 1*s.* to	0	5	0
8	Working Model of an Intermitting Spring, consisting of two vessels of different sizes, connected by a small pipe; the larger is filled with water, which slowly enters the small one. A syphon is fitted into this last, reaching to the bottom, and the bend being at the same height of the smaller vessel; hence, when this becomes full, the syphon begins to act, and continues until the vessel is empty, when it ceases until it is again filled from the larger vessel; the syphon then draws off the water as before	2	12	6
9	Tantalus Cup, consisting of a glass vessel, with a syphon concealed under an image; when water is poured into the vessel, before it reaches the lips of the image it is drawn off by the syphon	0	10	6
10	Hydrostatic Balances, with electro-gilt steel beam and sets of weights, and all the apparatus necessary for determining the specific gravity of liquid and solid bodies . . . . 2*l.* 12*s.* 6*d.*, 4*l.* 4*s.* to	7	17	6
11	Apparatus for showing that when a body is immersed in a liquid, it loses as much weight as is equal to the weight of its bulk in water 7*s.* 6*d.* to	0	15	0
12	Hydrometers and Saccharometers, in metal and glass, of various constructions . . . . . 7*s.* 6*d.* to	5	5	0
13	Hydrometrical Beads, in sets . . . . . 4*s.* 6*d.* to	1	1	0
14	Nicholson's Gravimeter, for determining the specific gravity of solids and liquids	1	10	0
15	Apparatus for Illustrating the Laws of Spouting Fluids . 2*l.* 10*s.* to	6	6	0
16	Set of Glass Tubes of Small Bore, for showing capillary attraction .	0	5	0
17	Apparatus, consisting of two plates of flat glass placed at a very small angle to show the form of the curve produced by capillary attraction 10*s.* to	1	1	0
18	Acting Model of Vera's Rope Pump, for raising water by capillary attraction	7	7	0
19	Acting Model of Archimedes' Screw . . . . . 1*l.* 15*s.* to	4	14	6
20	Ditto, with the screw or snail of glass	5	5	0

NO.		£	s.	d.
21	Acting Models of Over-shot, Under-shot, and Breast Wheels 2*l.* 2*s.*, 4*l.* 4*s.*, or	6	6	0
22	Working Model of Baker's Centrifugal Mill . . . 2*l.* 10*s.* to	6	6	0
23	Acting Model of the Chain Pump	8	8	0
24	Apparatus, consisting of a Floating Body shaped like a section of a ship at right angles to its length, with stem and movable weight for illustrating the properties of the metacentre and centre of buoyancy			
25	Glass Jar, with air-tight Caoutchouc Cover, containing a hollow glass balloon or figures of men, &c. floating at top; when pressure is applied to the cover, the air confined in the balloon or figures is condensed, and they fall to the bottom of the vessel, on removing the pressure, they again ascend . . . . . 5*s.*, 10*s.*, 15*s.*	1	1	0
26	Glass Balloons and Figures for ditto, without the glass jar . 1*s.* 6*d.* to	0	6	6

PNEUMATICS.

1	Largest size double-barrel Air-Pump, with Smeaton's single cylinder, on high mahogany stand, barometer gauge, gun-metal receiver-plate, forked key, and lever	60	0	0
2	Large size double-barrel Air-Pump, on high mahogany stand, barometer gauge, gun-metal receiver-plate, forked key, and lever . . .	36	0	0
3	Second size double-barrel Air-Pump, on high mahogany stand, barometer gauge, gun-metal receiver-plate, forked key, and lever . . .	16	16	0
4	Large size double-barrel table Air-Pump, mercurial gauge, gun-metal receiver-plate, wrought-iron clamp, and key	14	0	0
5	Second size ditto, ditto	10	0	0
6	Third size ditto, ditto	8	0	0
7	Fourth size ditto, ditto	6	0	0
8	Single-barrel Air-Pumps, with horizontal, vertical, or inclined barrel 1*l.* 1*s.* to	3	3	0
9	Exhausting Syringe . . . . . 7*s.* 6*d.* to	1	1	0
10	Condensing ditto . . . . . 10*s.* 6*d.* to	1	10	0
11	Syringe for exhausting and condensing . . . . . 15*s.* to	2	2	0
12	Open and close Glass-Receivers, with welted edges, accurately ground, of all sizes . . . . . 3*s.* to	1	1	0
13	The Torricellian Experiment, to illustrate the construction of the Barometer; consisting of a glass tube 34 inches long, closed at one end, a cup for mercury, and a tall glass receiver for covering both . .	0	16	0
14	Magdeburg Hemispheres, to illustrate that the pressure of the atmospheric air is nearly equal to 15 lbs. on the square inch; consisting of two half-spheres ground air-tight, and a stop-cock for securing the vacuum, with stand and stirrup handles . . . 7*s.* 6*d.* to	1	10	0
15	Four Barometer Tubes for showing the upward, downward, oblique, and lateral pressures of the atmosphere	0	10	0
16	Apparatus for shewing the Weight of Air; consisting of a strong hollow metallic vessel, with stop-cock and screw-piece to connect it with the air-pump and condensing syringe . . . 18*s.*, 1*l.* 10*s.*, to	2	2	0
17	Guinea and Feather Experiment, demonstrating the resistance of air; consisting of an apparatus to allow the fall of a heavy and a light body at the same time. One, two, or three falls 8*s.* 6*d.*, 18*s.*, 1*l.* 5*s.*	1	10	0
18	Two Sets of Windmills for the same purpose: the vanes of one have their vanes at right angles to their axis, the vanes of the other			

NO.		£	s.	d.
	are parallel. When both are set in motion in a vacuum, they revolve in equal time ; but in air the latter comes to rest before the former .	1	10	0
19	Bladder Glass, for illustrating the pressure of the Atmosphere : a piece of bladder is tied tightly over the larger end of the glass, and allowed to dry ; when this is placed on the air-pump plate, and the air withdrawn from beneath, the bladder is burst by the external pressure of the atmosphere with a loud report . . . . 2*s.* to	0	3	6
20	Hand Glass : a similar experiment to the above ; placing the hand on a receiver of a less diameter, it becomes fixed by the pressure of the atmosphere . . . . . 1*s.* 6*d.* to	0	3	6
21	Apparatus to illustrate the Porosity of Woods by forcing air and mercury through a cylindrical piece of wood by atmospheric pressure .	0	6	6
22	Lungs Glass, to illustrate the elasticity of air, consisting of a closed glass vessel having a bladder within it, which is open to the air : on partially withdrawing the air from the bladder, the air in the glass vessel expands, contracting the bladder ; on admitting the air within the bladder, it then expands, thus imitating the action of the lungs .	0	5	6
23	Apparatus to prove the Elasticity of Air, consisting of a stand of three pillars, within which are two hollow wooden boxes, containing a partially-blown bladder. Heavy lead weights are placed on the top of the upper box : when the air is exhausted from the receiver under which the apparatus is placed, the air within the bladder expands, and raises the box and weights ; on admitting the air, the bladder shrinks, and the weights descend . . . . . 6*s.* 6*d.*, 10*s.* 6*d.*, to	0	15	0
24	Wire Cage and six thin square Glass Bottles, for showing the Pressure and Elasticity of Air. One bottle, with brass cap and valve. . .	0	16	0
25	Apparatus, consisting of three Glass Vessels for illustrating the Mechanical Properties of Air. A coloured liquid is forced from the first vessel to the second by the elastic force of air, and from the second to the third by its pressure . . . . . 10*s.* 6*d.*	1	1	0
26	Double Transfer Plates, for illustrating the Expansibility of Air. When the air has been exhausted from a glass receiver on one plate, and a communication opened with another on the other plate that has not been exhausted, both receivers will be then held down with equal force	1	17	6
27	Ditto, ditto, with two glass receivers, ground on the edges . . .	2	12	6
28	Apparatus to show a Fountain in Vacuo, consisting of a ground brass plate, with jet and stop-cock. A tall glass receiver is placed on the plate and the air withdrawn, the stop-cock is immersed in water and opened, the pressure of the atmosphere on the water forces it through the jet up the receiver . . . . . 10*s.* 6*d.* to	1	1	0
29	Apparatus to produce a Fountain by the Expansion and Exhaustion of Air, consisting of a glass vessel partly filled with water, having a brass cap and jet, and a tube reaching nearly to the bottom : this being placed under a receiver, as soon as the air is exhausted in the receiver, the air in the vessel expands, and forces up the water in a jet 5*s.* to	0	10	6
30	Ditto, ditto, with glass receiver to save the water falling on the pump plate . . . . . 12*s.* 6*d.* to	0	18	0
31	Fountain by Condensed Air, consisting of a strong hollow copper vessel, pipe, stop-cock, set of jets, and condensing syringe . 2*l.* 15*s.* to	4	14	6
32	Acting Model of the Lifting Pump, with glass barrel, showing the action of the valves and piston. Plain, with ring on the end of piston rod, 1*l.* Best, with pump-handle	1	10	0
33	Acting Model of the Forcing Pump, with glass barrel, showing the valves and piston and glass air vessel on stand	2	10	0
34	Acting Models of the Lifting and Forcing Pumps on the same stand, with water cistern	4	14	6
35	Acting Model of De la Hire's Double-acting Pump	4	4	0

NO.		£	s.	d.
36	Acting Model of Montgolfier's Hydraulic Ram	5	5	0
37	Chromatic Fire-Cloud Fountain, consisting of a very strong copper vessel, with a lever handle, stop-cock, and tube reaching nearly to the bottom. A solution of muriate of copper and strontian in spirits of wine is put into the copper vessel, a condensing syringe is screwed on to the stop-cock, and air is condensed above the solution ; the syringe is removed, and a long brass jet is put in its place. The copper vessel is immersed in a tin pan, filled with boiling water. The operator now straps on a breastplate, removes the apparatus out of the hot-water pan, and places it in the breastplate, as seen at fig. 3 ; the cock is now turned for a moment, a portion of the liquid is projected on the ceiling, to which a light is applied. The room should be made dark, and while the flame still continues to burn, more of the liquid should be projected on it at intervals, which produces a brilliant and beautiful effect, like liquid waves of fire rolling in all directions, exhibiting a never-ending succession of prismatic-coloured flames. The copper apparatus, including the breastplate, brass condensing syringe, and tin pan for boiling water	6	10	0

Fig. 3.

38	Bell Apparatus, to prove that air is the medium of sound. This apparatus may be suspended in the receiver, and set in action by elevating and depressing alternately the wire that passes through a collar of leathers, proving that sound cannot be transmitted in a vacuum . . . . . 10*s.* 6*d.* to	0	16	0
39	Gunpowder Apparatus, to prove the same fact	1	0	0
40	Brass Stick for holding a piece of Wax Taper, to prove that air is necessary to support flame	0	0	6
41	Acting Model of the Diving Bell, consisting of a glass vessel for holding water, a glass bell, with apparatus to supply pure and withdraw the impure air. A living animal, such as a mouse, monkey, or squirrel, may be sent down in the bell ; or merely a lamp, the flame of which will afford a full illustration of the principle . . . 1*l.* 10*s.* to	15	15	0
42	Small Balloons for inflating with hydrogen gas, to illustrate the principles of Aërostation . . . . . 1*s.* 6*d.* to	0	10	0
43	Balloons, with netting and cage cars, for sending up monkeys, cats, &c. . . . . 4*l.* 14*s.* 6*d.* to	8	8	0
44	Delbruck's Patent Lead Apparatus, to generate hydrogen gas for ditto 1*l.* 10*s.* to	4	4	0
45	Leslie's Apparatus for producing congelation in a vacuum, consisting of a shallow bell glass receiver, a glass dish with open centre for sulphuric acid, and glass pan for the water to be frozen. This arrangement never fails . . . . . 12*s.* to	1	1	0
46	Another form of Leslie's Apparatus, with steel rod and polished plate of metal passing through the top of the receiver, to show that when the evaporation is impeded no congelation takes place . . 1*l.* 10*s.* to	2	12	6
47	Wollaston's Cryophorus, consisting of two bulbs connected by a tube 1*s.* 6*d.* to	1	10	0

NO.		£	s.	d.
48	Wollaston's Cryophorus, consisting of one bulb and a cylindrical chamber, with ground brass plate and stuffing box to place on an open receiver . . . . . 1*l.* 12*s.* 6*d.* to	3	3	0
49	Glass Flask, mounted with light brass cap and small stop-cock, for illustrating the influence of diminished pressure in facilitating ebullition .	0	7	6
50	Water Hammer for illustrating Elasticity of Air. In consequence of the absence of air, the water in the tube falls with a loud sound from one end to the other, as though it were a solid body . 2*s.* 6*d.* to	0	7	6
51	Syringe, with weight attached, to illustrate atmospheric pressure. In the air the piston is with difficulty raised from the bottom to the top of the barrel, and when let free immediately descends by the atmospheric pressure; but when suspended in a vacuum the piston descends	0	10	6
52	Ground Brass Plate, with metal rod sliding through a collar of leathers in a stuffing box, for suspending or giving motion to different pieces of apparatus when placed under glass receivers, such as Nos. 38, 49, &c. . . . . 7*s.* 6*d.* to	0	18	0
53	Balance on stand, with a cork or glass globe at one end, and a lead counterpoise at the other, to show that two bodies that are balanced in an atmosphere of common density, are not so when in a vacuum .	0	7	6
54	Brass Syringe, for igniting amadou by compressed air . . 2*s.* 6*d.*	0	8	0
55	Ditto, with glass barrel	2	10	0
56	Apparatus for experimenting with foul air	0	15	0
57	Painted Wooden Sectional Model of the Air-Pump in its present most improved form, showing the action of the Torricellian vacuum gauge, the opening and closing of the valves, and the working of the pistons. 3½ feet square	6	16	6
58	Painted Wooden Sectional Model of the Fire-Engine, showing the arrangement of the air-box, the working of the pistons and valves, &c. 3½ feet high, 3 feet wide	4	14	6

STEAM ENGINE.

APPARATUS AND MODELS TO ILLUSTRATE THE STEAM ENGINE.

1	Dr. Wollaston's Apparatus, consisting of a glass cylinder, with bulb, piston, and hollow rod, illustrating the production of motion by the generation and condensation of steam . . . . 5*s.* 6*d.* to	0	8	6
2	Marcet's Apparatus, with barometer, thermometer, stop-cock, and jet attached, for showing the temperature and elastic force of high-pressure steam, the economy of heating water by steam, and the most important facts connected with latent caloric. In consequence of many accidents having occurred with this instrument when made of brass, owing to the unavoidable amalgamation with the mercury, E. M. C. has always made this apparatus of cast-iron . . .	3	13	6
3	Ure's Apparatus for demonstrating the same phenomena at temperatures above and below the boiling point of water	3	15	0
4	Working Model of Hero's Rotary Engine. Motion is produced by the reaction of the steam rushing into the atmosphere from two opposite escape pipes . . . . . 3*l.* 13*s.* 6*d.* to	5	15	6
5	Working Model of De Caus' Engine. Water is forced out of this boiler in a small jet by the force or pressure of the generated steam 2*l.* 10*s.* to	3	13	6
6	Working Model of Branca's Engine. A jet of steam, blowing against vanes fixed on the periphery of a wheel, communicates a rotary motion to it . . . . . 3*l.* 13*s.* 6*d.* to	5	15	6

NO.		£	s.	d.
7	Working Model of Savory's Engine. This engine was the first that was brought into use, having been applied to drain mines, &c. 5*l.* 5*s.* to	7	17	6
8	Working Model of Papin's Engine. This was the first engine in which a piston was employed, and the first application of the safety valve to the boiler . . . . . 8*l.* 8*s.* to	15	15	0
9	Working Model of Newcomen's Atmospheric Engine. In this engine a great improvement was effected by the introduction of an oscillation beam, the extremity of one of its arms being attached to the piston by a rod, while from the other is suspended a rod for working a pump for raising water; motion is given by steam underneath the piston, assisted by counterpoise weights on the pump-rod raising it to the top of the cylinder, when the steam being condensed, the weight of the atmosphere forces it down again: this was the first engine in which the working cylinder was detached from the water to be raised 14*l.* 14*s.* to	22	0	0
10	Working Model of Watt's Single-acting Engine. The improvements in this engine consist in the substituting steam for atmospheric pressure above the piston, forcing it to the bottom of the cylinder; the steam being then admitted below the piston, placing it in equilibrium, when it is raised by a slight counterpoise to the top; the steam from the bottom of the cylinder is afterwards admitted to the condenser, which was in this engine first made separate from the cylinder. This was the first engine in which steam was practically employed as a direct motive power, having been heretofore only employed as a means of producing a vacuum to allow the atmosphere to act in a similar manner . . . . . 24*l.* to	45	0	0
11	Working Model of Watt's Double-acting Engine. The improvements of this engine over the last are the application of the power of steam alternately to both sides of the piston, forcing it up as well as down, the opposite ends of the cylinder being open to the condenser; the parallel motion, the crank and fly-wheel for converting the reciprocating motion of the beam into a rotary one, and the governor for regulating the action of the engine . . . . . 30*l.* to	60	0	0
12	Working Model of Cartwright's Engine. This engine was intended to be worked by the vapour of alcohol, and was the first in which a metallic piston was employed	22	10	0
13	Working Model of Wolf and Edwards' High-pressure and Expansive Engine. In this engine the steam from the first cylinder enters a larger one, where its expansive power is employed, from which it passes into the condenser . . . . . 35*l.* to	65	0	0
14	Working Model of Trevethick and Vivian's High-pressure Engine. The cylinder in this arrangement is fixed vertically in the boiler: this was the first non-condensing engine that was brought into general use	8	8	0
15	Working Model of an Oscillating High-pressure Steam Engine. By this arrangement the rotary motion is communicated to the cranked axle and fly-wheel direct from the piston rod . . . 4*l.* 14*s.* 6*d.* to	7	10	0
16	Working Models of various High-pressure Steam Engines, such as Murray's, Maudesley's, Brunel's, Perkins's, Nathan Gough's, &c.			
17	Working Models of Rotary Engines of various constructions, as Cartwright's, Hornblower's, Masterman's, Galloway's, Beal's, &c. . .			
18	Working Model of Trevethick and Vivian's Locomotive Steam Engine	14	14	0
19	Working Model of a Locomotive Steam Engine. This model is a perfect copy of the four-wheeled engines now in use, and is capable of drawing a model train on a circular or straight railroad	25	0	0
20	Working Model of a Six-wheeled Locomotive Steam Engine, similar to those now employed on many railroads	45	0	0

NO.		£	s.	d.
21	Working Model of a Six-wheeled Locomotive Steam Engine, warranted to work at a pressure of 200 lbs. per square inch of the boiler, and to draw 150 lbs. weight on a model railroad, as constructed by Lieutenant Rodney	95	0	0
22	Model Railroads, with cast-iron chairs and rails for the above carriages			
23	Models of Railway Trains, consisting of tender, mail, first, second, and third class carriages, luggage, and cattle waggons and trucks 17*s.* 6*d.* to	2	2	0
24	Working Models of Steam Carriages for common or turnpike roads .	36	10	0
25	Working Model of E. M. Clarke's Electro-Magnetic Locomotive Engine and Battery for Railroads. This model will remove the doubts of the most sceptical as to the possibility of applying Electro-Magnetism as a prime mover for this and other purposes	30	0	0
26	Working Model of a Marine Beam Engine, with paddle-wheels, &c., similar to those employed in most sea-going steamers, viz., Great Western, &c. . . . . 35*l.* to	56	0	0
27	Working Model of a Steeple Engine. Few engines of this description are employed, as their connecting rods &c. occupy a considerable portion of the deck, though between decks they require less space than the ordinary ones	35	0	0
28	Working Model of Maudesley's Vibrating Engine. This description of engine is simpler, and more compact than any other; the beams, cross-heads, connecting rods, and parallel motion being dispensed with. They are extensively employed in the steam-boats on the Thames . . . . . 20*l.* to	36	10	0
29	Working Models of Spillar's, Seward's, Field's, Humphrey's, &c., Marine Engines, made to order			
30	Working Models of Perkins' Steam-Gun for projecting Bullets, mounted on a strong copper boiler, generating steam at a pressure of 200 lbs. per square inch	10	10	0
31	Models of Sawing, Sugar, and Rolling Mills, Coining Presses, and Tilt Hammers, adapted to be worked by model steam-engines, made to order			
32	Painted Wooden Sectional Model of Bolton and Watt's Single-acting Engine, Boiler, and Furnace; showing the action of the piston, valves, cocks, tappets, pumps, &c.; motion being given to the beam by hand or otherwise. Engine, 3½ feet long by 3 feet high; boiler, 3 feet long	12	12	0
33	Painted Wooden Model of Bolton and Watt's Double-acting Engine Boiler and Furnace; showing the exterior of the engine, the working parts, such as the cylinder, condenser, air-pump, valves, &c. separating, thus showing their action in section: motion being communicated by the fly-wheel. Engine, 4½ feet long, 4 feet high; boiler, 5½ feet long	28	0	0
34	Painted Wooden Sectional Model of Bolton and Watt's Double-acting Engine, Waggon, Boiler, and Furnace; showing all the working parts in motion. Engine, 3½ feet long, 3 feet wide; boiler, 3 feet long .	14	14	0
35	Painted Wooden Sectional Model of Maudesley's Vibrating Condensing Engine. 2 feet wide, 3 feet high	6	6	0
36	Painted Wooden Sectional Model of a High-Pressure Engine and Cornish Boiler. Engine, 2 feet wide, 3 feet high; boiler, 2½ feet long .	10	10	0
37	Painted Wooden Sectional Model of a Locomotive Engine and Tender, showing the arrangement of the boiler, tubes, fire-box, smoke-box, safety-valves, whistle, cocks, cylinder, slide, crank, eccentric and pumps; motion being given by the driving wheel. Engine, 4 feet long; tender, 3½ feet long			
38	Painted Wooden Model of Bolton and Watt's Marine Engine. 3½ feet long, 3 feet high	10	10	0
39	Ditto, ditto, with boiler, furnace, flues, &c. Boiler, 3½ feet long . .	15	15	0

NO.		£	s.	d.
40	Painted Wooden Sectional Model of a Cylinder, Slide-valve, and Condenser, illustrating the action of the piston and slide-valve, and the distribution of the steam in the cylinder	3	13	6
41	Painted Wooden Sectional Model of Wolf and Edwards' Double Cylinders, Nozzles, Valves, and Condenser for their high-pressure and expansive Engines	6	6	0
42	Painted Wooden Model of a Cornish Steam Boiler, dissecting, to show the arrangement of all the flues, pipes, and general section of the boiler	8	8	0
43	Wooden Model of the puppet or T valve	1	10	0
44	Wooden Model of the short slide-valve, separating, showing the interior arrangement	1	12	6
45	Wooden Model of the D valve, separating as above	2	5	0
46	Wooden Model of the Four-way cock on plain surfaces	0	15	0
47	Painted Wooden Model of Maudesley's Four-way Cock, taking to pieces to explain its construction	2	10	0
48	Wooden Models of the different kinds of Pistons for steam-engine cylinders, 9 inches diameter	2	10	0
49	Wooden Models of Brine-pumps, Feed-heads, &c. &c.			

MATHEMATICAL INSTRUMENTS.

1	Plain Brass Drawing Instruments, with steel points and joints in paper and skin pull-off cases . . . . . 7*s.* 6*d.* to	2	12	6
2	Pair of Sector-jointed Dividers . . . . Brass 6*s.* Electrum	0	7	0
3	Pair of Sector-jointed Compasses, with double joints and pull-off leg. Brass 11*s.* 6*d.* Electrum	0	15	0
4	Pen and Pencil Points, to fit ditto . . Brass 4*s.* each. Electrum	0	5	0
5	Lengthening Bar for ditto . . . . Brass 5*s.* 6*d.* Electrum	0	7	6
6	Sector-jointed Hair Dividers . . . . Brass 9*s.* Electrum	0	10	6
7	Bow Pen or Pen Minutes . Brass plain 2*s.* 6*d.* Best 6*s.* Electrum	0	7	0
8	Bow Pencil or Pencil Minutes. Brass plain 2*s.* 6*d.* Best 6*s.* Electrum	0	7	0
9	Bow Pen, double-jointed . . . . Brass 12*s.* 6*d.* Electrum	0	13	6
10	Bow Pencil, double-jointed . . . . Brass 12*s.* 6*d.* Electrum	0	13	6
11	Spring Dividers, with brass, ivory, or electrum handle; the adjusting screw moves on a rivet to keep the milled head-nut parallel with the limb	0	10	6
12	Ditto, ditto, with pen or pencil, each	0	10	6
13	Plain Drawing Pen, with brass handle and protracting pin	0	2	6
14	Drawing Pen, with ivory handle	0	4	6
15	Ditto, with lift, brass joint to the blades and ivory handle	0	5	6
16	Ditto, ditto, electrum ditto	0	6	6
17	E. M. Clarke's Palladium Drawing Pen, with ivory handle. This pen is not liable to corrode, and delivers the ink better than steel	0	15	0
18	Road or Parallel Lines Pen	0	15	0
19	Dotting Pen, with rollers	0	10	6
20	Pricking or Tracing Point, with ivory handle	0	3	6
21	Triangular Compasses	0	10	0
22	Ditto, with shifting leg	0	15	0
23	Pocket Dividers, with sheath	0	8	0

NO.		£	s.	d.
24	Turn-in Compasses, with lengthening bar, bow-handles to pen and pencil, minutes, case, and scale . . . Brass 2*l.* 7*s.* 6*d.* Electrum	3	7	6
25	Ditto, ditto, without lengthening bar, scale or case. Brass 1*l.* 16*s.* Electrum	2	10	0
26	Ditto plain, without bow-handles . . Brass 1*l.* 10*s.* Electrum	2	2	0
27	Tube Compasses	2	2	0
28	Napier's Pocket Compasses . . . Brass 2*l.* 10*s.* Electrum	3	3	0
29	Wholes and Halves Sector, jointed	1	0	0
30	Proportional Compasses, 6 inches, half divided	1	11	6
31	Ditto, ditto, full divided . . . . Brass 1*l.* 18*s.* Electrum	2	10	0
32	Ditto, ditto, with clamp and tangent screw . Brass 2*l.* 10*s.* Electrum	3	10	0
33	Elliptical Compasses . . . . . 2*l.* 10*s.* to	4	4	0
34	Plain Beam Compasses, with steel points and mahogany bar . .	1	1	0
35	Ditto, ditto, with pen and pencil, steel points and rest, 3 feet long . .	2	5	0
36	Best Beam Compasses, with micrometer adjustment, ebony bar, and ivory graduated scale . . . . Brass 3*l.* 10*s.* Electrum	4	4	0
37	Ebony and Ivory Parallel Rules, with single or double bars . 2*s.* to	1	18	0
38	Ebony or Ivory Parallel Rules, plain . . . . . 7*s.* 6*d.* to	1	10	0
39	Ditto, ditto, with graduated edges and rollers . . . 12*s.* 6*d.* to	2	10	0
40	Marquois' Scales, in case complete	0	15	0
41	Plotting Scales, in box-wood or ivory . . . . 4*s.* 6*d.* to	0	15	0
42	Oblong Protracting Scales, in box-wood or ivory, with or without rollers . . . . . 3*s.* 6*d.* to	1	5	0
43	Plane Scales, in box-wood or ivory . . . . . 1*s.* to	0	5	0
44	Offset Scales, in ivory and box-wood . . . . . 1*s.* 6*d.* to	0	3	6
45	Gunter's Scale . . . . . 12 inches 2*s.* 6*d.* 2 feet	0	4	6
46	Box-wood and Ivory Sectors, with plain or French joint . 3*s.* 6*d.* to	1	1	0
47	Ivory or box-wood folding Pocket Rules, with brass electrum or silver mountings, and plain or sector joints . . . . 2*s.* to	2	12	6
48	Ebony and box-wood acute, obtuse, and right Angles . . . 2*s.* to	0	5	6
49	Ebony and box-wood Scrolls . . . . . 1*s.* 9*d.* to	0	5	0
50	Brass Drawing Pins, with steel points, per dozen	0	2	6
51	Small Cases of Drawing Instruments for the pocket, as arranged by Stephenson, Brunel, Barry, &c. . . . . 1*l.* 1*s.* to	2	5	0
52	Magazine and Cabinet Cases of Drawing Instruments, fitted up in brass electrum or silver, in mahogany, rosewood, leather, or fish-skin cases, for civil, military and naval engineers, architects, steel, copper and wood-block engravers, &c. . . . . 2*l.* 2*s.* to	47	10	0
53	Pocket Levels, plain and mounted in brass, with and without cross sights or graduated arc . . . . . 1*s.* 6*d.* to	2	10	0
54	Portable Levelling Instrument, with telescope and compass . . .	8	8	0
55	Improved 14-inch Level	11	11	0
56	Tripod Staff for ditto	1	1	0
57	Improved 20-inch Level	13	13	0
58	Tripod Staff for ditto	1	1	0
59	Y Levels, with 9-inch telescope	10	10	0
60	Twenty-inch ditto	16	16	0
61	Ditto, with compass	17	17	0
62	Dumpy Level, without legs or compass	12	12	0
63	Ditto, with silver ring, compass, and jointed legs	15	15	0
64	Ditto, ditto, with tripod staff	16	16	0

NO.		£	s.	d.
65	Fourteen-inch Dumpy Level, with round legs and card compass	15	15	0
66	Ditto, with silver ring, compass, and tripod staff	17	17	0
67	Common Theodolite 6*l.* 6*s.* to	9	9	0
68	Four-inch Theodolite, with telescope	12	12	0
69	Ditto, divided on silver	13	13	0
70	Five-inch Theodolite	18	18	0
71	Ditto, with tangent screw motions, divided on silver	24	0	0
72	Six-inch ditto, divided on silver to 20″	30	0	0
73	Ditto, with two telescopes	40	0	0
74	Seven-inch ditto	45	0	0
75	Twelve-inch ditto for horizontal angles only	42	0	0
76	Plane Tables 3*l.* 16*s.* 6*d.* to	10	0	0
77	Circumferenters 2*l.* 2*s.* to	5	5	0
78	Miner's Compass, in wood or brass mountings 1*l.* 10*s.* to	8	8	0
79	Prismatic Compass 2*l.* 10*s.* to	3	13	6
80	Best Ebony Quadrant, with tangent screw	3	13	6
81	Ditto, with telescope 4*l.* 4*s.* to	5	15	6
82	Optical Square	1	1	0
83	Box Sextant, plain	3	13	6
84	Ditto, with telescope	4	14	6
85	Ditto, ditto, with supplementary arc, &c.	5	5	0
86	Bell-metal Sextant, divided on silver to 20″	14	14	0
87	Ditto, ditto, 7-inch radius, divided to 10″	16	16	0
88	Eight-inch ditto, with double limbs, divided on silver to 10″	18	18	0
89	Dip Sector	12	12	0
90	Glass Plane, artificial horizons 1*l.* 1*s.* to	3	3	0
91	Best Mercurial ditto 4*l.* 4*s.* to	5	5	0
92	Twenty-four-inch Transit Instrument, with iron stand	21	0	0
93	Ditto, with portable brass stand	26	5	0
94	Thirty-inch Transit Instrument, on iron stand	43	10	0
95	Forty-two-inch Transit Instrument, for fixing on stone piers	84	0	0
96	Variation Transit	63	0	0
97	Dipping Needle ditto	30	0	0
98	Annular Micrometer, with eye-piece	1	5	0
99	Parallel Wire ditto 8*l.* 8*s.* to	15	15	0
100	Station Pointers 5*l.* 5*s.* to	16	16	0
101	Protractors 2*s.* 6*d.* to	10	0	0
102	Brass Pentagraphs, from 18 to 42 inches 5*l.* 5*s.* to	9	9	0
103	Wallace's Eidograph. This instrument possesses many advantages over the Pentagraph, which it is now superseding	9	9	0
104	Perambulators, plain, brass mounted, with wood or metal wheels 7*l.* 7*s.* to	14	14	0
105	Trochiameters, for counting the revolutions of a carriage-wheel	2	2	0
106	Twelve-foot Levelling Staff, common, portable, with or without level 1*l.* 10*s.* to	2	12	6
107	Ditto, for reading without an assistant	4	4	0
108	Land Chains 10*s.* to	1	1	0
109	Tape Measures, in brass or leather cases 5*s.* to	3	3	0
110	Pair of 36-inch Globes, on mahogany stands			
111	Ditto 21-inch ditto 9*l.* 9*s.* to	19	19	0

NO.		£	s.	d.
112	Pair of 18-inch ditto . . . . . 8*l.* 8*s.* to	17	17	0
113	Ditto 15-inch ditto . . . . . 6*l.* 6*s.* to	12	12	0
114	Ditto 12-inch ditto . . . . . 4*l.* 4*s.* to	7	17	6
115	Ditto 9-inch ditto . . . . . 2*l.* 12*s.* 6*d.* to	3	13	6
116	Ditto of 6-inch Globes, on mahogany stand . . . 2*l.* 2*s.* to	2	12	6
117	Ditto 3-inch ditto . . . . . 1*l.* 15*s.* to	2	2	0
118	Improved 3-inch Globe, in case, with meridian and horizon circles .	0	16	0
119	Three-inch Globe, in case	0	9	0
120	Larkin's Geometrical Solids . . . . . 7*s.* 6*d.* to	1	4	0
121	Models of Arches of Bridges . . . . . 5*s.* to	2	0	0
122	Dissected Cones . . . . . 7*s.* to	0	9	0
123	Juvenile Collections of Geometrical Planes and Solids, with sections of the cone and sphere, the set of 31 in a box . . . 10*s.* to	0	15	0
124	The set of eighteen 2-inch Models in wood, to illustrate Reiner's Lessons on Form . . . . . 1*l.* 2*s.* 6*d.* to	1	10	0
125	Glass Models, to facilitate the study of Crystallography and Geometry; the set of fifteen secondary forms, each enclosing its primitive Nucleus, in a box . . . . . 2*l.* 8*s.* to	3	3	0
126	Dissected Cube, in box, with Octahedron for its Nucleus . . .	0	5	0
127	Ditto, with Tetrahedron	0	6	0
128	Ditto, with Rhombic Dodecahedron	0	6	6
129	Ditto, with Pentagonal Dodecahedron	0	6	6
130	A Cone, with sections	0	2	6
131	Ditto, in box-wood and pinned	0	5	0
132	Set of Models in mahogany box, for teaching fractions . 12*s.* 6*d.* to	1	0	0
133	Co-ordinate Planes, intended to illustrate the first principles of Geometry, of three dimensions, and to construct the figures connected with it .			
134	Apparatus, with jointed planes for explaining the principles of Descriptive Geometry			
135	Drawing-board, with apparatus for expediting the processes of Descriptive Geometry and Perspective . . . . . 5*s.* to	2	2	0
136	Mounted Sphere of any dimensions, for drawing the figures of Spherical Geometry and Trigonometry			
137	Apparatus for exhibiting the Hyperboloide à une nappe, and other surfaces which admit of description by a straight line . . .			
138	Hollow Glass Figures, partly filled up with coloured fluid, for the purpose of exhibiting their plane sections			
139	Larkin's Set of Geometrical Solids, consisting of thirty-two figures, cube $\frac{5}{8}$ to $1\frac{1}{4}$ inch . . . . . 7*s.* 6*d.* to	1	4	0
140	Larkin's Set of Geometrical Solids, consisting of thirty-two figures, cube $\frac{5}{8}$ to $1\frac{1}{4}$ inch, in neat boxes, with sliding tops . . 9*s.* to	1	10	0
141	Two Cubes, relatively constructed so as to exhibit the apparent paradox of the larger passing through the smaller, the outer part made of brass	0	18	0

METEOROLOGICAL INSTRUMENTS.

NO.		£	s.	d.
1	Standard Barometers, with glass tubes, more than ½ an inch interior diameter and large mercury cisterns. The frame supported by brass arms and gymbols, with means furnished for regulating the scales so as to compensate for any alteration that may occur in the frame by moisture or change of temperature . . . . . 10*l.* 10*s.* to	21	0	0
2	Barometers for Naval Purposes, with brass arms and gymbols, by which contrivance the barometer is not sensibly affected by the motion of the vessel . . . . . 7*l.* 7*s.* to	9	9	0
3	Barometers for measuring the Pressure of the Atmosphere, with portable screws, so that they may be conveyed from one place to another with safety . . . . . 2*l.* 8*s.* to	3	3	0
4	Ditto, with Thermometer and rackwork movement for the vernier 3*l.* 13*s.* 6*d.* to	5	15	6
5	E. M. Clarke's Improved Wheel Barometer. In this arrangement the mercurial column and the apparatus for working the hands is fixed in front of the dial plate, rendering the instrument less liable to be put out of order. With or without plain, or Six's self-registering Thermometer . . . . . 3*l.* 16*s.* to	8	10	0
6	Bontein's Mountain Barometer, with Thermometer. This is the best instrument yet constructed for obtaining barometric measurements; and as made by E. M. C. not liable to get out of order. In leather sling case	7	7	0
7	Adie's Sympiesometer. The barometrical inches are three times the length of the common inch, hence the graduations are finer than in other barometers without the aid of a vernier. This instrument, when properly made, is not liable to get out of order . . .	5	5	0
8	Standard Thermometers, with graduated scales to ⅛th	2	2	0
9	Thermometers, with metal, box-wood, or ivory scales, graduated according to Fahrenheit, De Lisle, Reaumur, and the Centigrade 5*s.* 6*d.* to	2	10	0
10	Thermometers, in japanned tin cases, with scales graduated respectively for the purposes of Brewing, Baths, Botanical, and Stable purposes 10*s.* 6*d.* to	1	1	0
11	Thermometers with very fine bores, extremely sensible of slight changes of temperature, furnished with hollow cylindrical ivory graduated scales, intended for the use of the medical practitioner, with tubes either curved or straight	0	15	0
12	Thermometers for the Pocket, with ivory, metal, or box-wood graduated scales, with cases, in great variety . . . . . 6*s.* 6*d.* to	1	1	0
13	Small Pocket Thermometer, in morocco or ivory toothpick case, with or without magnetic compasses, in great variety . . . . 12*s.* to	2	12	6
14	Window Thermometer, with semi-transparent ivory scale inclosed in a cylindrical glass tube, fixed in a mahogany frame, with a copper roof to protect it from rain	1	7	6
15	Horizontal Day and Night Thermometers, mounted separate or together. This kind of thermometer cannot be relied on, and is easily put out of order . . . . . 10*s.* 6*d.* to	1	1	0
16	Six's Self-registering vertical Day and Night Thermometer. This is the best thermometer, yet constructed for keeping a daily register, being more sensitive than the horizontal, and less liable to be put out of order. Scale, 9 inches long, 1*l.* 10*s.* 12 inches long	1	15	0
17	Ditto, ditto, in copper cases . . . . . 1*l.* 15*s.*	2	0	0
18	Thermometers with the scales graduated on the glass tube . . .	1	1	0

NO.		£	s.	d.
19	Spirit Thermometers, with scales 150° below 0 . . . . 10*s.* 6*d.*	0	16	0
20	Leslie's Differential Thermometer, with 2½ inch bulbs, graduated scale 15 inches long	0	18	0
21	Howard's Differential Thermometer . . . . . 14*s.* to	1	10	0
22	Daniell's Hygrometer, packed in pocket case	2	10	0
23	Mason's Hygrometer consists of an upright standard, carrying a plate, to which is attached two Thermometers; the bulb of one is left exposed, the other is covered with a piece of white silk, the ends of which are immersed in water, contained in a glass bird-fountain placed between the Thermometers. Including the printed tables .	2	12	6

USES TO WHICH MASON'S HYGROMETER IS APPLICABLE.

The use of this Instrument in the sick chamber will be at once evident, as a fire kept up in a closed room naturally dries the air which the patient has to breathe, and it soon becomes either more *detrimental* or *beneficial* in many diseases of the *Lungs*, *Skin*, or *Intestinal Canal*. It is the duty of the Medical attendant to point out those conditions of the body which will be either benefited or injured by atmospheric influences, and suggest the means by which this can be obviated as far as art will allow; for in many cases life depends upon the temperature, state of dryness, or humidity of the climate or room in which an individual resides, which condition of the air it is the office of the Instrument to constantly register, and show, by mere inspection.

If the apartment is too *dry*, which is frequently the case in frosty weather, it will be necessary to maintain sufficient evaporation from a tea-urn, or other convenient apparatus, while the Hygrometer points out when the proper degree of humidity has been attained; the urn is then removed, and may be brought into the room again when required. On the contrary, if the air be required remarkably dry, it may be rendered so, either by raising the temperature of the room, or resorting to those substances which absorb vapour most rapidly.

Thus with the aid of this Instrument, (*as it indicates both the temperature, dryness, and humidity of the air,*) an artificial LOCALITY may be produced by very simple and easy means; and those, whose circumstances, avocations, or family ties prevent them from seeking a *climate* suited to their peculiar constitution, can, to a very great extent, obviate the necessity by the assistance of the Instrument now submitted to the public, the desideratum of which has been long felt, and its *prospective uses* fully appreciated by the reflecting portion of the Profession.

If the air be *very dry*, the difference between the two Thermometers will be great; if moist, less in proportion; and when FULLY SATURATED, *both will be alike*. For general purposes, it is only necessary to place the Instrument in a retired part of the room away from the fire, and not exposed to the open doors or passages; but for nice experiments, the observation should be *always* made in the open air and in the *shade*, taking especial care that the Instrument be not influenced by the radiation of any heated bodies, nor any currents of air; the Dew-point is then found by the Rule given on the other side, and corresponds exactly with the *Dew-point Hygrometer*, an Instrument described in "Jameson's Journal," July 1835, and modified by Dr. MASON.

Should the wind be strong upon the Instrument, the "Degrees of Dryness observed" multiplied by 2 gives the "Absolute Dryness," (the "Excess of Dryness" being omitted in the calculation,) because a strong current of air makes the Instrument indicate the *Excess of Dryness*; which is necessary to be added in a calm atmosphere.

If the Absolute Dryness of an apartment be required, the Instrument must be placed in the shade, and the Dew-point found, which subtracted from the Temperature of the apartment, will give its Absolute Dryness. The reason is obvious, and arises from this law, namely, That air has its dryness doubled for every increase of temperature corresponding to 21° of Fahrenheit's Thermometer, and in proportion for all intermediate temperatures.

It will detect the dampness of an apartment or bed.

The facility of registering Meteorological Observations by this Instrument will probably induce many to avail themselves of its use, and tend to enlarge that branch of science.

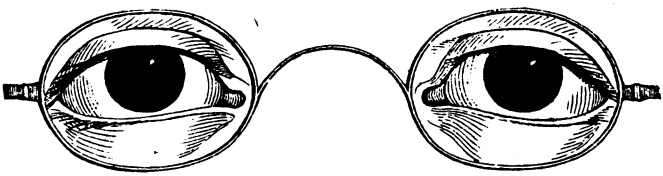
In regulating the Hygrometrical state of the air in hot-houses, green-houses, &c. as well as in manufactories, warehouses, malting-houses, and in the laboratory of the chemist, its use will be duly appreciated.

The advantages it offers at sea cannot be too forcibly pointed out. The objections made by naval men to the Barometer, leaving them in doubt whether to expect Wind or Rain by the fall of the mercury, would in a great measure be obviated by the joint observation of the Hygrometer, because if it indicate a relative Degree of Dryness, Wind alone may be expected; if the contrary, then Rain or Rain with Wind follows.

N.B.—The silk which covers the wet bulb and thread which conveys the water to it requires renewal about every month, and the fountain to be filled when requisite with distilled water, or water that has been boiled and allowed to cool, by immersing it in a basin of the water till the aperture *only* is just upon the surface, and the water will flow in. If the Hygrometer is placed out of doors in frosty weather, the fountain had better be removed, or the freezing of water within it may break it; in this case a thin coating of ice may soon be formed on the wet bulb, which will last a considerable time, and may be renewed when requisite.

NO.		£	s.	d.
24	Cumming's Hygrometer. This instrument is founded on the principle pursued by Dalton to find the force of the aqueous atmosphere 1*l.* 5*s.* to	2	10	0
25	Saussure's Hygrometer. The degree of humidity of the atmosphere is ascertained by the expansion and contraction of a piece of hair divested of its oil	2	2	0
26	Pocket Hygrometer. The property possessed by the beard of the wild oat, to coil up in dry weather and unfold in wet, is here employed to determine the hygrometrical state of the atmosphere	0	8	0
27	Anderson's Atmometer, for ascertaining the rate of evaporation from water or moist surfaces, thereby determining the solvent power of the atmosphere in relation to aqueous vapour; a thermometer is attached to the stem of the instrument	1	4	0
28	Pluviometer, or Rain-Gauge, of tinned iron japanned, or copper, with a glass graduated tube at the side, or float with slender divided rod 1*l.* 4*s.* to	2	2	0
29	Howard's Portable Rain-Gauge, with evaporating basin and graduated glass measure. The gauge consists of a funnel with a brass mouth turned to a sharp edge, and a glass bottle, into which the rain descends from the funnel. The evaporating basin has also a brass mouth turned to a sharp edge, the area of the opening corresponding exactly with the gauge. When the rain deposited in the bottle is decanted into the glass measure, its quantity is easily estimated by the graduations, and the difference between this quantity and that obtained from the basin is the loss due to evaporation	1	5	0
30	Crosley's Self-registering Rain-Gauge. This instrument measures and self-registers the quantity of rain that has fallen on a given surface, without management or interference for several months, and it is equally applicable for daily observations	4	4	0
31	Saunders' Pluviometer consists of a japanned copper or tin box, with a square-mouthed funnel, so constructed as to present exactly a square superficial foot of surface to the rain, effectually preventing any loss by splashing; and as the collected rain is quite enclosed, little can be lost by evaporation. The instrument is so very simple in its construction, its accuracy and facility of using so great, as to cause more complicated instruments to be disused	4	4	0
32	Lind's Anemometer, or Wind-Gauge, for ascertaining the course and measuring the force of the wind, consists of a bent glass tube with parallel branches: upon the top of one is fitted a slight metal tube, having its open end to receive the wind blowing horizontally into it. The instrument is attached by sockets to a vertical spindle, on which it turns. Water being placed in the tube, the columns would be equal but for the blowing in of the wind; and the difference of the heights of the columns determines the force	1	1	0
33	Whewell's Anemometer, consisting of a small set of vanes, presented to the wind by a common vane. The current as it passes sets the small vanes into rapid motion, which is communicated and reduced by a train of wheels and pinions to a tracing pencil pressing against an upright painted cylinder, and 10,000 revolutions of the fly only cause the pencil to descend $\frac{1}{10}$th of an inch. The character of the line traced gives the mean direction of the wind, its velocity, and the length of time during which it blows in each direction . . .	10	10	0

OPTICAL INSTRUMENTS.



SPECTACLES.

1	Gold Spectacles	2*l.* 2*s.* to	5	5 0
2	Best double-jointed Silver Spectacles		1	0 0
3	Ditto, single-joint		0	12 0
4	Best double-joint, Blue Spring Steel ditto		0	15 0
5	Best single-joint ditto		0	12 0
6	Best double joint Tortoiseshell Spectacles		0	14 0
7	Best single-joint		0	10 0
8	Spectacles with Glasses adapted for eyes that have been couched			
9	Spectacles of Tortoiseshell or Silver, or blued Steel, to fix on the brim of the hat, for riding, hunting, or shooting			
10	Gold Eye-rings and Glasses	16*s.* to	5	5 0
11	Silver ditto	5*s.* to	0	10 6
12	Tortoiseshell ditto		0	5 6
13	Improved Gold Hand Spectacles	2*l.* 12*s.* 6*d.* to	5	10 0
14	Silver ditto	1*l.* 2*s.* to	2	15 6
15	Tortoiseshell ditto		0	14 0
16	Ditto, with Blue Steel Spring Bridge		1	1 0
17	Spectacle Cases in great variety	6*d* to	1	1 0
18	Opera Glasses, in great variety of mountings	7*s.* 6*d.* to	1	1 0
19	Ditto, Achromatic ditto	1*l.* to	5	5 0
20	Binocular Opera Glasses, in great variety	1*l.* 10*s.* to	6	6 0
21	Skeleton Operas, in Gold, Silver, or Albata	1*l.* 10*s.* to	4	10 0

TELESCOPES.

1	Improved Pocket Telescope, shuts up to 3 inches		1	8 0
2	One-foot ditto, which shuts up to 5½ inches, with three sliding tubes		1	10 0
3	Ditto, in white metal		2	2 0
4	One-foot ditto, with seven sliding tubes, which shuts up to 4 inches		2	2 0
5	A 20-inch ditto, ditto, shuts to 7½ inches		2	10 0
6	Ditto, in white metal		3	13 0
7	Twenty-inch ditto, ditto, to 5 inches		3	3 0
8	Two-feet ditto, ditto, 9½ inches		3	10 0
9	Ditto, in white metal		4	14 6
10	Two-feet ditto, to 6 inches		4	4 0
11	Ditto, ditto, in white metal		5	10 0

NO.		£	s.	d.
12	Three-feet ditto, ditto, to 11 inches	5	5	0
13	Ditto, ditto, to 7 inches	6	16	0
14	Two-feet Telescope, with claw stand and pillar, one eye-piece for terrestrial, and one for celestial objects, in mahogany case	7	7	0
15	Two-and-half-feet Improved Achromatic Telescope, brass body and claw stand, with an eye-piece for land, and one ditto for astronomical purposes	10	10	0
16	Ditto, as above, with vertical rack motion, best quality	12	12	0
17	Three-feet Telescope, mahogany body, with plain clip stand and extra power, in case	9	0	0
18	Three-and-half-feet Telescope, all brass, with one extra power for day, and two for astronomical purposes	21	0	0
19	Three-and-half-feet ditto, as above, with vertical rack, achromatic finder, &c., best quality. The day tube graduated to show what degree of power is being used, by means of a movable eye-piece; aperture of object-glass $2\frac{3}{4}$ inches	27	0	0
20	Three-and-half-feet as above, with vertical and horizontal rack-work motions, with one day power, and three ditto for astronomical purposes; aperture of object-glass $3\frac{1}{4}$ inch	40	0	0
21	Plain Clips and Stands, made portable to any of the pull-out Telescopes 1*l.* 1*s.* to	2	2	0

MICROSCOPES.

1	Chevalier's Achromatic Compound Microscope, with two sets of achromatic lenses, of three powers each, and two eye-pieces to suit each set: metallic reflector fitted to the eye-pieces, by which the object is strongly depicted on a sheet of paper, whereby drawings may be taken of the most minute animalculæ, &c., considerably magnified; six objects prepared in Canadian Balsam, horizontal and vertical, stand in lock-up cabinet case. (This instrument is as good as those sold by London makers at 30*l.*)	14	14	0
2	E. M. Clarke's Improved Lucernal Microscope. This is the best arrangement for examining opaque objects; the field being sufficiently large to take in entire moths, beetles, &c. The peculiarity of this instrument is, that shadow is avoided, and the objects, whether opaque or transparent, can be viewed on a screen	15	0	0
3	Solar Microscopes 10*l.* 10*s.* to	20	0	0
4	Reflecting Microscopes 25*l.* to	56	0	0
5	Single and Compound Pocket Microscope, with rack-work stage, four magnifying powers, insect box, twelve plain objects, and one object prepared in Canadian Balsam; insect forceps with black and white stage; brush, forceps and point; concave and flat fluid glass fitted to the stage; black and white ivory dise, and glass slip for crystallising salts on; in a lock-up mahogany or rosewood case	2	5	0
6	Ditto, ditto, with two Canadian Balsam objects and condensing lens for illuminating opaque objects	2	10	0
7	Ditto, ditto, ditto, with three objects prepared in Canadian Balsam; and a jointed pillar so that the microscope may be set at any angle	3	0	0
8	Ditto, ditto, ditto, ditto, with four objects prepared in Canadian Balsam, folding tripod stand	4	0	0
9	Single Pocket Microscope, with sliding stage, three magnifying powers, forceps and point. In mahogany box	0	12	6
10	Ditto, black and white opaque disc, concave fluid glass	0	15	6

NO.		£	s.	d.
11	Single Pocket Microscope, Reflecting Mirror, twelve plain objects, insect box, glass slip for crystallising salts, spring forceps with black and white stage, brush and point	1	5	0
12	Folding Pocket Microscope, in paper case	0	5	0
13	Ditto, with spring forceps	0	7	6
14	Coddington's Lens, mounted in Silver, for viewing opaque and transparent objects	0	18	0
15	Ditto, mounted in Tortoiseshell case	0	12	6
16	Stanhope's Lens, mounted in Tortoiseshell folding case	0	8	6
17	Ditto in Electrum, Silver or Gold . . . . 4*s.* 6*d.*, 10*s.* 6*d.*	1	1	0
18	Single, Double, and Triple magnifying Lenses, in folding Tortoiseshell cases . . . . . from 2*s.* 9*d.* to	0	12	6
19	Condensers, with candle-holder on brass sliding stand . . 16*s.* to	1	6	0
20	Ditto, for viewing opaque objects . . . . . 6*s.* 6*d.* to	1	10	0
21	Achromatic Object Glasses fitted to Microscopes . . . 1*l.* 4*s.* to	6	6	0
22	Wollaston's Doublet ditto, ditto . . . . . 15*s.* to	1	0	0
23	An extensive Assortment of Objects for achromatic and plain Microscopes, by French and English artists . . . . 1*s.* to	0	5	0
24	Fossil Infusoria, unprepared, in small box	0	0	6
25	Micrometers on Glass, from $\frac{1}{50}$th to $\frac{1}{1000}$th of an inch . 1*s.* 6*d.* to	0	15	0

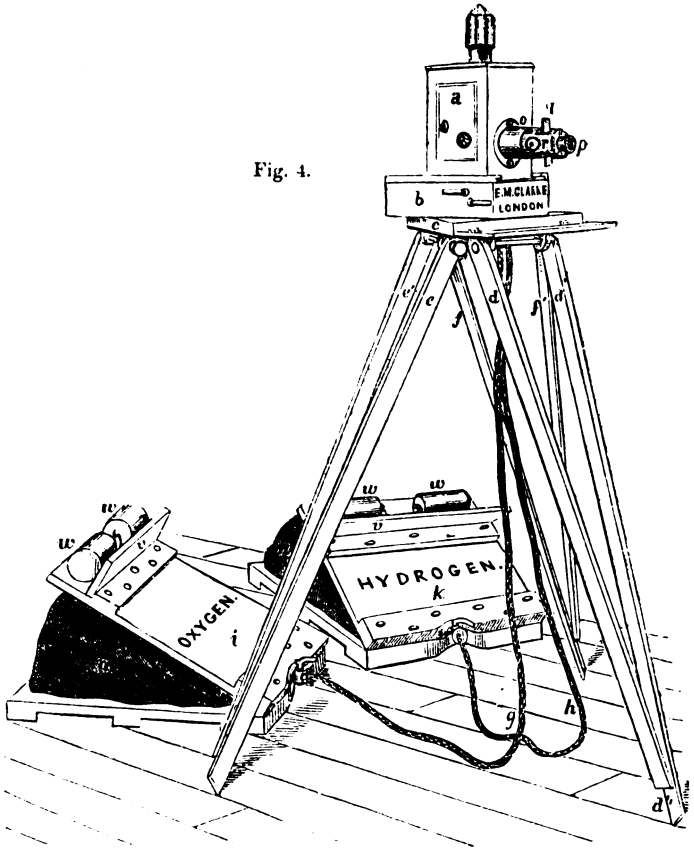
GAS MICROSCOPES.

1 E. M. Clarke's improved Hydro Oxygen Gas Microscopes, (fig. 4.) This form of the instrument has removed many and serious imperfections arising out of the previous constructions—viz., unwieldy bulk and weight, deficiency of light and definition in the high magnifying powers; want of uniformity of light on the disc, insecurity in the blowpipe, inconvenient, fixed, and dangerous position of the gas-bags, rendering them liable to communicate and explode. E. M. C. has removed these latter from their position, and separated them beyond the possibility of co-mixture; they may even be placed under lock and key in a separate room, or outside the house during the exhibition of the instrument. He has farther adapted Daniell's Blowpipe with Maugham's Jet, as the means of mixing the gases during combustion under circumstances which render explosion impossible. The apparatus consists of the mahogany lantern *a*, with sheet-iron cover, sliding back and forward on the base *b*; this has a circular horizontal motion on the triangle top *c* of the stand, to which is attached the double legs *d d'*, *e e'*, *f f'*; the tube containing the condensing lenses and slide-holder, with rack and pinion motion *r*, and adapted for carrying the magnifying powers *p*, are attached to the lantern at *o*. In front of *c* is a shelf for holding the objects, &c., and folds up in front when not in use. The Microscope is furnished with one low power for showing full-sized objects, such as entire butterflies; a second, magnifying more, for showing living aquatic insects, such as the skeleton larva, globe insect; and a third high power for smaller objects, such as the dust of moths' wings, &c. 22 0 0

2 The above instrument on a larger scale (the condensing lenses being 4$\frac{3}{8}$ inches diameter, that of the former being 2$\frac{7}{8}$ inches), better adapted for Professors of Universities, Scientific Institutions, and Public Lecturers 32 0 0

A detailed description of the method of using these instruments is given in the first part of "Directions for Using Philosophical Apparatus in Private Research or Public Exhibitions," by E. M. Clarke. Price 6*s.* 6*d.*

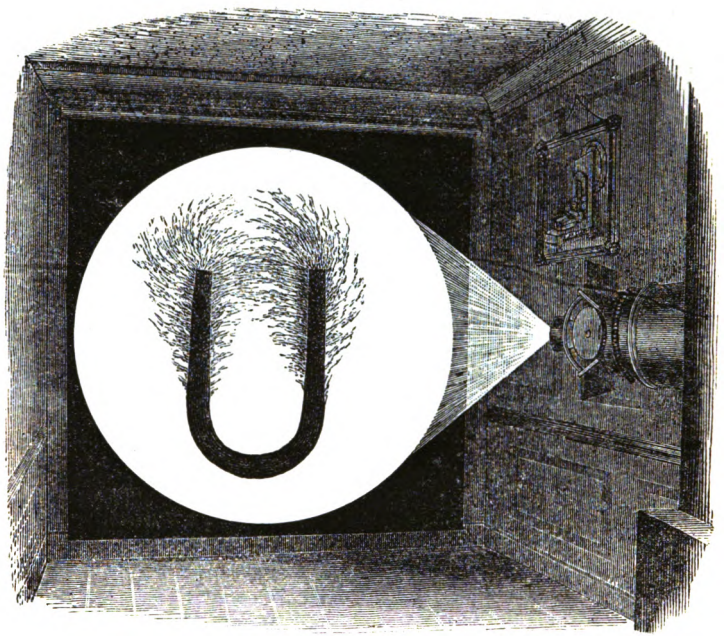
Fig. 4.



NO.		£	s.	d.
3	Pair of strong India rubber or Caoutchouc cloth Gas bags, one to hold hydrogen *n*, the other oxygen gas *m*, with lever handle stop-cocks, and union joints, to suit No. 1.	5	11	0
4	Ditto, ditto, larger to suit, No. 2	6	6	0
5	Pair of strong pressure boards *i*, *k*, with stout hinges and folding flap, holding the pressure weights that force the gas from the bags to suit No. 3	2	10	0
6	Ditto, ditto, larger to suit No. 4	3	3	0
7	Two lengths of flexible India rubber tube, 10 feet long, each with brass union joints, connected with the lime light and gas bags	1	15	0
8	Delbruck's patent Hydrogen Generator and Glass Purifier. This is a most convenient apparatus for the production of hydrogen, with union couplers to connect to the gas bag	2	5	0
9	Iron Retort, with winged brass coupler, gun-barrel, brass and flexible tin tube, to connect with gas bag for making oxygen gas	0	18	0
10	Dozen small objects prepared with Canada Balsam, between glass slips in mahogany frames, for the high powers	1	4	0
11	Dozen large objects prepared with Canada Balsam, and mounted in mahogany, for the low power	2	10	0

NO.		£	s.	d.
12	Large-sized solid Glass Water-Trough, with ground and polished parallel sides, for exhibiting living animalculæ with the low power; also, for showing the decomposition of water by chemical and voltaic action .	0	5	6
13	Frame, containing a long cooling glass Water-trough, and four small animalculæ glass troughs for showing, by the high powers, the smaller class of animalculæ	0	12	0
14	The Gas Microscope, No. 1, with the appurtenances. Nos. 3, 5, 7, 8, 9, 10, 11, 12, 13, furnished together	35	0	0
15	The Gas Microscope, No. 2, with Nos. 4, 6, 7, 8, 9, 10, 11, 12, 13 . .	45	0	0
16	Clock-work for keeping the Lime Cylinder revolving during combustion (see p. 39 of Directions for Using, &c.,) with a mechanical means of placing the lime cylinder in its proper position during the winding-up the main spring. Furnished with a new microscope	5	5	0
17	Ditto, ditto, when added to a Microscope that has been made without one	6	6	0
18	Dozen Lime Cylinders, in sealed bottle . . . Soft 3*s.* 6*d.* Hard	0	5	6

Fig. 5.



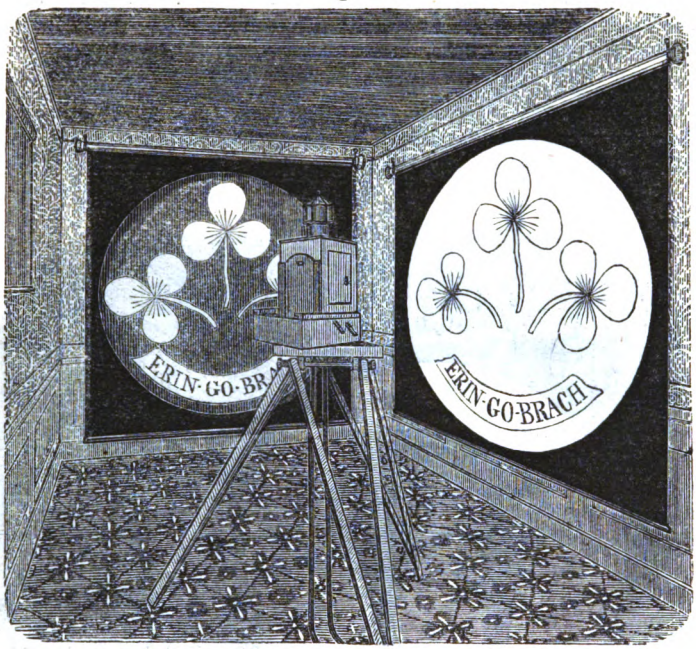
19	E. M. Clarke's Apparatus, for showing the formation of Magnetic Curves by the arrangement of minute particles of iron-filings on the poles of a horse-shoe magnet (fig. 5). See p. 52 of 'Directions,' &c. . .	0	10	6
20	Impressions in Glass, in imitation of Cameos; illustrative of Heathen Mythology, Ancient and Modern History, Antique Gems, forming on the Microscope disc figures in *basso relievo* . . . . 4*s.* to	0	15	0
21	Extensive Assortment of Objects prepared in Canadian Balsam for the Gas-Microscope . . . . . 2*s.* to	5	0	0

These objects consist of insects, parts of insects, such as wings and wing-cases, stings, tongues, eyes, dissections of the trachea and bronchial tubes, antennæ, legs, scales of butterflies and moths, zoophytes, ferns, fuci, mosses, madrepore, sections of recent and fossil woods, leaves, petals and farina of plants, feathers, and the exuviæ of spiders and aquatic insects.

POLARIZED LIGHT.

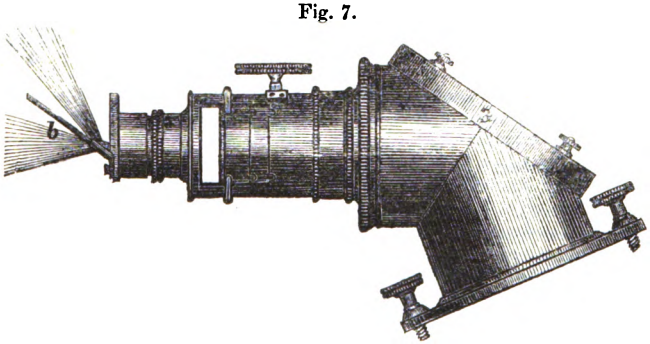
GAS POLARISCOPES.

Fig. 6.



1 Most improved Hydro-oxygen Polariscope (fig. 6), attached to mahogany lantern, with sliding base and horizontal movement on double tripod folding stand, same as already described at p. 23, No. 1, the Polariscope being attached in front of the lantern in place of the microscopic arrangement *p q r* (fig. 4). The Polariscope (fig. 7)

Fig. 7.



NO.		£	s.	d.
	has a movable cap at *a*, which gives great facility both for adjusting and cleaning the thin polarizing glass plates. The analyzing plates of glass at *b* are also easily removed, and have perfect freedom of motion, both horizontally and vertically	22	0	0
2	Ditto, ditto, same size as No. 2, p. 23	32	0	0
3	Parties already furnished with a Gas Microscope, or ordering one, may have the Polariscope (fig. 7) added to a No. 1 sized Microscope .	7	10	0
4	Ditto, ditto, No. 2 size	9	10	0

OBJECTS FOR THE GAS POLARISCOPE.

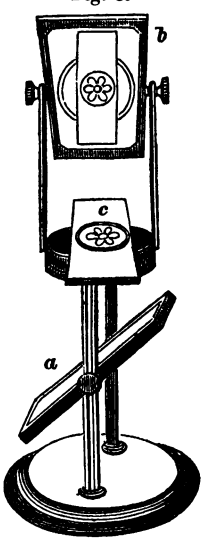
5	Thin selenite plate of equal thickness, developing uniform colour . .	0	4	0
6	Thin selenite plate of unequal thickness, developing various colours .	0	4	0
7	Single selenite wedge, (thick at one edge,) to show the colours due to its different thicknesses in bands parallel to its edges	0	10	0
8	Double selenite wedge, (thin at both edges, thick in the middle,) for ditto	0	10	0
9	E. M. Clarke's arrangement, to show that when two selenite wedges (double or single) are made to cross each other, and one to rotate, the coloured bands form diagonal bands to the square so formed . .	1	15	0
10	Circular plate of selenite ground concave or convex, to develop the colours in rings due to its varying thickness	0	10	0
11	Cube, formed of three pieces of selenite of different thickness . . .	0	5	6
12	Selenite star, composed of six lozenge-shaped pieces	0	8	0
13	Ditto rosette, five pieces	0	10	0
14	Ditto, ditto, six pieces	0	10	6
15	Ditto, 16-ray superposing star	0	14	6
16	Ditto, Maltese cross	0	10	6
17	E. M. Clarke's design, in selenite, of the shamrock, with motto on a coloured ribbon, "Erin-go-Bragh"—the films of selenite composing the leaves of the shamrock, are so arranged as to develop shamrock-green with its complementary colour, orange ; being an harmonious combination of colours suitable to an exhibition before a mixed assembly	0	15	0
18	E. M. Clarke's design, in selenite, of the Pansy (*Pensée*), with motto on coloured ribbon, "Heart's-ease," this is the only flower in which the change of colours harmonizes with nature	1	1	0
19	Thistle in selenite, with motto on coloured ribbon, "Dinna Forget" .	0	15	0
20	Branch of the Vine with leaves, bunch of grapes, and tendril . .	1	16	0
21	Tulip in selenite	0	15	0
22	Myosotis Palustris in selenite, with motto on ribbon, "Forget-me-Not"	0	15	0
23	E. M. Clarke's design, in selenite, of a Cabbage rose, with motto on ribbon, "Pretty and Good"	1	1	0
24	Cameleon in selenite	1	7	6
25	Dolphin ditto	0	15	0
26	Parrot ditto	1	7	6
27	Butterfly ditto, plain 15*s.*, marked	1	1	0
28	Madame Selenite, as Columbine, and Mrs. Jim Crow	3	3	0

No.		£	s.	d.
29	Selenite figure of Harlequin	3	3	0
30	Ditto of Caspar	2	15	0
31	Ditto of Robin Hood 1*l.* 10*s.* to	2	15	0
32	Ditto of Jim Crow, (black and white) 1*l.* 16*s.* to	3	3	0
33	Ditto of Sweep turned Baker	1	16	0
34	Ditto Gothic window	1	16	0
35	Apparatus to show the Polarizing Structure communicated to glass by mechanical pressure	0	7	6
36	Various figures of unannealed glass, for exhibiting the peculiar and permanent Polarizing Structure by uniformly heating and suddenly cooling, each	0	4	6
37	E. M. Clarke's dissected unannealed glass figures, to illustrate that the forms of the coloured bands are dependent on the external form of the glass, each	0	10	0
38	E. M. Clarke's Apparatus to show Brewster's experiment, (see p. 236, fig. 120, Treatise on Optics, Lardner's Cyclopædia ;) by this arrangement one glass bar rotates, which adds much to the interest of the experiment	1	1	0
39	E. M. Clarke's arrangement of six of the above bars crossing each other, in two separate sliders of three bars each, the effect of which, either separate or combined, is very pleasing	0	10	0
40	Glass Cameos and Intaglios, showing the black and white cross, also colour, each	0	10	0
41	E. M. Clarke's Slider, to show the polarizing structure of bladder	0	5	0
42	Pen Slider.—The varied colours of polarized light are beautifully developed by this interesting object	0	5	0
43	Cornea of the Human Eye	0	7	6
44	Unguis—Toe-nail	0	5	0
45	Sliders, with fish fins, laminæ of human cuticle, ditto of teeth, ditto of bones, preserved in Canadian Balsam, to exhibit their polarizing structure from 5*s.* to	0	15	0
46	Plate of amethyst, cut perpendicular to the axis, exhibiting on an extensive scale the phenomenon described at p. 219, fig. 111, Treatise on Optics, Lardner's Cyclopædia 12*s.* to	1	10	0
47	Plate of agate, with quartz	0	17	6
48	E. M. Clarke's arrangement of selenite discs of uniform thickness, $1\frac{3}{16}$th inch diameter, mounted in brass rings with band and pulley motion. The effect of these discs when placed in a polariscope, with groups of the various salts, aquatic insects, sections of bones and teeth, fish fins and scales, bladder, human cuticle and selenite designs, is greatly to increase the variations of the colours, each	1	1	0
49	Analyzing Tourmaline plate, mounted in a brass cap, to fit on front of the power *p*, fig. 4, p. 24. (See Directions for using, &c.) 7*s.* 6*d.* to	1	10	0
50	Double image prism of calc spar and glass, mounted as ditto, with contracting plate, for exhibiting that two complementary colours blending form white light	0	15	0
51	Ditto, to fit on the above, for showing Huygens' experiment, and illustrating the polarization of light by double refraction ; by means of which a single beam of light is refracted into four distinct discs on the screen, showing their separation, and all the variations of intensity	0	15	0

NO.		£	s.	d.
52	Plates of quartz, arragonite, topaz, calc spar, borax, nitre, beryl, Rochelle salts, sugar, bi-chromate of potass, sulphate of iron, cut at right angles to their axis, and mounted in brass caps as above, for exhibiting the coloured rings, each	0	6	10
53	Plates of quartz, arragonite, and calc spar, cut at different angles for exhibiting various compound figures of rings, bars, and cross bars, screws, and crosses . . . . . each 10*s.* to	2	0	0

E. M. Clarke begs to state, that all the objects mentioned from No. 5 to No. 53, are fitted up expressly for the Polariscope in proper mahogany frames, or brass caps, and fully protected from injury by being placed between glasses with Canada Balsam, which increases their transparency ; the diameter of the glasses is $1\frac{1}{8}$th inch, and the objects placed between them vary from 1 inch to $1\frac{1}{2}$.

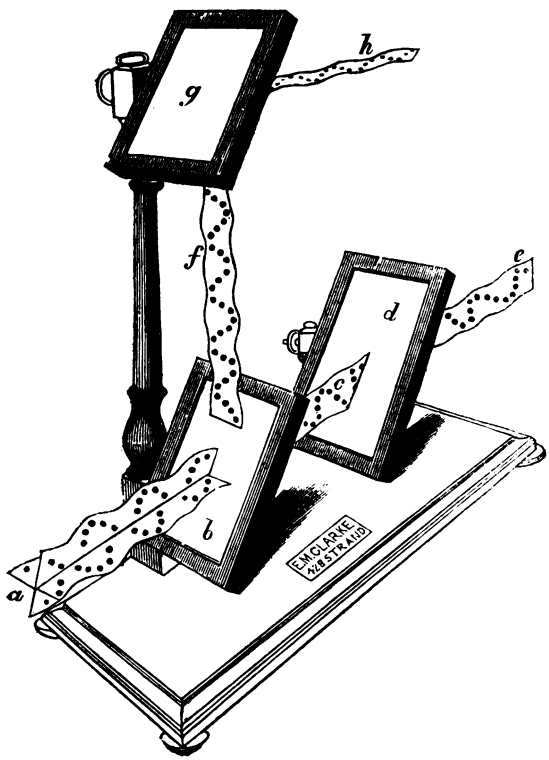
Fig. 8.



54	Biot's black Mirror Polariscope. This apparatus, with an Argand lamp placed opposite the polarizing bundle of glass *a* (fig. 8), exhibits in the analyzing black glass mirror *b* any polarizing object placed at *c*. The analyzing plate is movable in a horizontal plane, and so simple is the arrangement of both mirrors as to render graduated quadrants to adjust the angles quite unnecessary	2	2	0
55	Mirror Polariscope, with dispersing plate . .	1	0	0
56	Ditto, ditto, portable, with spring fastening, best flat glass	1	10	0
57	Tourmaline Polariscope, mounted in king wood, with the crystallized plates in a revolving wheel, so as to come within the tourmalines, which also revolve	2	12	6
58	Tourmaline Apparatus for showing the effect of crystalline films on the coloured rings surrounding the optic axis	2	2	0
59	Tourmaline Tongs Polariscope	0	15	0
60	Polarizing Eye-pieces of thin plates of Glass, in brass or Morocco leather cases . 3*s.*, 4*s.*, and	0	5	0
61	Tourmaline Eye-pieces and Plates of ditto, from 4*s.* to	5	0	0
62	Mica Analyzing Plates . . . 1*l.* 1*s.* to	1	10	0
63	Nicols's Single Image Prisms . . 6*s.* to	1	0	0
64	Polarizing Plates of *Papier Mâché* . . . . . 5*s.* to	1	10	0
65	Ditto, ditto, of black glass, per square inch	0	1	6
66	Ditto, ditto, of thin flatted crown glass, in black frames and velvet backs 6*s.* to	2	2	0
67	E. M. Clarke's Polarizing Kaleidoscope, with tourmaline eye-piece. The objects consist of figures and fragments of selenite, and configuration of various salts, in two separate cells	4	0	0
68	Plate of Nitre, with four axes	0	5	0
69	Ditto, ditto, with two axes	0	5	0
70	Ditto, quartz of different thickness, right or left-handed . 3*s.* to	0	7	6
71	Ditto, calc spar . . . . . 2*s.* to	0	4	0
72	Ditto, topaz	0	6	0
73	Rhombs of Iceland spar . . . . . 2*s.* to	35	0	0

NO.		£	s.	d.
74	Double refracting prisms of ditto . . . . . 8*s.* to	0	15	0
75	Prisms of calc spar and glass, in brass case	0	15	0
76	Double-image prisms of calc spar, showing two sets of coloured rings with black and white cross	0	17	6
77	Pieces of Iceland spar, for illustrating the two white rings observed in certain specimens . . . . . 5*s.* to	0	12	6
78	Rhombs of Iceland spar, to show the multiplication of images afforded by peculiar structure of the crystal . . . . . 5*s.* to	1	10	0
79	Pieces of unannealed glass of various figures and dimensions, to exhibit the permanent polarizing structure of glass that has been uniformly heated and suddenly cooled . . . . . 2*s.* 6*d.* to	1	10	0

Fig. 9.



80 E. M. Clarke's Models for illustrating the Polarization of Light by Refraction and Reflection, from bundles of glass plates, with card models, showing the planes of vibration. The Model (fig. 9) has the polarizing bundle *b* and the analyzing bundles *d g* in parallel planes; hence the reflected light is again reflected, and the refracted light is again refracted. The Model (fig. 10) has the polarizing bundle at right angles to the analyzing bundles; hence the reflected light is refracted, and the refracted light reflected . . . . The pair 5 50

Fig. 10.

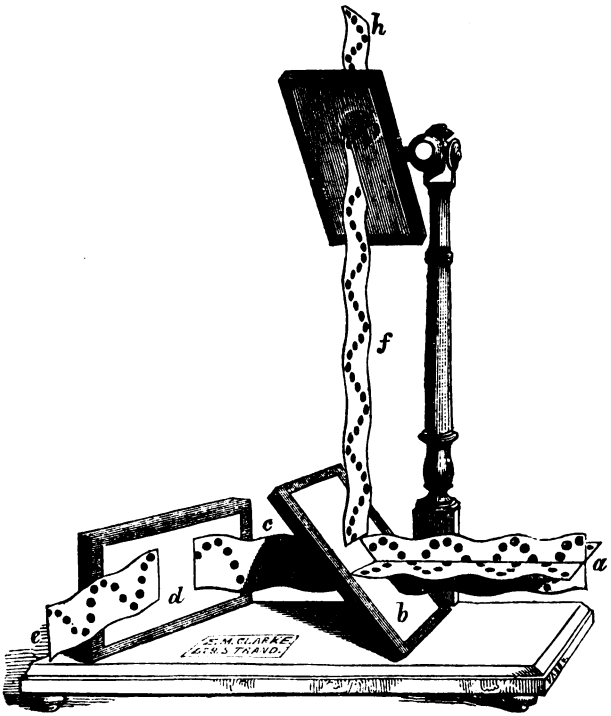
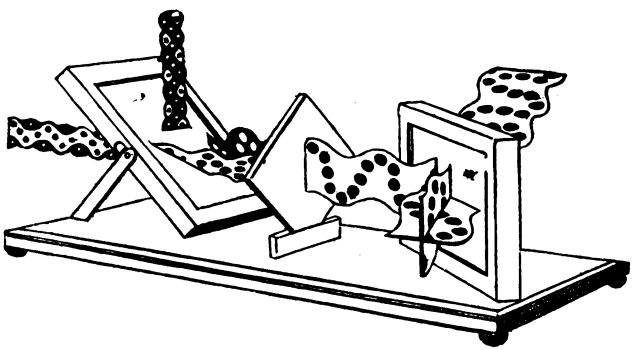
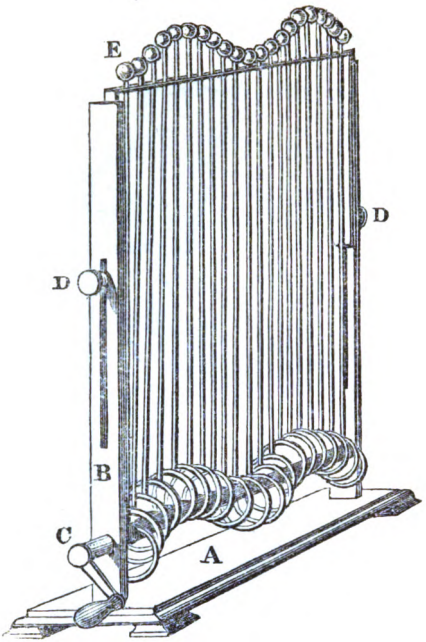


Fig. 11.



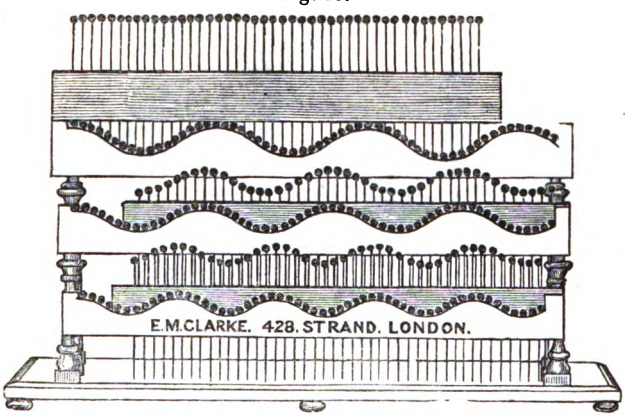
NO.		£	s.	d.
81	Model for illustrating the Mechanical Arrangement of the Gas Polariscope, showing the depolarizing action of double refracting Crystals, the action of the analyzing part of the apparatus in the production of colours by interference (fig. 11)	2	10	6

Fig. 12.



82 Professor Powell's Apparatus to exhibit Plain, Circular, and Elliptical Vibrations. The cranks in this arrangement are dispensed with (fig. 12) £3 13 6

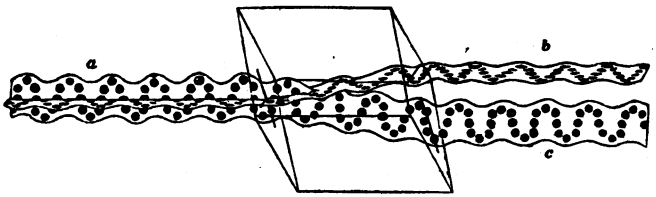
Fig. 13.



83 Woodward's Model for illustrating the Undulatory Theory of Light, showing different waves constituting the three primitive colours; also the effects of interference of undulations and production of complementary colours (fig. 13) 3 13 6

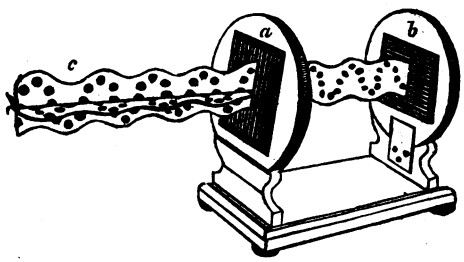
NO.		£	s.	d.
84	Glass Model of a Rhomb of Iceland Spar, for illustrating the Polarization of Light by double refraction (fig. 14)	0	17	6

Fig. 14.



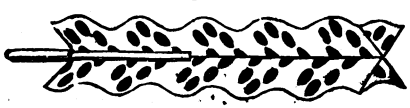
85	Pereira's Model of a Tourmaline, showing the direction of slitting for forming Polarizing Plates . . . . . 6s. 6d. to	0	10	6
86	Model, explaining the Action of two Tourmaline Plates in Polarizing Light (fig. 15)	1	1	0

Fig. 15.



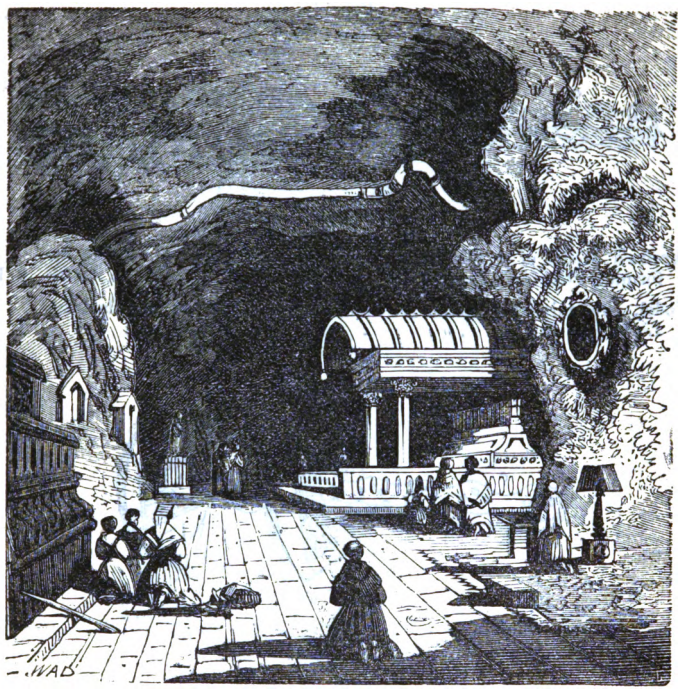
87	Woodward's Card Model of a ray of ordinary light, showing two Planes of Vibration (fig. 16)	0	5	0

Fig. 16.



DISSOLVING VIEWS.

Fig. 17.



NO.		£	s.	d.
1	E. M. Clarke's Biscenascope or Apparatus for exhibiting Dissolving Views by the Lime light, consists of two lanterns on a sliding base, each having optical arrangements of lenses and slide-holders, two Lime-light Instruments, with Union Couplers for connecting with gas bags or gasometers, two clock-work movements for keeping the lime cylinders revolving. The mechanical arrangement is so constructed that both lanterns may be used together or separate without dissolving. Largest size	65	0	0
2	Ditto, ditto, middle size	48	0	0
3	Ditto, ditto, small size, without clock movements	25	0	0

E. M. Clarke begs to state that he was the first person who constructed an Apparatus for exhibiting the Dissolving Views and Orrery by the Lime-light, which were first shown to the public by him at the late Royal Gallery of Practical Science, Dec. 5th, 1840; since which time he has made many improvements, such as producing panoramic views, introducing moving figures in landscapes and the interiors of buildings, also for illustrating lectures on Astronomy, Natural History, Geology, Botany, &c.

To give some idea of the effect to those who have not seen the dissolving views, suppose that the scene (fig. 17), "The Shrine of Santa Rosalia," is fully depicted; it begins gradually to fade from view; but as it gets indistinct, a second view seemingly becomes mixed with it, as at fig. 18; this gradually assumes a more perfect appearance: at last fig. 17 disappears, and the scene fig. 19, "The Water Girls of India," becomes perfect.

Fig. 18.

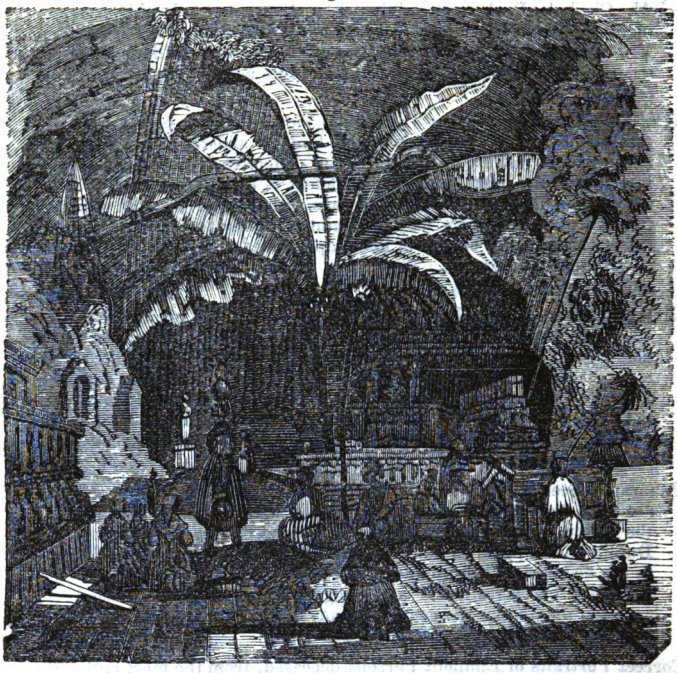
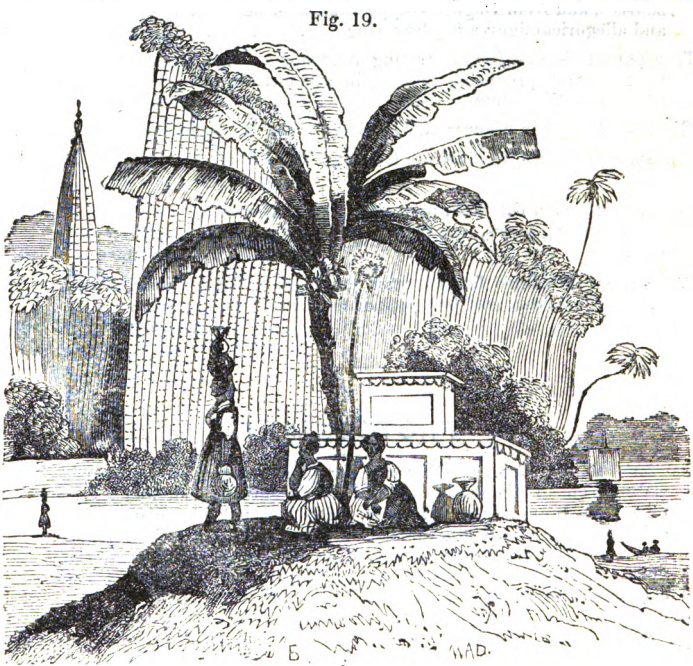


Fig. 19.



NO.		£	s.	d.
4	E. M. Clarke's Parlour Dissolving View Apparatus. In this arrangement the hydro-oxygen lime-light is not employed, but the Dissolving Views are exhibited with perfect clearness and brilliancy on an opaque or transparent screen. It is well adapted for schools and families	10	10	0
5	Transparent Scenes for the Dissolving Views. These paintings differ materially from the common magic-lantern sliders, requiring first-rate artistic talent to render them effective; as owing to the intensity of the light, the slightest defect is developed. They therefore require the most scrupulous care with regard to even the minutest detail: subjects may be painted to suit the taste or view of the purchaser, and consist of landscape scenes, interior and exterior, of public buildings, &c., varying in price according to the subject and size of the painting . . . . . from 1*l.* 1*s.* to	15	15	0
6	Dioramic Scenes for the Dissolving Views. The effect of these is exceedingly pleasing, such as exhibiting the interior of a cathedral by moonlight: morning gradually dawns, showing the aisles filled with a congregation, and the priest officiating at the altar. Also, a serene summer landscape changing to a thunder-storm, with rain and lightning; this clears away, developing a rainbow, and terminates by the summer being succeeded by winter, with its usual accompaniments of frost, and the falling of snow, &c. . . 2*l.* 2*s.* to	18	18	0
7	Panoramic Scenes for the Dissolving Views. Scenes of this description are used for illustrating a continuation of scenery, such as Views up the Rhine. Also, fixed scenes with moving figures, as a view of the Dublin and Kingstown Railroad, with the Bay of Dublin and Howth in the distance. The up and down trains are seen passing on the railroad; carriages, carts and waggons, horse and foot passengers, are seen moving on the common road, while numerous steam vessels and sailing ships are in motion at sea . . . 3*l.* 13*s.* 6*d.* to	21	0	0
8	Correct Portraits of Eminent Persons deceased, from the most authentic sources, and from Daguerreotype likenesses of the living. Classical and allegorical figures for dissolving . . . . 3*l.* 10*s.* to	18	18	0
9	Transparent Scenes for illustrating Astronomy, with mechanical contrivances for producing motion, in sets of from nine to thirty each, of different diameters . . . . . Per set 5*l.* 10*s.*	30	0	0
10	Movable Humorous Figures and Devices for the Biscenascope 10*s.* to	4	10	0
11	Transparent Scenes, to illustrate Geology, Natural History, Botany, &c. 15*s.* to	4	4	0
12	Opaque Screens of Oil-cloth, prepared for gas microscopes, polariscopes, and dissolving views, free from gloss on the surface, from 3 to 9 yards square . . . . . per square yard	0	5	6
13	Transparent Mediums for the same purposes, of Irish Linen, 3 yards wide. This linen may be so joined as not to show any seam . . per square yard	0	2	6

PHOTOGRAPHY.

1	Claudet's Patent Camera Obscura, for photographic purposes, with sliding front to take different optical arrangements, including a mercury bath, bromine pot and cover, iodine box, polishing clamp tablet, spirit lamp, box for holding plates, dark plate box, six polished plates, bottle of bromine, ditto iodine, ditto hyposulphate of soda, ditto mercury, ditto fixing liquid, rouge, tripoli, cotton with Gaudin's achromatic object glass	18	18	0

NO.		£	s.	d.
2	Voigtlaender's large-sized double achromatic Object Glass, filling a field of 6½ inches, in brass mounting, with rack and pinion adjustment .	22	0	0
3	Ditto, small size double achromatic Object Glass, filling a field of 3⅓ inches, ditto	9	9	0
4	Lerebour's large-size treble achromatic Object Glass, filling a field of 7 inches, in brass mounting, with sliding adjustment	14	14	0
5	Ditto, middle size double achromatic Object Glass, filling a field of 4 inches, in brass mounting, with rack and pinion adjustment . .	9	9	0
6	Ditto, small size ditto ditto, filling a field of 3½ inches, ditto . . .	5	5	0
7	Chevalier's double achromatic Object Glass, filling a field of 8 inches, in brass mounting	14	14	0
8	Gaudin's Camera Obscura for photographic purposes. This arrangement is very portable, but limited in the size of its images, filling a space of 3 inches. The apparatus consists of the mercury bath, bromine pot and cover, iodine box, polishing clamp, spirit lamp, box for holding plates and six polished plates, brass stand for fixing, bag of pounce in card box, lucifers in metal box, polishing cotton, achromatic object glass, with revolving diaphragm plate, and the following chemicals in glass bottles, with ground-glass stoppers, bromide of iodine, solution of bromine, iodine, hyposulpate of soda, chloride of gold, alcohol, mercury, tripoli, rouge and emery	8	8	0
9	Claudet's improved Mercury Vapour Baths for different-sized plates, with neutralizing view glass . . . . . 1*l.* 1*s.* to	2	2	0
10	Whatman's Paper for Talbot's process . . . . . per Quire	0	1	6
11	Claudet's improved Apparatus, for keeping the plates in motion during the time they are exposed to the vapours of iodine, bromine, and mercury . . . . . 4*l.* 4*s.* to	7	10	0
12	Claudet's Dark Boxes, for protecting the plates from light during the operation of fixing them in the Camera . . . . 7*s.* 6*d.* to	0	18	0
13	Plate Boxes, for holding any number of Plates of all sizes . 7*s.* 6*d.* to	1	10	0
14	Mahogany Frames and Glass, with padded back-board and pressing rods for taking images on prepared paper . . . . 4*s.* 6*d.* to	0	10	6
15	Apparatus to beat seconds and half-seconds			
16	Red and Yellow Glass to accelerate the process			
17	Blue Glass to protect the face of the sitter from the sun . . .			
18	Wire Ring Stands for holding plate during the process of fixing . .	0	5	0
19	Best Plated Copper plates, from 2 by 2½, 3⅛ by 2⅝, 3 by 4, 4 by 5, 6 by 8½ inches . . . . . per dozen 1*l.* 1*s.* to	6	0	0
20	Apparatus for protecting the Plates by Electro-Gilding, including voltaic battery for plates, 3 by 4 inches	1	15	0
21	Ditto, ditto, larger sizes . . . . . 2*l.* 2*s.* to	4	4	0
22	Superfine cotton for polishing . . . . . per lb.	0	3	6
23	Ackermann's Photogenic Drawing Apparatus; consists of a pressure frame and glass, prepared and plain paper, nitrate of silver in glass stoppered bottle, hydriodate of potass in bottle, muriate of soda, saucer, brush and ivory spatula	1	1	0
24	A full Assortment of all the Chemicals used in the various branches of Photography always ready.			

OPTICAL APPARATUS.

NO.		£	s.	d.
1	Camera Obscura; the image is depicted on a piece of ground glass 1*l.* 10*s.* to	2	0	0
2	Folding Camera Obscuras, with Parallel Mirror. The object is formed on a sheet of paper without being inverted. Two extra Lenses for different distances, and a Print Head for viewing pictures, may be added . . . . . 4*l.* to	7	17	0
3	Dr. Brewster's Kaleidoscope, with two reflecting planes at certain angles, which produce a circular field of view . . . . . 8*s.* to	2	10	0
4	Ditto, to exhibit by the hydro-oxygen light on a transparent screen or opaque disc			
5	Wollaston's Camera Lucida, for drawing objects in true perspective, in a small case for the pocket . . . . . 1*l.* 1*s.* to	3	13	6
6	Improved Stands for ditto	1	10	0
7	Amici's Camera Lucida	2	12	6
8	Glass Equilateral Prisms . . . . . 2*s.* to	1	1	0
9	Ditto, mounted on Brass Stand, with E. M. Clarke's arrangement of the Ball and Socket Joint . . . . . 1*l.* 10*s.* to	2	10	0
10	Sets of Glass Prisms, for demonstrating the principles of the achromatic object-glasses of Telescopes, Microscopes, &c.	0	18	0
11	Hollow Glass Prisms, with ground stopper and movable parallel glass sides for experiments with liquids of different refractive and dispersive powers	0	18	0
12	Claude Lorraine Glasses, for showing the effect of colour on pictures or real landscapes . . . . . 1*s.* 6*d.* to	0	15	0
13	Optical Diagonal Machines for viewing prints . . . . . 15*s.* to	2	2	0
14	Concave and Convex Glass Mirrors, mounted on stands with swing 1*l.* 1*s.* to	2	2	0
15	Concave and Convex Glass Mirrors, in frames . . . . 5*s.* 6*d.* to	10	0	0
16	Glass Mirrors, ground cylindrically, for showing the deformation of objects reflected by this species of curved surface . . 15*s.* to	1	10	0
17	Silver-mounted small Concave Mirror, for examining the interior of the mouth	0	17	6
18	Wheatstone's Stereoscope, with six pair of diagrams, in deal . . .	0	15	0
19	Ditto, in mahogany	1	1	0
20	Apparatus to illustrate that the intensity of light is inversely as the square of the distance	1	0	0
21	Leslie's Photometer . . . . . 1*l.* 10*s.* to	3	3	0
22	Ritchie's ditto . . . . . 14*s.* to	1	1	0
23	Apparatus to illustrate the Eye or Organ of Vision, with the different lenses formed in glass, the curvature of which is so contrived that rays of light proceeding from an object placed before the model are collected into a focus upon the retina, represented by a curved roughened glass. Two extra glasses are furnished, to demonstrate the optical action of different curved crystalline lenses; and also convex and concave glasses, to show how those defects are remedied. Packed in mahogany box	4	10	0
24	Set of Three Models, with the rays of light represented by coloured silk strings, to illustrate the effects of vision; also the formation of the eye in its natural, long-sighted, and short-sighted states . . .	5	12	6
25	Set of Two Models, with the rays of light represented by coloured silk strings, to illustrate the principles of refracting and reflecting Telescopes	3	3	0

NO.		£	s.	d.
26	Set of Three Models, with the rays of light represented by coloured silk strings, to show the principles of the solar, compound, and simple Microscopes	3	10	0
27	Model to show the Decomposition of White Light by the Prism	1	10	0
28	Painted Circular Prismatic Spectrum, for showing the composition of White Light	1	5	0
29	Apparatus for illustrating Newton's Theory of the fits of easy reflection and transmission . . . . . 7*s.* 6*d.* to	1	1	0
30	Improved Phantasmagoria Lantern, with spring to hold the sliders, and brass-adjusting tube, patent lamp, &c., in box. This apparatus has the power of producing more imposing effects than the magic-lantern 4*l.* 14*s.* 6*d.* to	8	8	0
31	Improved Magic Lanterns, with twelve sliders . . 1*l.* 10*s.* to	3	3	0
32	Glass Sliders, with a variety of subjects for exhibiting with magic-lanterns and phantasmagorias, per dozen . . . . 10*s.* 6*d.* to	3	13	6
33	Movable Humorous Sliders, upwards of 150 different subjects, each 3*s.* 6*d.* to	0	10	0
34	Shifting Glass Sliders, with a diversity of subjects, by which the magnified images on the screen appear to the spectators to have life and motion . . . . . 2*s.* to	2	10	0
35	A series of Glass Sliders, with astronomical diagrams, and telescopic views of the moon, planets, &c., for illustrating by the phantasmagoria, on an enlarged scale, various phenomena of astronomy . 3*s.* 6*d.* to	1	5	0
36	A series of Glass Sliders, with astronomical diagrams, having rack and pinion movements, by which the magnified images produced may be made to revolve . . . . . 8*s.* to	1	10	0

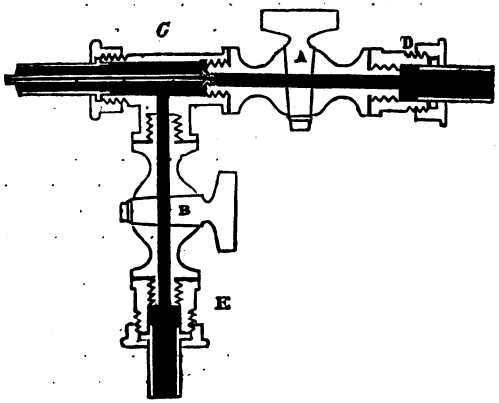
CHEMICAL APPARATUS, &c.

1	Dr. Black's Movable Universal Furnace . . . . . 6*l.* to	7	0	0
2	Improved Portable Round Furnace . . . . . 3*l.* to	5	5	0
3	Enamelling Furnace . . . . . 4*l.* 4*s.* to	10	10	0
4	Plumbago Portable Blast Furnace . . . . . 18*s.* to	3	3	0
5	Earthenware Table Furnaces	0	7	6
6	Ingot and Cupel Moulds	0	1	6
7	Iron Tongs, Shovels, and Ladles, for Furnaces			
8	Platinum, Silver, and Iron Crucibles			
9	Skittle and calcining Pot Crucibles			
10	Muffles for Assaying . . . . . 1*s.* to	0	2	6
11	Trays for Assaying . . . . . 4*d.* to	0	1	0
12	Bone-ash Tests and Cupels . . . . . 1*s.* 6*d.* to	0	2	6
13	Glass Retorts, plain and tubulated, of all sizes . . . . 9*d.* to	0	10	0
14	Tinned iron japanned Gasometer, Bell, 7½ inches wide, 13 inches high .	2	16	0
15	Ditto Sheet Copper ditto, same size	4	14	6
16	Tinned ironed japanned Gasometer, Bell, 10 inches wide, 22 inches high	4	4	0
17	Strong sheet Copper ditto, same size	8	8	0
18	Pepys' improved Gas Holder, tinned iron japanned, 9 inches wide, 13 inches high	2	9	0

No.		£	s.	d.
19	Pepys' improved Gas Holder, strong Sheet Copper, same size	4	10	0
20	Pepys' improved Gas Holder, Tinned Iron Japanned, 12 by 18 inches	2	17	0
21	Ditto strong Sheet Copper, 13 by 20 inches	4	14	6
22	Pepys' Mercurial Gasometer	6	6	0
23	Pneumatic Troughs of Copper, or Tinned Iron Japanned, of every description and size . . . . . 3s. 6d. to	3	3	0
24	Barker's improved Pneumatic Trough, Tin or Copper . 1l. 1s. to	3	3	0
25	Cast Iron Mercurial Pneumatic Trough, with Pepys' Gasometer	10	10	0
26	E. M. Clarke's Improved Cast Iron Mercurial Trough, with filling blocks and trays	1	15	0
27	Mercurial Troughs of Cast Iron or Mahogany, on most approved principles . . . . . 7s. 6d. to	1	10	0
28	Wrought Iron Retorts, with gun-barrel tube ground in the neck, and flexible conducting tube	0	18	0
29	Cast Iron ditto ditto	0	12	0
30	Wedgwood-ware Retorts . . . . . 10d. to	0	10	0
31	Leaden Retorts for Fluoric Acid . . . . . 8s. to	0	10	0
32	Leaden Bottles for Fluoric Acid . . . . . 4s. to	0	10	6
33	Knox's Fluor Spar Apparatus for Experiments when Fluoric Acid is required, described in the Transactions of the Royal Irish Academy			
34	Best large Brass Retort Stand with five Discharging Rings, and Knox's Triangle Runners	2	2	0
35	Second size ditto ditto, with three Discharging Rings	1	15	0
36	Retort, Stands with five Sliding Brass Rings, with Knox's Triangle Runners	1	10	0
37	Ditto ditto, three Rings, and Knox's Triangle Runners	1	1	0
38	Retort Stands, with three sliding brass rings, brass rod, a japanned iron foot . . . . . 7s. 6d. to	1	1	0
39	Knox's Test Tube and Retort Holder, with socket and ball motion for ditto	1	1	0
40	Chemical Thermometer, with boxwood scale to fold back at bottom, scale from freezing to boiling point of Mercury . . . 14s. to	0	18	0
41	Ditto, graduated on the glass tube	1	1	0
42	Ditto, with Spirits of Wine for low temperatures	0	15	0
43	Air Thermometers . . . . . 7s. 6d. to	0	16	0
44	Leslie's Differential Thermometer . . . . . 9s. to	1	11	6
45	Thermometers . . . . . 4s. 6d. to	1	11	6
46	Standard Thermometers . . . . . 1l. 10s. to	2	12	6
47	Six's Registering Thermometer . . . . . 1l. 5s. to	1	15	6
48	Horizontal Registering Thermometer	1	4	0
49	Day or Night ditto, singly	0	10	0
50	Lithographed graduated Paper Scales, on mahogany veneer, for air, differential, and other comparative Thermometers, used on lecture tables, from 2s. to	0	10	0
51	Leslie's Photometer	2	5	0
52	Leslie's Hygrometer	2	2	0
53	Daniell's ditto	2	10	0
54	Mason's ditto	2	12	6
55	Daniell's Oxy-hydrogen Blowpipe, with Maugham's Jets and Cary's Lime-holder	1	5	0

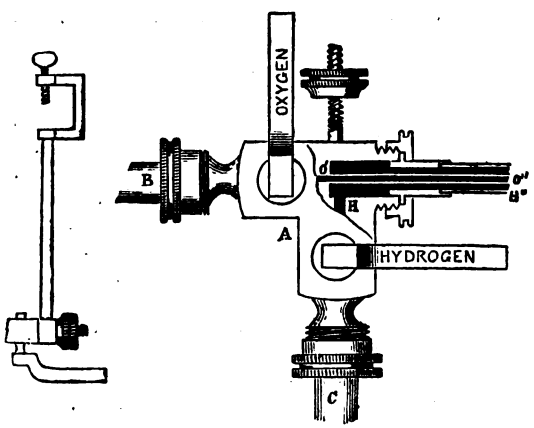
NO.		£	s.	d.
56	Daniell's Oxy-hydrogen Blowpipe, &c., including Two Stop-cocks and Union Coupler for the Hydrogen (fig. 20)	1	12	6

Fig. 20.



57	Ditto, as improved by E. M. C. whereby he has removed the inconvenience occasioned by the use of so many separate parts, including Stop cocks and four Union Joints, in mahogany lock-up case (fig. 21)	3	3	0

Fig. 21.



58	Mouth Blowpipes in Glass, Brass, Plain, Portable, &c. . . . 1s. to	0	10	0
59	Gurney's, Hemming's, Otley's, and Compression Blow-pipe for the Mixed Gases . . . . . 10s. to	2	10	0
60	Cuthbert's Improved Hydraulic Blowpipe . . . . . 2l. 2s. to	2	12	6
61	Blowpipe Lamps for Oil or Tallow . . . . . 2s. 6d. to	0	12	6
62	Bladder with Stop-cock and Jet	0	7	6
63	Strong Steel Forceps, with hardened points	0	6	0
64	Plain Glass Balloon Receivers . . . . . 1s. 6d. to	0	10	0
65	Tubulated ditto . . . . . 2s. 6d. to	0	14	0

NO.		£	s.	d.
66	Quilled Glass Balloon Receivers . . . . . 2s. 6d. to	0	12	0
67	Quilled and Tubulated ditto . . . . . 3s. to	0	16	0
68	Glass Mattresses . . . . . 1s. 6d. to	0	6	0
69	Glass Alembics . . . . . 4s. 6d. to	1	10	6
70	Silver Alembics, with Glass Capital . . . 1l. 11s. 6d to	4	4	0
71	Glass Flasks, with Bent Glass Tubes, ground in . . 3s. 6d. to	0	6	6
72	Digesting Flasks . . . . . 1s. 6d. to	0	5	0
73	Florence Flasks	0	0	6
74	Glass Flasks, mounted with brass cap, stop-cock, and connecting piece .	0	8	0
75	Lamp Furnace with copper chimney	0	10	0
76	Ditto, with double wick, and fountain reservoir of oil	1	16	0
77	Glass and Brass Spirit Lamps with ground caps . . 3s. 6d. to	0	5	6
78	Rumford's Spirit Lamp, three Wicks, copper	0	9	0
79	Rumford's Spirit Lamp, improved by E. M. Clarke. The spirit in this lamp is prevented going to waste when not in use	1	1	0
80	Chemical Stop-cocks that will stand the test of a high condensation, with brass bodies, and gun-metal plugs, and vice versâ . . 4s. to	0	10	6
81	Plain T and Elbow connecting Pieces . . . . . 1s. 6d. to	0	5	0
82	Brass Tobacco Pipe that screws in Stop-cocks	0	3	0
83	Revolving Jet that screws in Stop-cocks	0	7	6
84	Brass Caps with Stop-cock Screw, to cement on retorts, receivers, &c. 1s. to	0	3	6
85	Gas Jars, ½ pint, Plain	0	1	0
86	——— 1 pint	0	1	6
87	——— 2 pints	0	2	6
88	——— 4 pints	0	6	6
89	——— 6 pints	0	7	6
90	——— ½ pint, stopped	0	1	3
91	——— 1 pint, stopped	0	2	0
92	——— 2 pints, ditto	0	3	6
93	——— 4 pints, ditto	0	7	6
94	——— 6 pints, ditto	0	8	6
95	Capped and stoppered Air Jars of different sizes . . 1s. 6d. to	0	14	0
96	Plain Air Jars, in nests of 3, 4, and 5, with ground edges . 5s. to	0	8	6
97	Air Jars, divided into cubical inches and decimal parts . . 4s. to	0	14	0
98	Deflagrating Ladles, per doz. . . . . 6s. to	0	8	0
99	Ground Brass Plates, with collar of leathers to cover air jars 2s. 6d. to	0	5	6
100	Cubic-inch bottles, plain and graduated . . . . . 3s. to	0	6	0
101	Graduated Glass Measures . . . . . 2s. to	0	12	0
102	Ditto Drop Measures . . . . . 2s. 6d. to	0	7	0
103	Precipitating Glasses . . . . . 9d. to	0	5	6
104	Ditto Rods, Bars, and Plates of different Metals . . . 6d. to	0	4	0
105	Glass, Earthenware, and Iron Tubes			
106	Hydrostatic, Separating, and Wedgwood Funnels . . 3d. to	0	4	0
107	Glass Funnels . . . . . 5d. to	0	2	0
108	Glass Syphons . . . . . 1s. to	0	3	6
109	Woulf's Apparatus, consisting of three 3-necked Bottles, with conducting and safety tubes in tray . . . . . 1l. 4s. to	2	2	0
110	Ditto in Pint Bottles	1	10	0
111	Ditto Quart ditto	1	18	0
112	Two and three-necked Bottles, separate . . . 3s. 6d. to	0	8	0

NO.		£	s.	d.
113	Ground Stoppered Glass Bottles, with and without glass caps . 1s. to	0	10	6
114	Dropping Bottles and Tubes . . . . . 1s. 6d. to	0	2	6
115	Evaporating Basins in Glass, Wedgwood-ware, Silver, Platinum, Copper, with and without lips, in sets or single . . 1s. to	10	0	0
116	Glass Test Tubes, per dozen set, 3 each . . . . . 3s. to	0	6	0
117	Ditto Racks and Holders . . . . . 1s. to	0	16	0
118	Fergusson's Pyrometer . . . . . 3l. 3s. to	5	5	0
119	Wollaston's Cryophorus . . . . . 3s 6d. to	1	12	0
120	Freezing Apparatus . . . . . 15s to	2	2	0
121	Double Steel Forceps, with platinum tips at one end, and hardened points at the other . . . . . 7s. 6d. to	0	15	0
122	Deflagrating Forceps	0	8	6
123	Blowpipe Spoons of silver or platinum . . . . . 4s. to	0	9	6
124	Ditto Jets of brass or platinum . . . . . 1s. to	0	5	0
125	Mortars, with Pestles of Wedgwood-ware, Parisian porcelain, glass, agate, flint, steel, and iron . . . . . 1s. 6d. to	2	2	0
126	Assay Balances, with framed beam and steel knife edges on agate planes, in mahogany, glass case, with weights, &c. . . 8l. 8s. to	14	14	0
127	Hydrostatic Balances, with steel beams, packed in mahogany case 3l. 3s. to	8	8	0
128	Balances with pearl and metal pans, weights, &c. . . 10s. 6d. to	1	11	0
129	Boxes of Decimal Weights, in brass, silver, and platinum . 15s. to	2	10	0
130	Hydrometers . . . . . 7s. 6d. to	4	4	0
131	Nicholson's Gravimeter	1	10	0
132	Improved Glass Hydrometers and Saccharometers . 2s. 6d. to	1	1	0
133	Ditto, ditto, Saccharometer for brewing . . . . . 7s. 6d. to	3	3	0
134	Welter's Tube of Safety	0	2	6
135	Caoutchouc Gas Bags, with brass connexions . . . 16s. to	4	14	6
136	Sheets of prepared Caoutchouc, for making connexions . . .	0	1	6
137	Caoutchouc Tubes, per foot	0	1	6
138	Flexible Metallic Tube, per foot . . . . . 6d. to	0	1	0
139	Wollaston's Scale of chemical equivalents	0	3	0
140	Scale of chemical equivalents by Cuff	0	5	6
141	Warrington's Chemical Tables	0	3	0
142	Reid's Chemical Abacus for facilitating the study of the Atomic Theory of Dalton and Berzelian Symbols	0	1	6
143	Priestley's Eudiometer . . . . . 5s. to	0	12	0
144	Berthollet's Eudiometer	0	5	0
145	Hope's ditto	0	8	0
146	Davy's ditto	0	7	0
147	Pepys' ditto	0	10	0
148	Ure's Detonating Eudiometer	0	12	0
149	Cooper's ditto ditto	0	18	0
150	Volta's ditto ditto	0	12	0
151	Ditto, with steel spring for mercurial trough, to ensure safety to the operator	0	18	0
152	Cavendish's Eudiometer for the explosion of inflammable gases by the electric spark	3	3	0
153	Sand Baths of Copper fitting into the rings of the retort stand 2s. to	0	3	6
154	Marcet's Watch-glass holder	0	1	6

NO.		£	s.	d.
155	Strong hollow Iron Spheres. This apparatus shows the expansive force exerted in the Congelation of Water	0	4	6
156	Brass Gauge, with cylindrical metal rod, to illustrate the expansion of a metal when its temperature is increased 4s. to	0	7	0
157	Double Bar or Slip, composed of brass and iron, for illustrating the unequal expansion in two metals when heated 2s. 6d. to	0	7	0
158	Apparatus to exhibit the force of contraction in a metallic bar when it is suddenly reduced from a red heat to a comparatively low temperature. This contrivance shows the fact by the contracting bar snapping another bar connected with it	1	1	0
159	Apparatus for exhibiting the relative degrees of expansion produced in different liquids by like elevations of temperature	2	16	0
160	Glass Apparatus for showing the condensation in volume and heat given out with mixtures of water with sulphuric acid	0	7	6
161	Parabolic Mirrors on stands for experiments with radiant heat. Mirrors 12 inches diameter, including iron ball and 3 adjusting stands	5	0	0
162	Marcet's Steam Apparatus, with barometer and thermometer attached. This instrument E. M. C. makes of cast iron, thereby doing away with the accidents by explosion which have occurred owing to the action of the mercury on the brass rendering it incapable of confining high-pressure steam	3	13	6
163	Leslie's Radiator. This apparatus consists of a square tin vessel, with its sides coated with different substances. When hot water is placed in the vessel, the power of radiation of each side can be examined by turning them towards the reflector 10s. 6d. to	0	15	0
164	Metallic Vessels, with polished and blackened surfaces, for showing the effects of the absorption and radiation of different surfaces	0	4	6
165	Apparatus to illustrate the different radiating powers of two different surfaces. Shows that when the heated body is placed equidistant between the surfaces, a piece of phosphorus fixed behind the blackened surface is inflamed, while a similar piece behind the polished surface remains unchanged	0	15	0

166 *Particulars of a Set of Apparatus adapted principally for Gaseous Chemistry, for £5. 5s. for young beginners.*

	£	s.	d.
Iron Retort Stand	0	7	6
Pneumatic Trough	0	10	6
2 Gas Jars, 1 pint each	0	3	0
2 ditto 1 quart	0	5	0
1 ditto capped	0	5	0
2 Stop-cocks	0	7	0
1 Mounted Bladder	0	2	6
3 Plain Retorts	0	3	0
1 Receiver	0	1	0
2 Tubulated Retorts	0	3	6
1 Tubulated Receiver	0	1	6
1 Deflagrating Ladle and Plate	0	2	6
1 Common Ladle	0	1	0
3 Evaporating Dishes	0	2	6
Carried forward	£2	15	6
Brought forward	£2	15	6
1 Iron Retort, &c.	0	8	6
1 Graduated Measure	0	2	0
1 Retort Funnel	0	1	6
1 Funnel	0	1	0
1 Spirit Lamp	0	4	0
8 Saucers for Transferring	0	1	6
2 Three-neck Woulf's bottles	0	6	0
Tubes for ditto	0	2	6
1 Dozen Test Tubes	0	2	6
Test Tube Rack	0	2	0
1 Mortar and Pestle	0	3	6
Chemicals, &c. for the production of various gases, &c.	0	14	6
	£5	5	0

167 A more extensive Set for £10 10s.

	£	s.	d.
The above	5	5	0
Mercurial Trough, and Mercury	2	12	6
Portable Furnaces	1	5	0
4 Gas Jars for mercurial trough	0	5	0
Platina Spoon, Forceps, Wire, &c.	0	6	0
Glass Tubes, various	0	4	0
Carried forward	£9	17	6
Brought forward	9	17	6
Earthen Tubes	0	3	0
Iron Tubes	0	1	0
Stirring Rods	0	1	0
3 Precipitating Glasses	0	4	0
Blowpipe	0	3	6
	£10	10	0

NO.

168 Chemical Cabinet Stand of 48 glass stoppered 2 oz. bottles, containing as follows:—

FIRST SHELF.

1 Tartaric acid
2 Acetate lead
3 Pure oxalic acid
4 Sulphate copper
5 Phosphate soda
6 Sulphate magnesia
7 Alcohol
8 Muriate lime
9 Carbonate ammonia
10 Iodide potassium
11 Tartarate antimony
12 Muriate ammonia.

SECOND SHELF.

13 Chloride barium
14 Phosphoric acid
15 Chloride platinum
16 Sulphate iron
17 Sulphuric acid
18 Iodine
19 Chloride gold
20 Oxalate ammonia
21 Carbonate potash
22 Solution pure potash
23 Bichromate potash
24 Ferrocyanate potash

THIRD SHELF.

25 Hydrosulphate ammonia
26 Lime water
27 Chloride cobalt
28 Permuriate iron
29 Bichloride mercury
30 Red precipitate potash
31 Chromate potash
32 Sulphate nickel
33 Chloride cadmium
34 Sulphate zinc
35 Nitrate bismuth
36 Bicarbonate potash

FOURTH SHELF.

37 Sulphate alumina
38 Pure nitric acid
39 Sulphuretted hydrogen
40 Fluosilicic acid
41 Chloride tin
42 Muriatic acid
43 Nitrate mercury
44 Sulphate potash
45 Nitrate silver
46 Pure soda
47 Succinate ammonia
48 Tincture galls

Four drawers containing test tubes, glass blow-pipe, dropping tube, stirring rod, watch glasses, glass tubes, turmeric and litmus paper, filtering paper, Marcet's watch-glass holder and test-tube holder, complete £5 10 0

CHEMICALS.

	s.	d.		s.	d.
Acid, Acetic	0	3 oz.	Acid, Fluoric	0	6 „
„ „ Strong	1	6 „	„ Fluo-silicic	0	6 oz.
„ Arsenious	0	2 „	„ Gallic	12	0 „
„ Arsenic	1	0 „	„ Hydriodic		
„ Benzoic	3	6 „	„ Indigotic		
„ Boracic	1	6 „	„ Lithic		
„ Camphoric			„ Malic		
„ Carbazotic			„ Meconic		
„ Chloric			„ Muriatic, Common	0	3 lb.
„ Chromic	5	0 „	„ „ Pure	0	2 oz.
„ Chloro-chromic	5	0 „	„ Molybdic	14	0 „
„ Citric	1	0 „	„ Nitrous	1	3 lb.
„ Croconic			„ Nitric	1	6 „

	s.	d.	
Acid, Nitric, Pure	0	4	oz.
„ Nitro-muriatic	0	4	„
„ Osimic			
„ Oxalic, Common	0	4	„
„ „ Pure	0	6	„
„ Perchloric			
„ Phosphoric, Sol.	1	3	„
„ „ Glacial, Pure	15	0	„
„ Prussic	2	0	„
„ Pyroligneous	1	0	lb.
„ Succinic	9	0	oz.
„ Sulphuric, Common	0	3	lb.
„ „ Pure	0	2	oz.
„ Sulphuric Nordhausen	0	3	„
„ Anhydrous			
„ Sulpho-Naphthalic			oz.
„ Tartaric, Common	0	4	„
„ „ Pure	0	6	„
„ Titanic			
„ Tungstic	7	0	„
Alcohol	3	6	lb.
„ Pure	6	0	„
Alloys, various			
Æther, Acetic	1	0	oz.
„ Pyroligneous	1	6	pt.
„ Sulphuric	0	6	oz.
„ „ Rectified	0	8	„
„ Nitric	0	8	„
Aluminum			
Alumine	1	6	„
„ Acetate, Sol	0	6	„
„ Muriate, Solution	0	4	„
„ Nitrate, Solution	0	4	„
„ and Potash Sulphate	0	3	„
„ Sulphate, Solution	0	4	„
Amber	0	6	„
Ammonia, Solution	0	2	„
„ Strong	0	3	„
„ Benzoate	3	6	„
„ Carbonate, Pure	0	3	„
„ „ Common	1	0	lb.
„ Chlorate	2	6	oz.
„ Fluate	1	0	„
„ Hydro. Sulph. Sol.	0	6	„
„ Muriate	0	2	„
„ „ Pure	0	6	„
„ Nitrate	0	4	„
„ Oxalate	1	0	„
„ Phosphate	0	8	„
„ Succinate	9	0	„
„ Prussiate	1	0	„
„ Sulphate	0	3	„
Antimony	0	3	„
„ Pure	1	0	„
„ Glass	0	4	„
„ Nitro-muriate, Sol.	0	3	„
„ Oxides	1	0	„
„ Phosphate	0	8	„
„ Sulphuret	0	10	lb.
„ Tartrate & Potash	0	6	oz.
Archil	0	2	„
Arsenic, Pure	1	0	„

	s.	d.	
Arsenic, Common	0	6	oz.
„ Sulphurets	0	6	„
Barytes	2	6	„
„ Crystals	3	0	„
Barytes, Acetate	1	0	„
„ Carbonate	0	4	„
„ „ Native	0	4	lb.
„ Chlorate	2	6	oz.
„ Muriate	0	6	„
„ Nitrate	0	8	„
„ Oxalate	0	8	„
„ Phosphate	0	8	„
„ Sulphate	0	4	„
Barytic Water	0	6	„
Beryl	1	6	„
Bismuth	0	4	„
„ Pure	1	0	„
„ Oxide	1	0	„
„ Nitrate	1	6	„
„ „ Solution	0	6	„
Black Flux	0	6	„
Borax	0	3	„
Boron			gr.
Bromine	3	6	bot
Cadmium	2	6	dr.
„ Oxides	3	0	„
Calcium, Chloride, Fused	1	0	oz.
„ Sulphuret	0	4	„
Caoutchoucine			„
Capnomor			
Carbon, Sulphuret	4	0	oz.
Cerite	3	6	„
Cerium			
„ Protox	18	0	„
„ Peroxide	18	0	„
„ Carbonate	18	0	„
„ Sulphate	18	0	„
Charcoal, Animal	0	2	„
„ Boxwood			
Chlorine, Sol	0	3	„
Chromium			
„ Oxide	0	6	„
„ Oxalate and Potash	4	0	„
Copper, Granulated	4	0	lb.
Copper, Pure	1	0	oz.
„ Acetate	1	0	„
„ Carbonate	1	0	„
„ Leaf	0	2	bk.
„ Muriate	1	6	oz.
„ Nitrate	0	4	„
„ Oxides	1	6	„
„ Sulphate, Common	0	2	„
„ Sulphate, Pure	0	3	„
„ Sulphuret	0	6	„
„ Turnings	3	0	lb.
Cobalt			„
„ Acetate, solution	1	6	oz.
„ Carbonate	10	0	„
„ Muriate, Solution	1	6	„
„ Oxide, Common 3*s.* 4*s.* &	5	0	„
„ „ Pure	20	0	„
Cobalt ores 2*s.* &	3	0	„

	s.	d.	
Creosote			
Distilled Water	0	6	gal
Eupione			
Fluor Spar	0	6	lb.
Flux, Black	0	6	oz.
„ White	0	6	„
Fulminating Mercury	3	6	„
Galls	0	2	„
„ Tincture	0	4	„
Glucinæ	£3	0	0 „
„ Carbonate	£3	0	0 „
„ Sulphate	£3	0	0 „
Gold Chloride, Solution	5	0	„
Gold Leaf	1	9	bk.
Hydrogen Gas	0	6	gal
Iodine	2	0	oz.
Iodide Iron	2	6	„
„ Lead	3	0	„
„ Mercury	3	0	„
„ Sulphur	3	0	„
Iridium, Native	10	0	„
„ Oxide			
Iron			
„ Acetate	0	6	„
„ Carbonate			
„ Chromate	0	6	lb.
„ Filings . . 6*d.* and	0	8	„
„ Muriate	0	6	oz.
„ Nitrate, Solution	0	3	„
„ Oxide	0	6	„
„ Prussiate	1	0	„
„ Sulphate	0	2	„
„ Sulphuret	0	8	lb.
„ Turnings . . 9*d.* 1*s.* &	2	6	„
Lead, Pure	1	0	oz.
„ Acetate	0	1	„
„ Acetate, Pure	0	6	„
„ Carbonate	0	4	„
„ Chromate	0	6	„
„ Granulated	1	6	lb.
„ Muriate	0	6	„
„ Nitrate	0	8	oz.
„ Oxalate	0	6	„
„ Oxide, Common	0	3	„
„ „ Pure	1	0	„
„ Deutoxide	0	3	„
„ Peroxide	1	6	„
„ Phosphate	0	6	„
„ Red	0	3	lb.
„ Tartrate	0	8	oz.
Lime	1	0	lb.
„ Carbonate	0	1	oz.
„ „ Pure	0	3	„
„ Chlorine	0	8	lb.
„ Fluate	0	6	„
„ Hydro-sulphuret	1	0	oz.
„ Muriate, Crystals	0	6	„
„ „ Fused	1	0	„
„ Oxalate	0	6	„
„ Prussiate	1	0	„
„ Phosphate, Common	1	0	lb.
„ Phosphuret	3	6	oz.

	s.	d.	
Lime Sulphuret	0	6	oz.
Lithia			
„ Carbonate			
Lithia Sulphate			
Litmus	0	6	oz.
Litmus Tincture	0	3	„
Lycopodium	0	6	„
Magnesia	0	8	„
„ Carbonate	0	4	„
„ Muriate	0	4	„
„ Nitrate	0	6	„
„ Oxalate	0	8	„
„ Sulphate	0	1	„
Manganese	0	4	lb.
„ Carbonate	1	6	oz.
„ Muriate	1	0	„
„ Oxalate	1	0	„
„ Oxides, Pure			
„ „ Black	0	3	lb.
„ „ Grain	0	3	„
„ Sulphate	1	0	oz.
Mercury	*variable*		
„ Acetate	2	6	oz.
„ Chloride	0	6	„
„ Bi-chloride	0	6	„
„ Nitrate	0	6	„
„ Oxides	1	0	„
„ Prussiate	2	0	„
„ Sulphate	1	0	„
„ Sulphuret	0	6	„
Minerals for Analysis (various)			
Molybdenum			„
„ Oxide	20	0	„
Morphia	36	0	„
„ Acetate	34	0	„
„ Muriate	34	0	„
„ Sulphate	34	0	„
Naphtha	1	0	„
„ Rectified	2	0	„
Naphthaline, Pure	12	0	„
„ Common	2	6	„
Nickel, Pure	3	0	„
„ Common	0	3	„
„ Carbonate	2	0	„
„ Muriate	1	0	„
„ Oxide			„
„ Sulphate	1	0	„
Osmium			„
„ Oxide			
Oxygen Gas	0	6	gal
Paraffine			
Phosphorus	4	0	oz.
Palladium			
„ Oxide			
Piccamar			
Pittacal			
Platina Ammon. Muriate	25	0	„
„ Balls	0	6	ea.
„ Chloride	2	0	oz.
„ Native	15	0	„
„ Sponge	35	0	„
Platinum, Pure	30	0	„

	s.	d.	
Potassium	0	4	gr.
Potash, Fused	0	6	oz.
,, Pure	2	6	,,
Potash Acetate	1	0	,,
,, Arseniate	0	4	,,
,, Carbonate, Common	0	8	lb.
,, ,, Pure	0	6	oz.
,, Bi-carbonate	0	4	,,
,, Chlorate	0	9	,,
,, Per chlorate	5	0	,,
,, Chromate	0	6	,,
,, Bi-chromate	0	6	,,
,, Fluo-silicate	1	0	,,
,, Hydriodate	2	6	,,
,, Muriate	0	6	,,
,, Nitrate, Pure	0	3	,,
,, Oxalate	0	6	,,
,, Prussiate	0	4	,,
,, ,,	0	6	,,
,, Silicate	0	6	,,
,, Sulphate	0	3	,,
,, Bi-sulphate	0	3	,,
,, Sulpho-cyanide			
,, Tartrate	0	3	,,
,, Bi-tartrate	0	2	,,
,, ,, Crude	0	10	lb.
Rhodium			
,, Oxide			
Selenium	1	0	gr.
Silex	1	0	oz.
Sodium	0	9	gr.
Soda, Pure	3	0	oz.
,, Arseniate	0	4	,,
,, Benzoate	3	6	,,
,, Carbonate	0	3	,,
,, Bi-carbonate	0	3	,,
,, Muriate	0	4	,,
,, Nitrate	0	6	,,
,, Oxalate	0	6	,,
,, Phosphate and Ammonia	2	6	,,
,, Phosphate	0	6	,,
,, Sulphate, Pure	0	2	,,
,, Succinate	10	0	,,
,, Tartrate and Potash	0	4	,,
Strontia	3	0	,,
,, Crystals	4	0	,,
,, Acetate	1	0	,,
,, Carbonate, Pure	0	8	,,
,, Muriate	1	0	,,
,, Nitrate, Common	0	4	,,
,, Nitrate, Pure	0	6	,,
,, Oxalate	0	8	,,
,, Sulphate, Pure	0	8	,,

NO.	s.	d.	
Strontia Sulphate, Native	0	4	lb.
,, Water	0	6	oz.
Silver Acetate	8	0	,,
,, Chloride	5	0	,,
,, Leaf	1	6	bk
,, Nitrate	5	6	oz.
,, Fused	5	6	,,
,, Phosphate	5	0	,,
,, Sulphate	5	6	,,
Sulphur Chloride	4	0	,,
,, Roll	0	4	lb.
,, Sublimed	0	6	,,
Sulphuretted Hydrogen Water	0	3	oz.
Tin	0	3	,,
,, Pure	1	0	oz.
,, Bi-chloride	2	0	,,
,, Foil	0	8	sht
,, Granulated	0	4	oz.
,, Muriate	1	0	,,
,, Nitrate	1	0	,,
,, Oxides	1	6	oz.
Tincture Litmus	0	3	,,
,, Galls	0	6	,,
,, Brazil Wood	0	4	,,
,, Red Cabbage	0	4	,,
,, Turmeric	0	4	,,
Titanium			
,, Oxide			
Test Papers, Brazil Wood	0	1	sht
,, Litmus	0	1	,,
,, Red	0	1	,,
,, Red Cabbage	0	1	,,
,, Turmeric	0	1	,,
Tungsten			
,, Oxide			
Uranite			
Uranium			
,, Oxide			
Vanadium			
,, Oxide			oz.
,, Wolfram	0	6	,,
Zinc	0	4	,,
,, Pure	1	0	oz.
,, Acetate	1	6	,,
,, Carbonate	0	6	,,
,, Foil			
,, Granulated	0	6	lb.
,, Malleable Sheet	0	8	,,
,, Oxide	0	6	oz.
,, Sulphate	0	3	,,
Zirconia			
Zircons			

CRUCIBLES.

BLACK-LEAD POTS.

NO.	s.	d.
1 each	0	2½
2	0	4½
3	0	6
4	0	8

NO.	s.	d.
5 each	0	10
6	1	1
7	1	3
8	1	6
9	1	8

NO.		£	s.	d.
10	each	0	2	0
12		0	2	3
14		0	2	9
15		0	3	3
16		0	3	6
18		0	4	0
20		0	4	6
25		0	5	6
30		0	7	3
35		0	8	8
40		0	10	6
45		0	12	6
50		0	14	6
60		0	17	0
70		0	18	6
80		1	2	6
90		1	5	0
100		1	10	0

SQUARE CRUCIBLES NESTED.

3		0	3	0
4		0	4	0
5		0	6	0

TRIANGULAR CRUCIBLES.

½ in.	per doz.	0	0	6
1		0	0	8
1½		0	0	10
2		0	1	0
3		0	1	6
3½		0	1	10
4		0	2	0
4½		0	2	6
5		0	3	6

ROUND CRUCIBLES.

3	each	0	0	1½
4		0	0	2½
4½		0	0	3½
5		0	0	4
5½		0	0	5
6		0	0	6½
6½		0	0	8
7		0	0	10

		£	s.	d.
8		0	1	0
9	each	0	1	4
10		0	2	0

CHEMICAL RETORTS.

¼ pint	each	0	0	9
½		0	1	6
1		0	2	0
1½		0	3	0
2		0	3	6
3		0	4	6
2 qts.		0	5	6
3		0	7	6
4		0	10	0

Tubulated 6*d.* each extra.

SKITTLE POTS.

3	each	0	0	2
4		0	0	3
5		0	0	4
6		0	0	5
7		0	0	6
8		0	0	7
9		0	0	9
10		0	1	2
11		0	1	6
12		0	1	9
14		0	2	0
16		0	3	0

CASTING POTS.

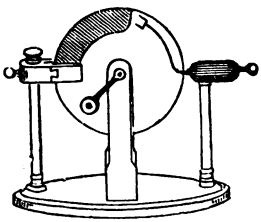
5 lbs.	each	0	0	8
10		0	0	10
15		0	1	0
20		0	1	2
30		0	1	6
40		0	1	9
50		0	2	2
60		0	2	6
70		0	2	10
80		0	3	0
90		0	3	6
100		0	4	0
120		0	6	0

Fine Stourbridge Loam.—Fire Lumps, Bricks, and Tiles.

FRICTIONAL ELECTRICITY.

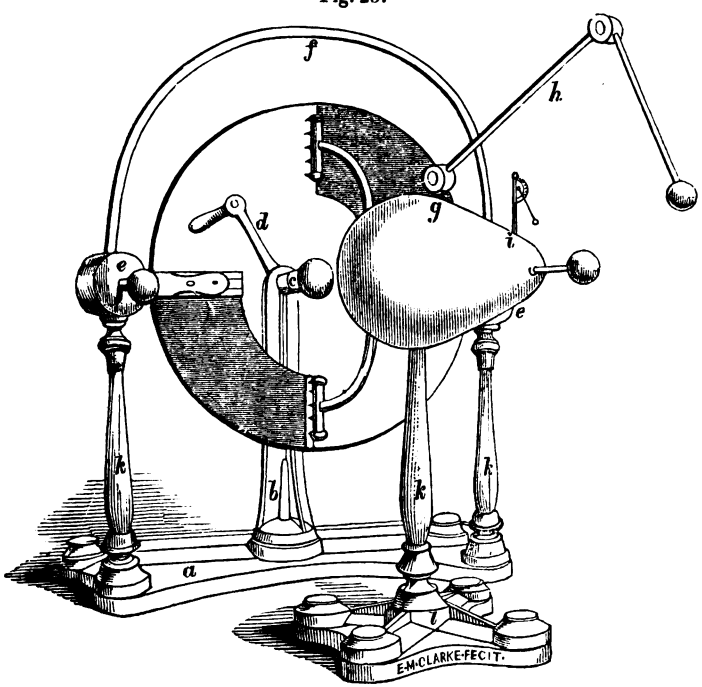
NO.		£	s.	d.
1	Plate Electrical Machines on the French plan, having one pair of rubbers (fig. 22). This arrangement answers well for small machines. Plate 6 inches diameter	2	2	0
2	Ditto. Plate 9 inches diameter . .	3	3	0
3	Ditto. Plate 12 inches diameter . .	4	10	0

Fig. 22.



E. M. Clarke's arrangement of the Plate Electrical Machine :—The advantages of this form of machine over all others : is as follows ; the frame-work being of cast-iron, renders two pillars for supporting the glass plate unnecessary ; hence the entire surface of the glass is exposed to the collecting forks of the positive conductor, thus rendering it impossible that the electricity should be dissipated to the axle. The positive conductor is pear-shaped, (as recommended by Priestley), and detached from the machine, standing on a separate frame, supported on a long glass pillar, thus securing perfect insulation—a matter attended with much difficulty when the conductor is attached to the frame of the

Fig. 23.



machine by a short piece of cane glass. The shape secures a greater extent of conducting surface than the usual bent tube conductors at present in use, giving to the plate machine the only advantage the now fully superseded cylinder machines possessed over them. The negative conductors are supported on glass pillars attached to the

iron frame, and carry the two pair of rubbers. This arrangement of machine E. M. C. can with confidence recommend as being superior in power and more convenient than any other yet offered the public.

Fig. 23 represents the machine, *a* the mahogany bottom board to which is fixed a cast-iron japanned framing, on which is bolted the strong upright iron pillar *b*; and at the top runs at right angles a hollow iron stem *c*. The glass plate has the usual brass axle attached to its centre, fits into *c* with a stout screw projecting from it, to which is attached the handle *d*. The negative conductors, *e e*, are supported on the glass pillars, *k k*, and carry the rubbers and silk flaps, and are connected by the brass arch, *f*, which is moveable. The positive conductor, *g*, is also supported on a glass pillar, *k*, and cast-iron foot, *l*. From *g* project two brass arms with the collecting forks; and on the upper part of the conductor is a conical hole, *g*, for holding a movable branch arm, *h*, which is very convenient for many experiments; and at *i* is a smaller aperture, for holding any apparatus, such as a quadrant, electrometer, &c.

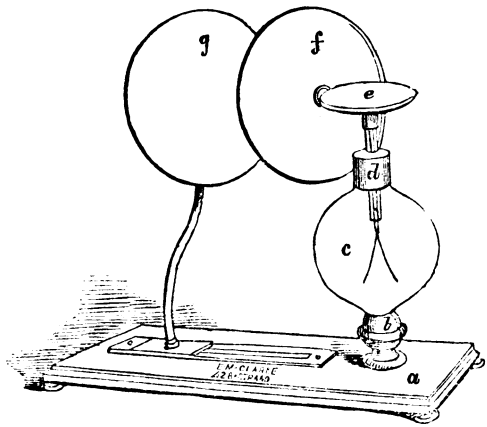
NO.					£	s.	d.
4	Plate 12 inches	diameter,	japanned	conductors	5	15	6
5	Ditto ditto	ditto	polished brass	ditto	6	10	0
6	Ditto 15	ditto	japanned	ditto	8	8	0
7	Ditto ditto	ditto	polished brass	ditto	10	0	0
8	Ditto 18	ditto	japanned	ditto	11	11	0
9	Ditto ditto	ditto	polished brass	ditto	13	10	0
10	Ditto 24	ditto	japanned	ditto	14	14	0
11	Ditto ditto	ditto	polished brass	ditto	18	18	0
12	Ditto 30	ditto	japanned	ditto	22	10	0
13	Ditto ditto	ditto	polished brass	ditto	28	16	0
14	Ditto 36	ditto	japanned	ditto	35	15	0
15	Ditto ditto	ditto	polished brass	ditto	43	2	0
16	Ditto 42	ditto	japanned	ditto	50	0	0
17	Ditto ditto	ditto	polished brass	ditto	58	10	0
18	Ditto 48	ditto	japanned	ditto	65	10	0
19	Ditto ditto	ditto	polished brass	ditto	75	0	0

The above sizes are those E. M. C. generally manufactures, but is anxious that it may be understood he is not limited to size, and begs to state as a proof of the superiority of his machines, that the manufacture of the largest plate electrifying machine in the world was committed to his charge, the diameter of the plate being 84 inches, and is now to be seen at the Polytechnic Institution, worked by steam power.

20	3-inch Cylinder Electrical Machine			1	12	6
21	4 „	ditto	ditto	3	7	6
22	5 „	ditto	ditto	5	0	0
23	6 „	ditto	ditto	6	10	0
24	7 „	ditto	ditto	8	15	0
25	9 „	ditto	ditto	11	16	0
26	10 „	ditto	ditto	13	13	0
27	Electrophorus, with glass handle to the upper plate			0	10	6
28	Ditto, larger size, on mahogany bottom-board			1	1	0
29	Ditto, in cabinet case, with joint and lifter to upper plate, so that a Leyden jar may be readily charged at a ball conductor on top of the cabinet. A useful instrument in a chemical laboratory			1	15	0
30	Ditto, with cannon on pedestal for firing inflammable air			2	7	6
31	Glass Hydrogen Generators, with stop-cock for the above		8*s.* to	0	15	0
32	Glass Rod, in clip handle and circular rubber for exhibiting electrical excitation			0	15	0
33	Plain Glass Rods for the above		3*s.* to	0	7	6
34	Rods of Resin to fit into handle of No. 32, or used plain as No. 33, per oz.			0	0	6

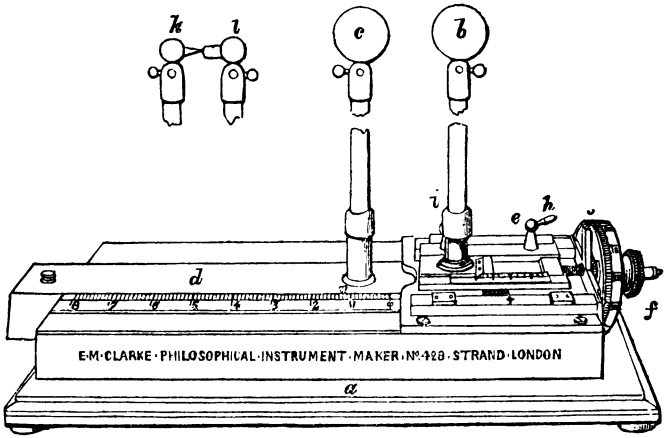
NO.		£	s.	d.
35	Electrical Insulating Stools, with solid glass legs and mahogany tops to suit. No. 4, 10*s.* 6*d.*; No. 6, 15*s.*; No. 8, 1*l.*; No. 10, 1*l.* 6*s.*; No. 12, 1*l.* 12*s.* 6*d.*; No. 14, 1*l.* 18*s.* 6*d.*; No. 16, 2*l.* 10*s.*; No. 18	3	0	0
36	Plain Leyden Jars, with mahogany covers, brass balls, and stems, 2*s.* 6*d.* to	0	10	6
37	Open-mouthed Leyden Jars. In this arrangement the ball and stem is fixed to the bottom, so as to dispense with the cover; the stem is enclosed in glass, thus the jar takes a much higher charge, is less liable to spontaneous discharges, and is easier cleaned and aired, 7*s.* 6*d.* to	2	10	0
38	Leyden Batteries, consisting of 4, 6, 9, or 12 of the above jars mounted in an open frame stand, so as to allow the jars to be more readily aired before a fire . . . . . 4*l.* 4*s.* to	24	0	0
39	Two Leyden Jars, one insulated to illustrate the Franklinean theory, small size 10*s.* 6*d.*, large	0	18	0
40	Jar with movable metallic coatings for demonstrating the principle of the Leyden jar . . . . . 10*s.* 6*d.* to	1	1	0
41	Medical Leyden Jars, with sliding wire to regulate the intensity of the charge . . . . . 7*s*. 6*d.* to	0	12	6
42	Leyden Jars, with Lane's Electrometer attached . . 10*s.* 6*d.* to	1	10	0
43	Electrical Discharger, for discharging Leyden jars, &c. . 3*s.* 6*d.* to	0	7	6
44	Medical Electrical Discharger . . . . . 6*s.* 6*d.* to	0	15	0
45	Electrical Tongues, or jointed Discharger, with glass insulating handle, so as to remove any possibility of getting the shock while discharging a jar or battery . . . . . 8*s.* 6*d.* to	1	10	0
46	Forceps, to screw on the arms of ditto, for holding wet silk; thread, wire, chain, &c. . . . . 2*s.* to	0	7	6
47	Brass stems, with balls and points for fitting into conductors, or holding in the hand . . . . . 2*s.* to	1	1	0
48	Balls of brass, ivory, bone, boxwood, and ebony, . . . 6*d.* to	0	4	6
49	E. M. Clarke's Electrical Amalgam, free from tin and tallow, per oz.	0	1	6
50	Apparatus for electrifying the eye	0	5	6
51	Ditto ditto tooth	0	5	6
52	Ditto, ditto ear	0	5	6
53	Electrical Condenser; consisting of two vertical copper discs, one fixed and insulated, the other sliding in a groove on the bottom board, so that the discs, when separated, may still be parallel. With binding screws. Discs, 6 inches diameter, 18*s.*; discs, 12 inches diameter .	1	18	0
54	Cavallo's Pith-ball Electroscope, for atmospheric electricity . . .	0	18	0
55	Ditto, Pocket Electroscope	0	7	6
56	Singer's Gold-leaf Electroscope. This instrument has superseded Bennet's Electroscope	0	15	0
57	Singer's Condensing Electroscope, with parallel plates	1	15	0
58	Singer's Condensing Electroscope, improved by E. M. Clarke. fig. 24. In this arrangement, the gold-leaf strips are suspended in a spherical glass vessel *c*; and instead of the usual metallic cap at *d*, one of ivory or baked wood is employed, thereby obtaining a treble insulation. This is the most delicate instrument yet constructed for denoting the presence of free electricity	2	12	6
59	Singer's Electroscope, as above, without the condensing plates . . .	1	10	0
60	Haüy's Needle Electroscope, for testing the electrical state of minerals .	0	7	6
61	Hare's Single-leaf Electroscope	1	1	0
62	Zamboni's Pile Electroscope: between the terminal wires of the pile a slip of gold leaf is suspended, and neutralised; on the application of an electrified body the gold leaf is deflected, showing not only the presence, but also the quality or condition	2	10	0

Fig. 24.



NO.	£	s.	d.
63 Faraday's Glass-thread Electroscope, for exhibiting electrical action derived from feeble sources in a decided manner to a class . . .	1	1	0
64 Harris's Double-quadrant Electroscope. Without a joint, 1*l.* 1*s.*; with a joint	1	10	0
65 Coulomb's Torsion Electrometer, an accurate instrument for measuring small quantities of electricity	2	8	0
66 Cuthbertson's Grain-weight Discharging Chronometer. This instrument is indispensable when a Leyden battery is employed, regulating with accuracy the amount of the charge, thereby insuring success to the experiment	2	5	0
67 Harris's Discharging Electrometer, for discharging batteries or large jars	1	7	6
68 Lane's Discharging Electrometer: is much used in medical electricity for regulating the strength of the spark from the prime conductor, as also the shock from the Leyden jar	0	7	6
69 Harris's Unit Jar Electrometer, for measuring the quantity of electricity passed into a larger jar or battery	1	0	0
70 Henley's Quadrant Electrometer . . . . . 6*s.* 6*d.* to	0	14	0
71 Barker's Atmospheric Electrometer. This is the most correct instrument for experimenting on atmospheric electricity	3	13	6
72 Harris's Electro-thermometer, consists of a glass tube and bulb, having a graduated scale attached; a fine piece of wire is fixed in a chamber that communicates with the liquid in the tube; on passing a current of electricity through the wire, its temperature is increased; this expands the air in the chamber, and causes the liquid in the tube to rise. The only objection to this instrument is now removed—namely, the insecure manner of attaching the connexions to the glass bulb . .	1	10	0
73 E. M. Clarke's Micrometer Electrometer. This instrument is for measuring the smallest appreciable distance at which an electrical spark can be developed. *a*, fig. 25, the mahogany base; *b*, *c*, two brass balls fixed on glass pillars, with brass caps and binding-screw connexions; *d*, is a dovetail slide with an ivory scale, divided into inches and 10ths, by which the pillar *c* can be moved; *e*, a metal slide, carrying the pillar *b*, having an index and scale to 10ths of an inch; and *f*, a scale attached to the base of the instrument graduated to 50ths of an inch. The metallic slide *e*, is moved by a micrometer screw *g*, the circumference of which is divided into 100 equal parts; one revolu-			

Fig. 25.



NO.		£	s.	d.
	tion of the screw *g*, acts on the slide *e*, and consequently on pillar *b*, to the extent of $\frac{1}{50}$th of an inch; and as the circumference of *g* is divided into $\frac{1}{100}$ equal parts, each division will indicate an action on the pillar *b*, to $\frac{1}{5000}$ths part of an inch. *h*, *i*, two clamp levers, to allow *b* to be more quickly moved than the screw *g* would admit of; *k*, *l*, two small brass balls, having a platina or silver point and disc fixed to them, to be used in lieu of *b*, *c*, when more delicate contact is required	8	8	0
74	Harris's Balance-beam Electrometer, for estimating in grain weights the attractive power exerted between two oppositely electrified surfaces	6	6	0
75	Two Balls of different diameters with metallic coatings, for illustrating the conditions of electricity called quantity and intensity . .	1	1	0
76	Henley's Universal Discharger and Press for deflagrating metallic wires and directing the discharge of Leyden jars or batteries through various bodies. To suit No. 4, 1*l*. 7*s*. 6*d*; No. 6, 1*l*. 10*s*.; No. 8, 1*l*. 12*s*. 6*d*.; No. 10, with glass insulating handles and pair of flat screw forceps, 2*l*. 2*s*.; Nos. 12 and 14, 2*l*. 12*s*. 6*d*.; Nos. 16 and 18	3	?	0
77	Mahogany Stand for passing a shock through eggs, making them luminous, and exhibiting the yolk	0	7	0
78	Faraday's Apparatus for ditto, consisting of a glass tube with foot and cover; eggs, oranges, and onions are placed within, and on passing the shock through, all are made luminous . . . 12*s*. 6*d*. to	2	2	0
79	E. M. Clarke's Apparatus for directing the shock across a lump of sugar, chalk, or burned oyster-shell. This experiment generally fails, owing to the universal discharger being employed for the purpose. To suit Nos. 4, 6, 1*l*. 1*s*.; Nos. 8, 10, 12, 1*l*. 10*s*.; Nos. 14, 16, 18,	2	2	0
80	E. M. Clarke's Apparatus for passing a shock under a glass vessel of water. This is a very showy experiment	1	15	0
81	Insulated Brass Conductors with pith balls attached, for illustrating electrical indication . . . . . each 3*s*. 6*d*. to	0	10	6
82	Insulated Brass or Wood Stands for suspending light bodies, to exhibit the effects of electrical attraction and repulsion. Wood, 5*s*. 6*d*. to 15*s*.; Brass . . . . . 10*s*. 6*d*. to	1	5	0

NO.		£	s.	d.
83	Electrical See Saw, to illustrate attraction and repulsion, consists of two figures, as Clown and Columbine, on a plank vibrating on its axis	0	12	6
84	Modification of Dr. Franklin's self-moving Wheel, consisting of a stellar wheel formed of light glass tubes and balls; the balls are covered with gold leaf. By placing the apparatus near the prime conductor, and holding a brass ball at the opposite side, rotary motion will be produced	1	18	0
85	Set of Three Electrical Bells attached to a brass rod, for suspending from the prime conductor . . . . . 6*s.* 6*d.* to	0	10	6
86	Set of Five Electrical Bells on stand. To suit No. 4, 6*s.* 6*d.*; No. 6, 10*s.*; No. 8, 1*l.*; Nos. 10, 12, 1*l.* 15*s.*; Nos. 14, 16, 2*l.* 10*s.*; No. 18	3	10	0
87	Set of Eight Bells or Gamut; the bells are struck by a clapper attached to a revolving flyer. To suit Nos. 4, 6, 1*l.* 10*s.*; Nos. 8, 10, 2*l.* 10*s.*; Nos. 12, 14, 3*l.* 3*s.*; Nos. 16, 18,	4	4	0
88	Grotesque Carved Head, with hair, to illustrate that bodies, similarly electrified repel each other . . . . . 6*s.* 6*d.* to	0	7	6
89	Ditto, very superior	0	10	6
90	Glass Plumes, for the same purpose . . . . . 2*s.* 6*d.* to	0	5	6
91	Dancing Image, plates for showing electrical attraction and repulsion. Plain, without stand, 4*s.*; with stand, 8*s.*; copper-plates	0	10	6
92	Ditto, with glass pillar to suspend the upper plate . . . 12*s.* 6*d.* to	1	1	0
93	Painted Pith Figures for the above. Plain, 1*s.*; jointed	0	2	0
94	Pith Balls; plain or painted, per dozen, 1*s.*: large	0	1	6
95	Stand for Pith Balls, to exhibit them in motion . . . 5*s.* to	0	7	6
96	Electrical Spider, to suspend on the prime conductor	0	1	6
97	Ditto, attached to a Leyden jar . . . . . 7*s.* 6*d.* to	0	10	6
98	Electrical Fly and pointed stem, consisting of a brass cap, having two or more cross wires with the points bent at right angles; when placed on the prime conductor a rapid revolution is produced by the dispersion of the electricity in the atmosphere. Two wires, 2*s.*; three wires, 2*s.* 6*d.*; four wires, 3*s.*; five wires	0	3	6
99	Brass Stand with three branch arms for showing the rotation of three electrical flyers; with two points each, 7*s.*; three points, 8*s.* 6*d.*; four points	0	12	6
100	Ditto, Stand with four flyers of three points each, 18*s.*; Four points, 1*l.* 5*s.*; five points	1	15	0
101	Ditto, Stand with five flyers of four points each, 1*l.* 10*s.*; five points,	2	2	0
102	Ditto, Stand with eight flyers, points various	3	10	0
103	Apparatus to show a Flyer ascending an inclined plane . 17*s.* 6*d.* to	2	2	0
104	Electrical Planetarium, representing the motions of the Sun, Earth, and Moon; to suit No. 4, 6*s.* 6*d.*; No. 6, 10*s.* 6*d.*; No. 8	0	18	0
105	Ditto, on Stand to suit No. 10, 1*l.* 5*s.*; Nos. 12, 14, 1*l.* 10*s.*; Nos. 16, 18	2	2	0
106	Three Working Models of a Corn Mill. A three-barrelled pump, worked by cranks; and an Orrery made of card-paper, cork, and wire . . . . . each	0	15	0
107	Apparatus for showing that the direction of an electrical current is from the positive to the negative conductor. It consists of a bottom board having two insulated pointed wires, between which is placed a light fan-wheel, also insulated; on connecting one of the points with the positive, and the other with the negative conductors, the wheel will rotate from the former to the latter. Nos. 4, 6, 15*s.*; Nos. 8, 10, 1*l.* 1*s.*; Nos. 12, 14, 1*l.* 10*s.*; Nos. 16, 18,	2	2	0
108	Apparatus for showing the above by the ignition of a piece of phosphorus. Nos. 4, 6, 12*s.* 6*d.*; Nos. 8, 10, 12, 1*l.* 1*s.*; Nos. 14, 16, 18,	1	10	0

NO.		£	s.	d.
109	Electrical Bucket. This apparatus has a small insulated orifice in the bottom that allows water to pass in drops, but when suspended on the prime conductor and the water electrified, it passes in a stream, and in a dark room appears luminous . . 3*s.* 6*d.*, 10*s.* 6*d.* to	1	1	0
110	Leyden Jars with diamond and spangled coatings, in a great variety of patterns . . . . . 6*s.*, 12*s.* 6*d.*, 1*l.* 1*s.*, 1*l.* 10*s.* to	2	0	0
111	De Loude's Lightning Plate, consisting of a large plate of glass, placed vertically on a stand, both sides being coated with tinfoil, on which small interstices are cut, diagonally crossing. During the charging of the plate, the electricity is seen flitting in all directions ; and when the charge is complete, it then discharges itself, producing a most splendid display of electrical light. No. 4, 1*l.* 10*s.* ; No. 6, 2*l.* ; No. 8, 2*l.* 10*s.* ; No. 10, 3*l.* ; No. 12, 3*l.* 10*s.* ; No. 14, 4*l.* ; No. 16, 4*l.* 10*s.* ; No. 18	5	0	0
112	Strips of Gilt and Silvered Leather to illuminate by the electric spark or shock . . . . . per yard 2*s.* to	0	4	6
113	Spangled Glass Tubes in a variety of patterns. Holding the brass ball at one extremity in the hand, and presenting the other ball to the prime conductor, the spaces between the tinfoil spangles are rendered luminous. No. 4, 4*s.* 6*d.* ; Nos. 6 and 8, 7*s.* 6*d.* ; Nos. 10 and 12	0	18	0
114	Ditto on Stand, to connect with the negative conductor. No. 14, 1*l.* 7*s.* 6*d.* ; Nos. 16 and 18	2	0	0
115	Five of the-above Tubes, mounted on a mahogany stand, with an insulated mobile brass wire, having balls at each extremity, placed in the centre ; as the wire revolves the electricity passes down the spangled tubes, producing lines of light of various patterns. No. 4, 15*s.* ; No. 6, 1*l.* ; No. 8, 1*l.* 10*s.* ; No. 10, 2*l.* ; Nos. 12 and 14, 2*l.* 10*s.* ; No. 16, 3*l.* ; No. 18	3	10	0
116	Spangled Glass Plates of various patterns, with handle and snapping ball. No. 4, 7*s.* 6*d.* ; No. 6	0	10	6
117	Ditto on Mahogany Foot and Pillar. No. 8, 18*s.* ; No. 10, 1*l.* 6*s.* ; No. 12, 1*l.* 13*s.* ; No. 14, 1*l.* 18*s.* ; No. 16, 2*l.* 5*s* ; No. 18 . .	2	16	6
118	Stars, Birds, Scrolls, Names, Words, &c., formed of tinfoil, on flat pieces of glass . . . . . from	0	4	0
119	Barker's Rotating Spangled Plates, with or without clockwork, from	0	10	0
120	Rusted Iron Chain with long links, the loops at right angles, for illuminating a darkened apartment by the electrical shock . per yard	0	0	4
121	Semicircular Glass Tube, with a brass cap and ball at each end, having a piece of rusty iron chain enclosed, which becomes brilliantly illuminated when employed for discharging a Leyden jar or battery 8*s.*, 15*s.*	1	10	0
122	Electrical Sportsman. This apparatus consists of a figure of a Sportsman, and a Leyden Jar, having two wires of different lengths projecting from the cover from the longest wire ; some birds made of pith are suspended, when the muzzle of the gun is brought within striking distance of the ball on the shorter wire, the jar is discharged, and the birds fall as if shot . . . . . 1*l.* 1*s.* to	2	10	0
123	Magic Picture representing the Queen, with a metallic Crown. On attempting to remove the Crown a smart shock is felt . . .	0	15	0
124	Magic Picture of a Miser, for the same purpose	0	7	6
125	Mahogany Model to illustrate the necessity of lightning conductors, for the protection of buildings . . . . . 6*s.* 6*d.* to	1	1	0
126	Mahogany Model of a House for the same purpose. The electricity in its passage ignites gunpowder, that causes the buildings to fall to pieces, 16*s.* to	1	10	0
127	Model of a Church with a lofty spire. The electricity strikes the spire, which falls to pieces, and the roof catches fire	5	5	0

NO.		£	s.	d.
128	Mahogany Model of an Obelisk. The lightning strikes the pyramid, which throws it from the base	0	6	6
129	Fire House made of japanned sheet tin, to exhibit the heat evolved by an electric discharge, igniting tow saturated with rosin, spirits of wine, or ether	0	15	0
130	Lullin's Apparatus for exhibiting the perforation of compact bodies by the electrical shock . . . . . 10*s.* 6*d.*, 1*l.* 1*s.* to	2	2	0
131	Metallic Dish for igniting spirits of wine, ether, &c., by the spark .	0	1	6
132	Brass Pistol for firing inflammable gas by the spark . . 5*s.* to	1	1	0
133	Brass Cannon for ditto . . . . . 7*s.* 6*d.* to	1	1	0
134	Ditto for firing gunpowder by an electric shock . . 17*s.* 6*d.* to	2	2	0
135	Ivory Bomb to project a ball by passing a shock through a drop of water, oil, ether, or fulminating mercury	0	10	0
136	Glass Globe with sliding rods and stop-cock for experimenting on electric light in vacuum	1	3	6
137	Ditto with Forceps to hold Charcoal points, &c., and binding screw connections	1	10	0
138	Aurora Flask with Brass cap valve and ball . . 5*s.*, 10*s.* 6*d.* to	1	1	0
139	Barker's Electrical Flask Experiment, with ground brass plate and open glass jar for the air-pump . . . . . 2*l.* 10*s.* to	4	4	0
140	Luminous Conductor, consisting of a long glass tube with brass ball, cup, and valve, for showing the luminous passage of electrical light in a partial vacuum. No. 4, 7*s.* 6*d.*; No. 6, 12*s.* 6*d.*; No. 8 . . .	0	18	0
141.	Ditto on Stand. No. 10, 1*l.* 5*s.*; Nos. 12, 14, 2*l.* 5*s.*; Nos. 16 and 18	3	3	0
142	Apparatus for Filling Nos 140 and 141 with Nitrogen Gas, which adds much to the brilliancy of the effect			
143	Fallen Star Apparatus. This experiment has been considered very difficult to perform, owing to the apparatus being generally improperly constructed. It requires at least a No. 8 machine to ensure success. No 8, 1*l.* 7*s.* 6*d.*; No. 10, 2*l.*; Nos. 12 and 14, 2*l.* 16*s.* 6*d.*; Nos 16 and 18	3	13	6
144	Adam's Combined Apparatus, consisting of an exhausting-flask, two Leyden jars, luminous conductor, insulating pillar, exhausting syringe. By these many pleasing and instructing experiments may be performed . . . . . 2*l.* 12*s.* 6*d.* to	4	4	0
145	Insulated conductor for Collecting Electricity from steam . . .	1	1	0

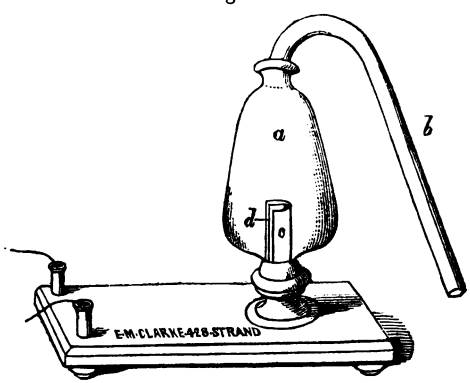
ELECTRO-CHEMICAL, OR VOLTAIC APPARATUS.

1	Volta's Pile of 50 pair of zinc and copper-plates soldered together on mahogany stand with three glass pillars . . . . . 15*s.* to	1	5	0
2	Pairs of Zinc and Copper Plates soldered together per doz. 2*s.* 6*d.* to	0	5	0
3	Pairs of Silver and Zinc Wires soldered together for Volta's Courroie de tasses . . . . . per doz.	0	7	0
4	Pair of Zinc and Copper Plates, with glass handles for showing the production of electricity by contact	0	10	0
5	Cruikshank's Galvanic Battery in long mahogany troughs of various sizes and number of plates . . . . . 1*l.* 5*s.* to	3	10	0
6	Wollaston's Voltaic Battery. Twelve pair of zinc and double copper plates in Wedgwood troughs	2	2	0
7	Hare's Calorimeter in all its various arrangements of spiral and flat plates 15*s.* to	6	6	0
8	Daniell's Elementary Battery, large platina plates	1	15	0

NO.		£	s.	d.
9	Daniell's Dissected Battery, large platina plates	6	12	0
10	Daniell's Constant or Sulphate of Copper Battery, which consists of three parts—a zinc slip or rod amalgamated with mercury, a porous vessel for holding it, and a copper vessel for placing both in. A dilute solution of sulphuric acid and water is put into the porous cylinder, and a saturated solution of sulphate of copper into the copper vessel. This is a good battery where a long-continued and uniform current is required, and is the parent of all the late improvements in the Voltaic battery. Pint 7*s.* 6*d.*, quart 10*s.* 6*d.*, three pints	0	15	0
11	Series of Ten of the above fitted in a wooden stand, with an arrangement for quantity or intensity	5	10	0
12	Another arrangement of Daniell's Battery, the zinc being placed outside the copper cylinder. Pint 6*s.* 6*d.*, three pints 10*s.* 6*d.*, two quarts	0	14	0
13	Series of Six of the above, with quantity and intensity arrangement in box	2	2	0
14	Series of Ten of ditto	3	10	0
15	Series of Ten of ditto, three pint size	5	15	6
16	Four of the above boxes	22	0	0
17	Shillibeer's Sustaining Battery and Pole Director	0	15	0
18	Smee's Silver Battery. This arrangement possesses many advantages, being composed of a double plate of zinc amalgamated with mercury, and a plate of pure silver having platina precipitated on it from the bi-chloride. Only one exciting liquid is required, namely, dilute sulphuric acid and water, thus dispensing with porous diaphragms. For most purposes this battery is very convenient, being readily excited and continuous in its action. Page 60, fig. 27, (*a*) a Smee's Battery connected to an electrotyping apparatus; (*b*) the double plate of zinc; (*c*) the silver plate in a glass box; (*e*) and (*f*) two copper ribands for connexion. Again, at page 67, fig. 32, (*a*) exciting a medical Callan's Coil Machine. These batteries are mounted in glass jars, where room is not an object, or in glass boxes when it is desirable to keep them compact	0	12	0
19	Ditto ditto, larger size	0	15	0
20	Six Smee's Batteries in mahogany stand, with two binding screws and two mercury cup connexions. This forms a most convenient and efficient intensity battery, and as only hydrogen is given off, it is well adapted for private experimenting. Batteries, size of No. 17	3	12	0
21	Ditto ditto, size of No. 18	4	5	0
22	Mahogany Stand, with twelve Smee's Batteries, size of No. 17	6	18	0
23	Ditto ditto No. 18	8	0	0
24	Four Batteries of No. 22	25	0	0
25	Ditto ditto No. 23	28	10	0
26	Grove's Platina Battery: the elements consist of a double plate of amalgamated zinc, and a single plate of platina; a porous cell of pipe-clay separates the metals; the former being excited by sulphuric acid and water, the latter by concentrated nitric acid. This is the most powerful of all voltaic arrangements, and is the best adapted for brilliant and showy experiments in public institutions, or where a powerful current is required for exciting electro-magnetic engines. In glass boxes or jars same size as No. 17	0	16	0
27	Six Grove's Batteries, in mahogany stand, with two binding screw and two mercury cap connexions. Batteries size of No. 17	4	16	0
28	Ditto ditto, size of No. 18	6	0	0
29	Ditto ditto, same size as No. 18	1	0	0
30	Mahogany Stand, with 12 Grove's batteries, size of No. 17	9	5	0

NO.		£	s.	d.
31	Mahogany Stand, with 12 Grove's Batteries, size of No. 18	11	0	0
32	Four Batteries of No. 30	34	5	0
33	Ditto No. 31	38	10	0
34	Barker's Hood, for collecting the noxious Gases given off from Grove's Batteries, so as to prevent their escape in the apartment 15*s.* to	2	2	0
35	E. M. Clarke's arrangement of the Apparatus for Decomposing Water	0	7	6
36	Ditto, larger, on Stand, with pillar and clip for supporting the tube	0	12	6
37	Ditto ditto, with graduated tube	0	14	6
38	Ditto ditto, with two glass tubes for collecting the Gases separately, with pillar and clips for supporting the tubes. Glass dish 2 inches diam.	0	15	0
39	Ditto ditto. Glass dish 4 inches diameter	1	10	0
40	Ditto ditto, with stopcocks and suction tube for filling the gas-receivers with acidulated water. Glass dish seven inches diameter	2	2	0
41	Ditto, ditto, ditto; Glass dish 12 inches diameter	4	4	0
42	Faraday's Volta Electrometer improved, the platina electrodes being better secured than when fixed in the glass tube. The tube holds a cubic inch divided into 100 equal parts	1	10	0
43	Faraday's Volta Gasometer, modified by E. M. C. *a* (fig. 26), a glass vessel, with a movable bent glass tube (*b*) ground into it; *c*, a double platina plate, presenting a surface to each side of the other platina plate (*d*); here the gases pass from the tube (*b*), and may be collected under a glass receiver, in a pneumatic trough, in large quantities	2	10	0

Fig. 26.



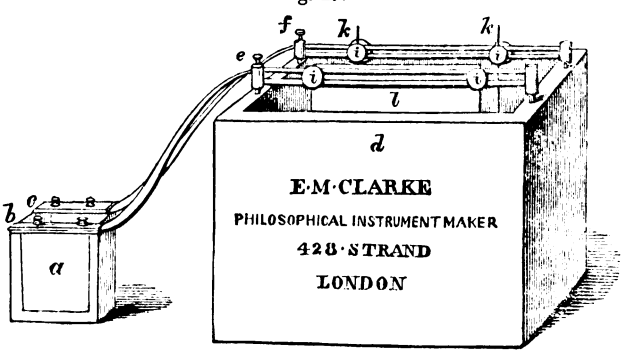
44	Faraday's Apparatus for showing Electro-chemical Decompositions, consisting of a rectangular glass cell or box, with a diaphragm of bibulous paper. This apparatus is not made of separate pieces of plate glass, cemented and bound together with brass clamps, and fixed on a board, which always leaked; but is blown in a mould, with the sides ground and polished	0	12	6
45	Ditto ditto, divided into two or more pieces, for the more accurately fitting various diaphragms 18*s.* to	1	7	6
46	Universal Discharger, with charcoal crayons, wire and foil forceps, insulated sliding rods, with ball and socket motion, and binding screw connexions	1	12	0
47	Pepys' Apparatus for Decomposing Alkaline Substances	1	10	0
48	Pair of Platinum Plates, on glass pillars, for the decomposition of the alkalies 1*l.* 10*s.* to	3	3	0

NO.		£	s.	d.
49	Voltaic Powder Cup, on bottom board, with binding screws . . .	0	10	0
50	Voltaic Gas Pistol	0	18	0
51	Apparatus for showing the simultaneous production of Heat and Cold, by a voltaic current	2	2	0
52	Pieces of Platina and Silver Wire soldered together alternately. A powerful voltaic current passing through causes the platina to become red hot without affecting the silver.			
53	Books of Leaf Gold, Silver, and Dutch Metal, and reels of fine Wire, for combustion.			
54	Lignum Vitæ and Boxwood Charcoal . . . . . per oz.			
55	De Luc's Column or Dry Pile . . . . . 1*l.* 10*s.* to	3	3	0
56	Zamboni's Electric Pile of Zinc, Manganese, and Honey. These are much more powerful than the dry pile of De Luc	0	12	6
57	Cabinet containing a number of the above, which keep a metallic disc in a constant reciprocating motion, under a glass shade . . .	3	13	6
58	Ditto, ditto, which keep a butterfly hovering over alternately two vases of flowers, under a glass shade	5	5	0
59	Ditto, ditto, much larger size, representing four Cupids chasing each other, and playing at the game of Jeu de Bague, under a glass shade	12	12	0

ELECTROTYPE APPARATUS.

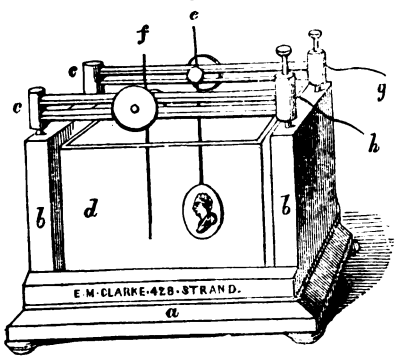
1	Porcelain Jar, with pipeclay tube, zinc rod, and binding screw connection, for taking small impressions from plaster of Paris, wax, or fusible metal moulds . . . . . 3*s.* 6*d.* to	0	10	0
2	Glass Jar, with flat pipeclay cell and piece of sheet zinc, with connection, for electrotyping two or more moulds at the same time . 6*s.* to	0	18	0
3	E. M. Clarke's Separating Mahogany Trough for Electrotyping: consists of a square trough, sawed vertically in two; between each half a piece of scaleboard is fitted, and the whole bound together with screw-bolts. Several plates of zinc, with moulds, may be depositing at once. This is the most convenient arrangement for electrotyping on the single system. Two binding screws, clamps, and clamping bar. Box 6 inches long, 5 inches deep	1	1	0
4	Ditto ditto, 8 inches long, 7 inches deep	1	10	0
5	Ditto ditto, 12 inches long, 9 inches deep	2	2	0
6	E. M. Clarke's Precipitating Trough, for Electrotyping on the double			

Fig. 27.



NO.		£	s.	d.
	system. *d* (fig. 27), a strong mahogany box, lined inside with cement, which resists the action of the sulphate of copper solution. A number of holes are made in two sides of the trough, into which the brass connections (*e*, *f*,) are placed at any required distance. The connections consist of two parallel bars, between which brass sliding clamps (*iiii*) are fitted with broad shoulders or bearings for holding the moulds, as at *k k*, and the conducting plate *l*. With Smee's Battery, (*a*) 2*l*. 2*s*.; without	1	10	0
7	Large-sized Electrotype Apparatus on the same principle, but the mechanical arrangement of the connections differ; large iron clamps, with brass sliding bars, being used instead of the parallel bars, having more power for forming perfect metallic contact with large surfaces. Trough twenty inches long, thirteen deep	4	4	0
8	Salt-glazed stone ware, troughs various sizes. These do not answer well for electrotyping, as the saline solution soon penetrates them, and they crumble to pieces . . . . . 6*d*. to	0	5	0
9	E. M. Clarke's Apparatus for Electro gilding and plating (*a*), Fig. 28. A mahogany bottom board, with two uprights (*bb*), between which is placed a glass box (*d*) for holding the solution; the parallel connecting bars (*cc*) fit on (*bb*). From one, as at *e*, is suspended the medal, &c., to be plated; and from the other a fine piece of gold or silver wire, *f* the battery is connected at *g h* . 1*l*. 1*s*. to	1	5	0
10	Cabinets, with lift out trays for holding plaster of Paris casts, medallions, &c. . . 7*s*. 6*d*. to	3	10	0
11	Plaster casts, plain and prepared, for electrotyping 3*d*. to	0	10	6
12	Moulds taken from plaster casts and prepared with plumbago . 1*s*. to	1	10	0
13	Variety of Electrotype medals, busts, figures, &c., with gilt, plated, bronzed, or bright copper surface . . . . 1*s*. 6*d*. to	10	10	0
14	Medals with the relief gilt and plated, and the base in dark bronze 7*s*. 6*d*. to	5	5	0
15	Smee's Batteries in Glass, suited for Electrotyping . . 12*s*., 18*s*. to	1	1	0
16	Daniell's Battery in Glass Jar for Electrotyping . . . 15*s*., 1*l*.	1	6	0
17	Tin trays, for impregnating plaster casts with boiling water prior to taking wax moulds. With spirit lamp . . . . 7*s*. 6*d*. to	1	1	0
18	Brushes for covering plaster or wax moulds with plumbago . .	0	0	6
19	Hard Brushes for polishing and bronzing Electrotypes . . .	0	0	7
20	Camel Hair Brushes for cleaning plaster casts prior to wetting 1*s*. 6*d*. to	0	3	0
21	Bronzing Liquid, in bottles from . . . . 1*s*. 6*d*., 2*s*. 6*d*. to	0	3	0
22	Solution in stoppered bottles for Electro Gilding, ½ pint, 1*l*. 10*s*.; pint .	2	12	6
23	Solution for Electro Plating, in ½ pint bottles, 7*s*.; pint ditto, 12*s*. 6*d*.; quart	1	1	0
24	Flour Plumbago, in 4 oz. packets	0	0	6
25	Composition for taking impressions from plaster casts . . per lb.	0	4	6
26	Composition for taking impressions from metallic surfaces . . „	0	3	3
27	Pure Sulphuric Acid for Smee's Battery . . . . . „	0	0	6
28	Ditto Sulphate of Copper . . . . . „	0	1	0

Fig. 28.



MAGNETISM.

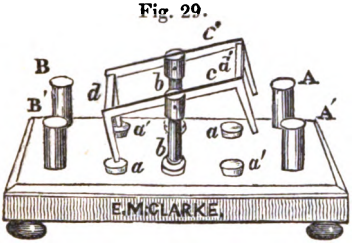
NO.		£	s.	d.
1	Elba Loadstone, in slices . . . . . 1*s.* 6*d.* to	0	7	6
2	Ditto, ditto, in blocks, mounted with iron conductors, and armature in brass box, with suspension swivel ring . . . . 5*l.* 5*s.* to	21	0	0
3	Common Sheffield-made Bar and Horse-shoe Magnets. These Magnets will not retain their magnetism . . . . . 6*d.* to	0	10	6
4	Best cast-steel Magnets of every variety of form, warranted to retain their magnetism. Pair of Bar Magnets, with centres, to suspend on points when required, in mahogany case, with armatures from six inches to three feet long. Bright or wax varnished . 6*s.* 8*d.* to	3	3	0
5	Cylindrical Bar Magnets, with polished centres at the poles. These Magnets are convenient for introducing within wire coils, &c. 5*s.* to	2	18	0
6	Horse-shoe or Bent Bar Magnets, with parallel poles and soft iron armatures . . . . . 5*s.* to	3	3	0
7	Magnetic Batteries, consisting of a number of Horse-shoe Magnets bound together by screws, capable of sustaining from 20 to 300 lbs. weight . . . . . 5*l.* to	60	0	0
8	Magazine Magnets for making Magnets . . . . 8*l.* 10*s.* to	75	0	0
9	Magnetic Needle on brass stand, with graduated arc, with horizontal and vertical motion for illustrating the influence of Terrestrial Magnetism	1	1	0
10	Dipping Needle, on brass stand, with vertical motion. By moving the needle on a bar magnet, it illustrates the Earth's influence in producing the dip	0	10	6
11	Horizontal Magnetic Needles of every variety of form, with hard metal or agate centres.			
12	Stands for Magnetic Needles, with hard steel points, on brass or ivory feet . . . . . 1*s.* to	0	7	6
13	Astatic Needles, to suspend on a point, or from a silk fibre or hair . 7*s.* 6*d.* to	1	1	0
14	Small Magnetic Needle in pocket case and stand, for testing the polarity of mineralogical specimens	0	7	6
15	Sieve Boxes, for sifting iron filings on paper or glass, having a magnet placed beneath, to show the magnetic curves	0	5	0
16	Y Armature, for demonstrating the law of induced magnetism. 2*s.* 6*d.* to	0	18	0
17	Disc of soft Iron, to show that when a magnetic pole is in contact with the centre, an opposite polarity is developed at the periphery 2*s.* to	0	5	0
18	Stellar-shaped Plate of Iron, for showing the same experiment; but the poles at the extreme points will be stronger . . . 5*s.* to	0	12	6
19	Rolling Armature: consists of a cylindrical bar of iron, having two brass fly-wheels at each extremity; if the iron bar be placed at some distance from the poles on a magnet whose poles are placed inclining downwards, the armature will roll towards the poles, but the magnetic attraction will prevent it falling off, while the acquired momentum will carry it round the end, and roll it some distance up the underside . . . . . 10*s.* to	1	5	0
20	Soft Iron cubes, rings, balls, and spinners, to illustrate induction and attraction . . . . . each 3*d.* to	0	1	6
21	Magnetic Toys, consisting of fishes, ships, mermaids, swans, ducks, &c., to show magnetic attraction and repulsion . . . . 6*d.* to	0	5	0
22	Best Pocket Compasses, with stops and agate centres, mounted in gilt metal, electrum, and silver, with morocco cases . . 17*s.* 6*d.* to	3	13	6

NO.		£	s.	d.
23	Best Pocket Compasses, without stops, and having hard metal centres in gilt metal and morocco cases . . . . . 9s. to	1	1	0
24	Plain Compasses in circular brass cases, with lifts . . . 3s. to			
25	Miners' Compasses in square mahogany boxes, with lifts . 2s. 6d. to			
26	Miners' Compass, with folding sights, in mahogany case . 1l. 10s. to	2	10	0
27	Prismatic Compass . . . . . 2l. 10s. to	4	14	6
28	Military Compass	2	12	6
29	Kater's Azimuth Compass	2	12	6
30	Azimuth Compass, with detached gimbles . . . . 2l. 10s. to	8	8	0
31	Telltale, or Cabin Compass . . . . . 1l. 10s. to	3	3	0

ELECTRO-MAGNETISM.

1	Apparatus to show Œrsted's Experiment of the Deflection of the Magnetic Needle, by a wire transmitting an electrical current above and below it	0	10	6
2	Œrsted's Experiment, so arranged by E. M. Clarke that the wire conveying the current is stationary; but the needles may be placed above or below it, or in the same horizontal plane, thus showing the dip, &c. Two needles	1	5	0
3	E. M. Clarke's Electrepeter. This instrument changes in a moment the direction of Voltaic currents, or totally stops their passage, without the necessity as heretofore of removing and rearranging the conducting wires by hand. To Lecturers this instrument is of great utility, enabling them to show with rapidity and precision the changes that take place in the directions of electro-magnetic motions, fig. 29.	0	15	0
4	Insulated Copper wire Helix, on iron cylinder, to show the production of magnetism in iron by a Voltaic current . . . . . 2s. 6d. to	0	5	0
5	Glass Tube, surrounded with a coil of copper wire, for magnetising steel needles by induction . . . . . 1s. 6d. to	0	3	0
6	Ditto, mounted on a stand, with binding-screw connexions . . .	0	7	6
7	Vertical Helix on stand, to show Mrs. Somerville's experiment of the suspension of a steel sewing needle within the coil	0	15	0
8	Dense coil of insulated copper wire, for inducing magnetism in two semicircles of soft iron, so as to sustain a considerable weight . 10s. to	2	2	0
9	Soft Iron Voltaic Magnet with armature	0	3	6
10	Ditto ditto, with two coils of covered wire	0	5	0
11	Ditto ditto, with two coils condensed at the poles	0	7	6
12	Ditto ditto, with four coils	0	15	0
13	Ditto ditto, with four coils condensed at the poles	0	18	0
14	Ditto ditto, with four coils 20 yards each, and binding screw connexions	1	5	0
15	Ditto ditto, with six coils 20 yards each, ditto	2	2	0

Fig. 29.



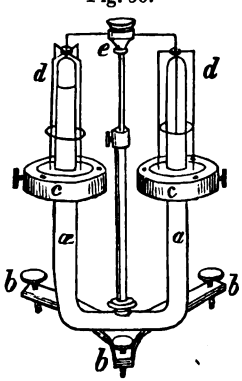
		£.	s.	d.
16	Professor Henry's Electro-magnet, with oval suspension collar to armature. This is the most powerful arrangement, sustaining from 5 cwt. to 20 ton . . . . . 5*l.* 5*s.* to	12	12	0
17	Triangle Stands for Voltaic Magnets . . . . . 10*s.* to	1	10	0
18	Professor Henry's Lever Stand for ditto			
19	Faraday's Apparatus for exhibiting the rotation of a vertical Voltaic wire round the pole of a magnet	0	10	6
20	Marsh's apparatus to show the vibatory motion produced in a vertical voltaic wire when placed between the poles of a horse-shoe magnet	0	5	6
21	Barlow's stellar wheel for converting the vibratory motion of Marsh into a rotary motion . . . . . 18*s.* to	1	10	0
22	Sturgeon's improvement on Barlow's Apparatus, using a disc instead of the stellar wheel, thereby obtaining increased speed by the contact being always perfect . . . . . 18*s.* to	1	10	0
23	Ampere's Apparatus arranged by E. M. Clarke, to show the attraction and repulsion of magnetic and Voltaic currents; consisting of a rectangular mobile wire frame on a stand with battery connections for sending a voltaic current through it; also another rectangular frame fixed to a battery, on putting the frames in approximation a powerful attraction or repulsion will take place, a magnet being applied to the mobile frame will produce a like result	1	18	6
24	De La Rive's Floating Battery, in glass tube with cork float . . .	0	3	0
25	Ditto, improved by E. M. C.; being placed in a shallow dish instead of the glass and float, is much lighter	0	6	6
26	Ditto, ditto, with horizontal wire coil	0	6	6
27	Vibrating Wire Coils. This apparatus consists of a horizontal horse-shoe magnet on a bottom-board; from a pillar is suspended two dense coils of wire opposite the poles of the magnet, a Voltaic current being passed through the coils causes them to be attracted towards the magnet; then the battery contact is broken and the coils recede, but on gaining the perpendicular the current is again renewed, thus keeping up a reciprocating motion	2	2	0
28	Electrodynamic Rotating Coil, consisting of a fixed dense coil of wire on a stand inclosing another dense mobile coil; the inner coil has an electrepeter attached; on passing the current through both, the outer coil retains the current in the same direction, but the inside coil changes its direction when in the same plane, hence rotation is produced	1	10	0
29	Suspended Electro-Magnetic Helix	0	16	0
30	Suspended Electro-Magnetic Flat Spiral	0	16	0
31	Electro-Magnetic Double Spiral	1	10	0
32	Apparatus to show the Rotation of a pair of mobile Wire Frames round the poles of a magnet; consisting of a vertical horse-shoe magnet on brass foot and levelling screws, pair of flood cups with adjusting screws, brass pillar, and connecting fork and pair of light wire frames. Rotation may be produced in the frames by voltaic, magnetic or thermo electricity	1	15	0
33	Ampere's Apparatus for showing the Rotation of the Voltaic Battery round the poles of a horse-shoe magnet. The zinc and copper of each battery revolve in opposite directions; consists of a cylindrical horse-shoe magnet on brass foot, and levelling screws, and a pair of Voltaic batteries	1	5	0
34	Sturgeon's experiment of a pair of smooth zinc slips rotating within a rough circular zinc trough placed on the poles of a magnet, illustrating the production of a voltaic current from the same metal, but in different states of surface; consisting of a Cylindrical Horse-shoe Magnet on brass foot, with levelling screws and a pair of zinc troughs and slips	1	10	0

NO.		£	s.	d.
35	Ritchie's Apparatus for showing the rotation of a Bar Electro Magnet between the poles of a permanent horse-shoe magnet, consisting of a Cylindrical Horse-shoe Magnet on brass foot with levelling screws, mercury cup or electrepeter to dispense with mercury on brass pillar and clip screw, and voltaic bar magnet . . .	1	5	0
36	Ritchie's Apparatus to show the rotation of a rectangular wire frame between the poles of a horse-shoe magnet; consisting of a vertical magnet on brass stand, with a rectangular wire coil the length of the magnet placed between the poles, with an electrepeter attached for changing the current	1	7	6
37	Ritchie's Apparatus to show the rotation of a rectangular wire cage between the poles of a magnet. This experiment differs from No. 36, the wire frame being a continuation of the same wire, but the cage is formed of distinct rectangular frames. Including magnet on brass foot, cage, mercury cup and pillar	1	5	0
38	Ritchie's Apparatus to show the rotation of a coil of copper wire between the poles of a magnet. This experiment is similar to No. 36, a circular coil being used instead of a rectangular frame. Including magnet on brass foot and coil	1	7	6
39	Barlow's Apparatus for showing the rotation of a pair of Hollow Metallic Cylinders round the poles of a horse-shoe magnet, consisting of a cylindrical magnet on brass foot and levelling screws, pair of flood cups with adjusting screws, brass pillar, connecting fork, and hollow metallic cylinders	1	15	0

Note.—The apparatus described from Nos. 32 to 39, are perfect in themselves, each having large cylindrical horse-shoe magnets, 10 inches long from the arch to the poles, and are intended for the lecture table, where the delay of shifting one part to allow another adaptation, could not be admitted; but the same experiments may be shown more economically by the apparatus included from Nos. 40 to 48.

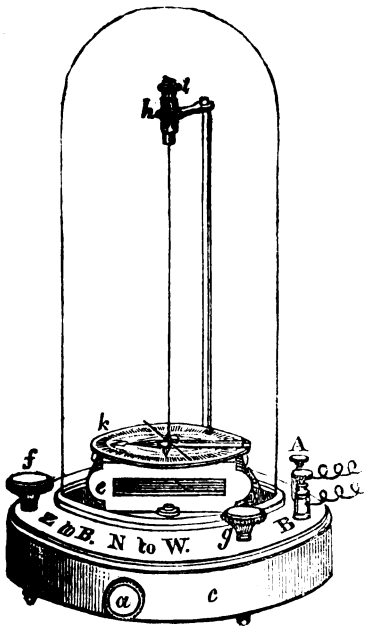
		£	s.	d.
40	E. M. Clarke's Arrangement of the Vertical Cylindrical Magnet, with flood cups *c c*, levelling screws *b b b*, brass pillar and connecting fork *e*, on tripod stand, Fig. 30.	1	10	0
41	Mobile Wire Frames, *d d*, to rotate by Voltaic, magnetic, or thermo-electricity for ditto . . . per pair, 7*s*. 6*d*., each	0	4	0
42	E. M. Clarke's Arrangement of Ritchie's Rotating Voltaic Magnet for ditto . .	0	10	0
43	E. M. Clarke's Arrangement of Ritchie's Rotating Wire Cage for ditto . .	0	7	6
44	E. M. Clarke's Arrangement of Ritchie's Wire Coil for ditto	0	7	6
45	Ditto, ditto, ditto, rectangular Wire Frame for ditto	0	10	6
46	Pair of Ampere's Voltaic Batteries to rotate on the poles of ditto	0	10	0
47	Pair of Sturgeon's Rough Zinc Circular Troughs with mobile zinc leaves, to show rotation produced by one metal on the poles of ditto	0	12	6
48	Pair of Barlow's Metallic Cylinders to rotate on the poles of ditto . .	0	10	0
49	Ritchie's Rotating Magnet, without steel permanent magnet, on bottom-board . . . . . 5*s*. 6*d*. to	0	10	0
50	Ditto to rotate horizontally by terrestrial magnetism . 10*s*. 6*d*. to	1	0	0
51	Ditto to rotate vertically by ditto	1	1	0

Fig. 30.



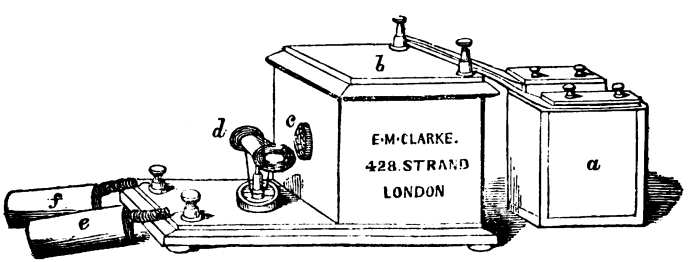
NO.		£	s.	d.
52	Ditto Voltaic Magnet and Steel Permanent Magnet, with Lockey's Intercepter. By this arrangement battery contact is broken nine times during every revolution of the voltaic magnet, without its speed being decreased	1	10	0
53	Page's Rotatory Multiplier	1	10	0
54	Apparatus to show the rotation of a Vertical Bar Magnet round a conducting wire having an ascending or descending current . . .	1	0	0
55	Apparatus to show Ampere's experiment of a Vertical Bar Magnet rotating on its axis. The voltaic currents pass from the equator to the poles, or the reverse	1	0	0
56	Apparatus to show E. M. Clarke's experiment of the rotation of one of the Light Wire Frames (No. 41) on a Vertical Wire Helical Coil, both having a voltaic current passing	1	5	0
57	Apparatus to show E. M. Clarke's experiment of the rotation of one of the Light Wire Frames (No. 41) over a horizontal flat spiral coil . .	1	5	0
58	Apparatus to show Sturgeon's experiment of the rotation of a Vertical Bar Electro Magnet on its axis	1	10	0
59	Apparatus to show Saxton's experiment of a Horizontal Voltaic Magnet having a permanent steel magnet revolving vertically in front of the poles	3	3	0
60	Ditto, ditto, with Silver Electrepeter, to dispense with the Mercury and Callan's secondary coils to give shocks	5	5	0
61	Apparatus to show E. M. Clarke's experiment of a Voltaic Bar Magnet revolving within two semi-circular permanent steel magnets; these also revolving, but in the opposite direction	2	2	0
62	Cummins's Gold Leaf Galvanoscope, consisting of a glass tube fixed vertically between the poles of a Horse-shoe Magnet; a slip of gold leaf is suspended loosely within the tube, having metallic contact secured at top and bottom. This is an exceedingly delicate indicator of the presence of a feeble current of Voltaic, Magnetic, or Thermo electricity	1	5	0
63	Cummins's Galvanometer, consisting of a Magnetic Needle, surrounded with a coil of insulated copper wire; when an electrical current is sent through the coil the needle is deflected, the strength of the current being measured by the amount of deflection . . *7s. 6d.* to	0	10	0
64	Ditto, ditto, with Needle and Coil under a Glass Plate, and Levelling Screws. Needle, 4 inches	0	17	6
65	Ditto, ditto, improved by Collingwood, with Arched Glass . . .	2	10	0
66	Faraday's Galvanometer, with 4 inch astatic needles suspended by a hair, movable coil on brass frame, levelling screws, and tall glass shade	2	10	0
67	Melloni's Galvanometer. This instrument is the most delicate yet invented for measuring feeble electric currents, and consists of a massive circular pure brass base *c*, (Fig. 31.) through which three levelling screws pass, two of which are seen at *f g*; the coil is wound on a brass frame *e*, which can be moved horizontally by the tangent screw *a*, the terminal wires of the coil are soldered to the binding screw connections A B. The astatic needles are suspended by a fibre from the cocoon of the silk-worm, and to allow their being accurately adjusted to the coil, the thread is attached to a piece of tube *i*, that slides in the spring socket *h*, the engine divided scale *k*, slides off the brass frame of the coil by a dovetail. The weight of the base *c*, protects the instrument from vibration	5	5	0
68	Faraday's Compound Helical Coil for illustrating the production of Volta-Electric currents, consists of a coil of insulated copper wire on a cylinder, the terminals being connected with a voltaic battery; a second helis of wire being coiled on the first, its terminal wires being in connection with a galvanometer. When the battery contact is			

Fig. 31.



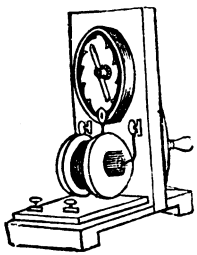
NO.		£	s.	d.
	broken with the first coil, the needle of the galvanometer is deflected by the secondary current induced in the second or outside coil . .	2	2	0
69	Callan's Primary and Secondary Coil. This apparatus consists of a primary coil of thick copper wire on a hollow cylinder, upon this is wound a second coil of very fine copper wire, and of considerable length. When a voltaic current is passed through or withdrawn from the thick wire or primary coil, a temporary current is induced in the contrary direction in the fine wire or secondary coil. If connection is made by the hands with the terminal wires of the secondary coil, a violent shock will be felt each time battery contact is made or broken with the primary coil . . . . . 7*s.* 6*d.* to	0	15	0
70	Ditto, ditto, on Mahogany Bottom Board, more convenient . 10*s.* to	1	10	0
71	Electro-Magnetic Apparatus, for giving shocks, consisting of a Callan's			

Fig. 32.



NO.		£	s.	d.
	Coil *b*, (Fig. 32) boxed in to protect the fine wire of the secondary coil from injury by the mercury of the revolving voltaic magnet *d*, which acts as contact breaker; *c*, a bundle of soft iron wire which gives the requisite impetus to *d*, by its induced polarity; *e f*, the brass conductors to grasp in the hands for giving the shock. Small size without *a*	1	10	0
72	Ditto, ditto, much larger, for giving more powerful shocks	2	0	0
73	Lockey's Electro-Magnetic Machine, consisting of a large Callan's Coil, with Lockey's arrangement for breaking battery contact. A continuous circle of voltaic light is produced, the colour of which depends on the description of metallic circle and spring that is undergoing combustion. The machine has a lock-up cover and cupboard, which contain five metallic circles and five springs, viz.: copper, brass, tin, lead, and zinc; a mercury cup, and star, and pair of brass conductors for giving shocks, Fig. 33 . . .	4	14	6

Fig. 33.



74	Collis's Electro-Magnetic Machine for giving shocks, consists of a Callan's coil, as at Fig. 32, but instead of a revolving voltaic magnet being used to break battery contact, a vibrating iron plate is employed. Pair of conductors 1*l.* 10*s.* to	2	2	0
75	E. M. Clarke's Medical Electro-Magnetic Machine consists of a mahogany lock-up cabinet case and multiplying wheel, as seen at Fig. 51, page 82, with a Callan's coil on the bottom board, having a revolving voltaic bar magnet placed between the poles of a permanent steel horseshoe magnet, and furnished with an electrepeter, so as to dispense with mercury. With this arrangement battery contact is is broken, and is a self-acting machine; but as this will not answer in every case, there is fixed to the back board a circular contact breaker, with a continuous periphre, so as to make no unpleasant noise, and is worked by a multiplying wheel and band. By these two arrangements a patient may electrify himself by connecting the battery with the revolving Electro-Magnet, or the shocks may be administered by hand, as feeble or powerful as the case may require, by putting the battery to the contact breaker. The apparatus includes a pair of brass conductors, pair of sponge directors, a foot conductor, Smee's battery, and bottle of sulphuric acid	5	5	0
76	E. M. Clarke's Medical Electro-Magnetic Machine, plain, on bottom board with revolving magnet and electrepeter, and pair of conductors 1*l.* 10*s.* to	2	2	0
77	Barlow's Apparatus to illustrate Terrestial Magnetism; consisting of a coil of copper wire surrounding a globe, which is supported between two pillars from a bottom board, with a dipping needle placed over the globe. When a voltaic current is passed through the coil, the dipping needle takes different angles of inclination, according to the situation between the equator and the pole. Four magnetic needles are placed in varying positions, to more fully develop the electric current. Globe, nine inches diameter, including four magnetic needles and a dipping needle	3	15	0
78	Ditto ditto Globe, twelve inches diameter	4	10	0
79	Henry's Reciprocating Electro-Magnetic Beam. This apparatus answers for breaking battery contact	2	0	0
80	Voltaic Magnet with Horizontal Revolving Armatures; consisting of an upright voltaic magnet, on the poles of which is fixed a brass plate, carrying two upright pillars to support the axis of a wheel, on the periphre of which is fixed three soft iron bars, parallel to the axis a			

NO.		£	s.	d.
	circular contact breaker is fixed on the axis, so that when an armature is within three quarters of an inch of the poles of the magnet, it is powerfully attracted towards it, but when directly over the poles the current is broken, and the armature continues to revolve by the momentum acquired, until it brings the next iron bar within the required distance, thus producing continuous rotary motion by Electro Magnetic attraction . . . . . 1*l.* 10*s.* to	2	10	0
81	Electro-Magnetic Bell Engine ; consisting of a voltaic bar magnet revolving between the poles of a fixed magnet, carrying an electrepeter. An endless screw is fixed on the axis of the voltaic magnet. This acts on a toothed wheel, that has a pin attached to it, which draws back the stem of the hammer	3	0	0
82	Lockey's Electro-Magnetic Protector, for carriages, &c. By this simple contrivance persons are effectually prevented climbing behind carriages, cabs, &c. Fitted to and including battery, coil, &c. . .	7	7	0
83	Ditto ditto Hall Knocker and Bell Pull Protector. By this contrivance persons are effectually prevented, after a certain hour of night, using either . . . . . 3*l.* 3*s.* to	6	16	6
84	E. M. Clarke's Electro-Magnetic Engine. This model apparatus illustrates the possibility of applying Electro-Magnetism as a motive power, and may be employed for many purposes where a small power is required, such as playing an organ or full-sized musical box, working water pumps, giving motion to sectional and other models of machinery, &c. The engine is complete in itself, and may be adapted to any purpose within its power, by the purchaser . 10 10 0 to	26	10	0
85	Ditto ditto, made to any required power.			
86	E. M. Clarke's Electro-Magnetic Locomotive Engine and Tender. This working model will travel round a circular railroad of 15 feet diameter in 20 seconds, and continue the same speed for 8 hours. The engine and tender, including the Grove's battery, weighs 45 lbs. .	30	0	0
87	E. M. Clarke's Working Model of an Electro Magnetic Marine Engine, with paddle wheels, &c. In principle the same as No. 85 . .	30	0	0
88	Electro-Magnetic Telegraphs, fitted up in private dwellings, club-houses, public institutions, factories, theatres, &c., by contract.			
89	Electro-Magnetic Alarums, planted in game preserves, orchards, and round dwelling-houses to any distance.			

THERMO ELECTRICITY.

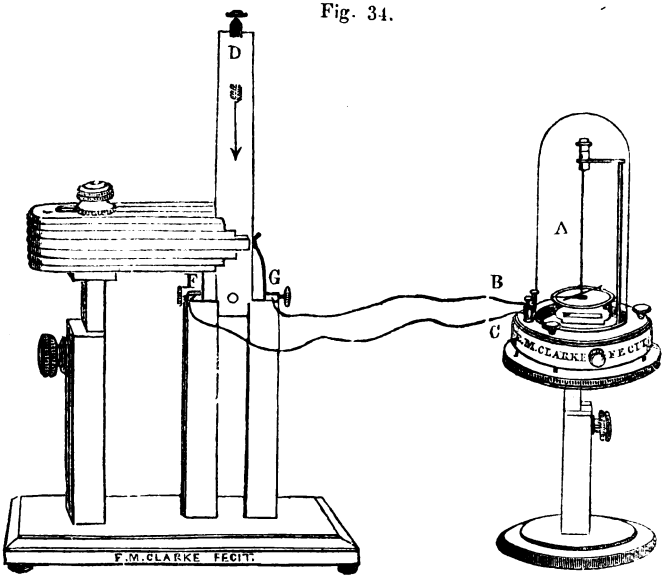
1	Seebeck's Compound Rectangular Frame of Bismuth and Antimony, enclosing an Astatic Magnetic Needle to show the production of an electric current by the disturbance of the equilibrium of temperature of two dissimilar metals deflecting the needle	0	10	0
2	Apparatus to show the production of a thermo electric current in a compound bar of Bismuth and Antimony by deflecting the needle of the galvanometer	0	7	6
3	Ditto, with Magnetic Needle attached. By this arrangement the compound bar is fixed on a stand, so that the flame of a spirit-lamp may be applied without fear of breaking the bar	0	17	6
4	Apparatus consisting of a Bismuth and Copper Rectangular Frame, with Astatic Needle, to show thermo-electric action when heat is added or extracted at one juncture of the metals	0	10	0
5	Compound Frame of Copper and Zinc, terminating in flat spiral coil on stand and needle	0	15	0
6	Frame of Copper, with spiral termination on stand and needle . .	0	10	0

NO.		£	s.	d.
7	Thermo-Electric Battery of ten pair of German silver and brass wires, soldered together, to excite by spirit-lamp or the heat of the hand .	0	7	6
8	Thermo-Electric pairs of German silver and brass wires . . 1*s.* to	0	2	6
9	E. M. Clarke's Thermo-Electrical Battery. This instrument is the most powerful apparatus yet constructed for generating Thermo-Electricity, and consists of a number of plates of Bismuth and Antimony arranged in alternations. A heated metallic plate is applied to one series of alternate connections, and a pan of ice to the opposite, thus producing an electric current of sufficient power to develop sparks, shocks, and produce rotation in a voltaic bar magnet; induce magnetism in soft iron so as to sustain a considerable weight, and chemical decompositions	8	8	0
10	Thermo Motors of Silver and Platina Wires . . . 2*s.* 6*d.* to	0	10	6
11	Compound Thermo Motors of Platina and Silver Wires, to produce rotation of the wire frames, No. 41, page 65, by a thermo-electric current	0	7	6
12	Thermo-Electric Revolving Arch of Brass and German Silver, with pillar and foot	0	7	6
13	Ditto to rotate between the poles of the Horse-shoe Magnet, No. 40, page, 65, with pillar	0	10	6
14	Ditto, ditto, with Magnet	1	1	0
15	Thermo Rotating Compound Rectangles, composed of three platina and silver wire frames, having a needle point for suspension where the platina wires cross above, and a silver wire ring below, to admit of their being placed on a stand, a bar magnet being put at one side of the frames, and the flame of a spirit lamp being applied at the opposite side, rotation immediately commences; by changing the pole of the magnet the direction of the rotation is also reversed. This is the most satisfactory way of showing the experiment, and the surest of acting	0	10	6
16	Two of ditto, smaller size, on Vertical Horse-shoe Magnet, with spirit lamp	0	18	0
17	Melloni's-Thermo Electric Pile, consisting of a combination of bars of Bismuth and Antimony, 1½ inch long, ⅛ inch square, in a frame, on pillar and feet	1	1	0
18	Dowe's Thermo-Electric Pile, consisting of 100 pair of platina and iron elements	4	4	0

MAGNETIC ELECTRICAL APPARATUS.

1	Farraday's Apparatus to Illustrate the production of Electricity by Magnetism, consists of a thin wood tube, having a helical coil of insulated copper wire wound on it, with binding screw connections attached to the terminal wires. If connection be made with a galvanometer, (such as Nos. 66, or 67, page 66,) and the pole of a cylindrical bar magnet be introduced within the tube, the magnetic needle will be deflected. On withdrawing it the deflection will be in the opposite direction	1	1	0
2	Faraday's Apparatus for Illustrating the Production of Magnetic Electrical Currents, by inducing magnetism in a cylinder of soft iron	2	2	0
3	E. M. Clarke's Apparatus to show Faraday's experiment of the production of Magnetic-Electrical Currents, in a strip of sheet copper, silver, or zinc, when moved between the poles of a magnetic battery. Fig 34 consists of a mahogany clamp stand, to carry a magnetic battery, two uprights are fixed in the bottom board, having grooves in the sides to allow the piece of metal D to slide up and down between the poles of the magnet. F, G, two metallic springs for making con-			

Fig. 34.



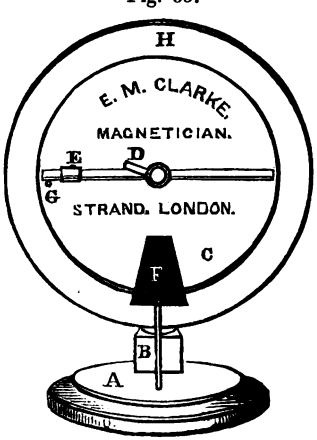
NO. tact with the sides of the strip D, having binding screw connections for making contact with the galvanometer A, by means of the conducting wires B, C ; a third connection, is fixed on the top of D, so as to change the direction of the current. On moving D in the direction of the arrow, the needle of the galvanometer will be temporarily deflected ; on drawing it up a deflection in the opposite direction will be produced 2 2 0

4 Vertical Cylindrical Horse-shoe Magnet on brass foot, with two reels of insulated copper wire, for showing the deflections produced by moving the coils on the poles, also the neutralizing the currents by opposing their directions 1 16 0

5 Pair of Helical Coil Reels, to adapt to apparatus No. 40, page 65 . 0 15 0

6 Arago's Apparatus for showing the retarding effect of a massive metallic ring on the oscillations of a magnet, free to move on its centres. Fig. 35. A, a mahogany foot with pillar B, to support a circular back-board C, a metallic ring H, is slipped on the back board, and projects so as to be flush with the magnet E, which is delicately suspended at D ; a pin projects through the back board at G, which supports it in a horizontal position. On withdrawing the pin the magnet oscillates, the number of which are counted by its passing behind the screen F. If the metallic ring be now removed, the number of oscillations will be increased 3*l.* 13*s.* 6*d.* to 5 0 0

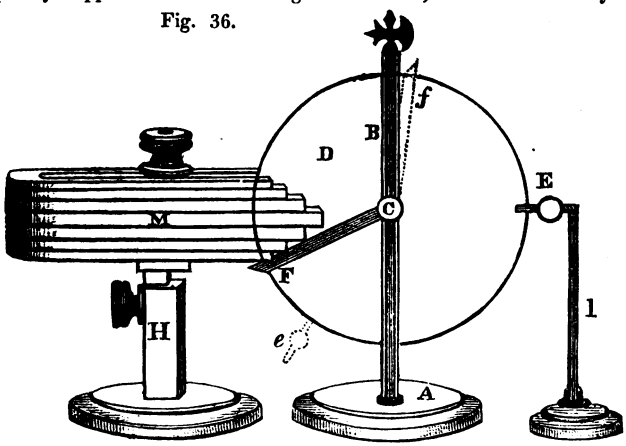
Fig. 35.



NO. £ s. d.

7 Sturgeon's 'Apparatus to show the converse experiment to No. 6. A, (Fig. 36), a mahogany foot with two brass uprights B, connected at top, between which is placed upon centres C, a metallic disk D, a small weight E, is attached to the periphery, under which is a temporary support I. On the magnet stand H, is fixed a battery

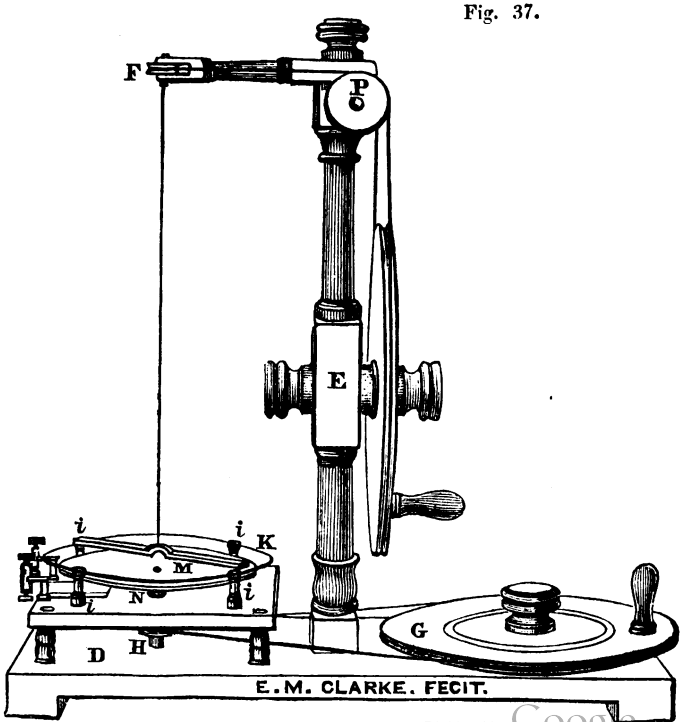
Fig. 36.



M; so that disc will oscillate between its poles; when I is withdrawn, the number of oscillations is counted by the passing of the index hand F, through the frame B; including three discs, iron, copper, and zinc 2 2 0

8 E. M. Clarke's Combined Apparatus, Fig. 37, to show various experi-

Fig. 37.



NO.		£	s.	d.
	ments of Faraday, Arago, and Harris, on the capacity of different metals for the development of magnetic electricity by induction. A horizontal metallic disc N is made to rotate rapidly under a screen of glass K, a magnetic needle being placed on a short point on the screen, the needle rotates in the same direction with the disc. Or by suspending from the branch arm F the bar magnet M, set the copper disc in motion, and the magnet will rotate in the same direction. Reverse the direction of rotation of N, and M will first come to a state of rest, and then commence revolving in the same direction of N.; To prove that this is due to the magnetism of the steel bar, remove it, and in its place suspend a similar bar of unpolar or soft iron, set N in rapid motion, and the iron bar remains stationary. Also when compound bar magnets are made to rotate under the glass K, and a metallic disc suspended over the screen, it rotates in the same direction with the magnets. Also shows Harris's experiments of the influence of screens of different metals in arresting the passage of magnetic induction. Also Faraday's experiment of rotating a disc of copper between the poles of a magnetic battery, on connecting conducting wires from a galvanometer; one with the centre, the other with the periphery of the rotating disc, a permanent deflection of the needle is produced. In addition to the accessaries already mentioned, it is also furnished with a thick disc of copper, with a groove at the periphre, and a male screw at the centre to fix in H; combination of bar magnets with brass flange and male screw at centre, to fix in H; a bar magnet with arched centre M, and a bar of soft iron to correspond, to suspend from F; circular glass screen and binding-screw connections for Faraday's experiment . . .	8	8	0
9	E. M. Clarke's Magnetic-Electrical Machine. This instrument develops all the phenomenon of magnetic electricity, and for medical purposes possesses numerous advantages over every other description of electrical apparatus, and is the only one that exhibits separately the effects of *quantity* and *intensity* with the full power of the magnets, which are quite detached from the rotary armatures, so that all injurious vibrations are completely prevented. The latest improvements of lathe machinery are adapted to the instrument to secure the most perfect steadiness and freedom of motion. It requires no mercury flood, so that when once adjusted, it goes through its operations with ease and certainty. In addition to its power of producing light, heat, and motion, effecting chemical compositions and decompositions, and acting powerfully on the living nerves and muscles, it deflects the gold leaves of the electroscope, charges the Leyden jar, and ignites gunpowder. The machine, fig. 38, is furnished with two armatures, figs. 38 D, 44; decomposition of water apparatus, fig. 40; apparatus to show the ignition of platina wire, fig. 46; pair of brass conductors (R S) fig. 38; iron wire to show combustion, fig. 45; steel lever for unscrewing the armatures, extra hooks (Q) and springs (O), fig. 38; the battery of horse-shoe magnets, A fig. 38; weight 14lbs. with mahogany lock-up case, fig. 51	12	12	0
10	E. M. Clarke's Magnetic-Electrical Machine, fitted up for medical purposes only, with an intensity armature, pair of brass conductors, pair of sponge directors (U V) fig. 38. Foot conductors, pair of puncturing directors for applying to persons apparently drowned, extra hooks, springs, &c.	10	10	0
11	Flat Conductor for placing under the foot or connecting with a bath .	0	6	6
12	Pair of Puncturing Directors, for applying to persons apparently drowned	0	15	0
13	Separate Sponge Directors, U and V, fig. 38; these serve as charcoal holders, fig. 42	0	7	6

NO.		£	s.	d.
14	Decomposition of Water Apparatus, for collecting the gases, separate, fig. 41	0	10	6
15	Pair of Platina Discs, D C, fig. 41, for showing the decomposition of neutral salts	0	5	6
16	Leyden Phials, to charge by magnetic electricity, so as to deflect the gold leaves of the electroscope, fig. 43	0	10	0
17	Micrometer Eye-piece for showing the magnetic-electrical spectrum, single 5*s.* 6*d.*, double	0	8	6
18	Mercury Cup and Points to show the disadvantage of the mercury flood, fig. 49. It also shows the combustion of mercury and ignition of ether	0	3	0
19	Apparatus to show brilliant flashes of magnetic electricity on burnished gold or silver paper	0	7	6
20	E. M. Clarke's arrangement of the Vertical Cylindrical Magnet, with flood cups, levelling screws, on tripod stand, pair of mobile wire frames, to show rotation on the poles of ditto, by magnetic electricity, fig. 50	1	15	0
21	Mahogany Stand, with multiplying-wheel, crank, hook, and treadle, to work the magnetic electrical-machine, Nos. 9 and 10, by foot	5	0	0
22	E. M. Clarke's Magnetic-Electrical Machine, large size, with the magnetic battery weighing 40 lbs., on a cast-iron frame, having a multiplying-wheel, crank, treadle, and hook, to work by the foot	44	15	0
23	Ditto ditto, larger size, weight of the magnetic battery 50lbs.	69	7	0
24	Decomposition of Water Apparatus, on mahogany bottom-board, with pillar, and clip to hold the glass tube	0	15	0
25	Ditto ditto, with two glass tubes for collecting the gases separately, pillar and clips	0	18	0
26	Apparatus for Showing the Decomposition of Neutral Salts, consisting of two vertical platina plates, one fixed, the other having a spiral spring motion on a bottom-board, and binding-screw connexions	1	10	0
27	Apparatus consisting of a pair of adjusting forceps with silver points, for showing the ignition of platina and steel wire, by Nos. 22 or 23, with binding-screw connexions on bottom-board	1	1	0
28	Soft iron Horse-shoe, covered with insulated copper wires suspended from a pillar on a stand, with armature and scale-pan, to show the production of magnetism by magnetic-electrical currents	1	1	0

For a description of E. M. Clarke's Magnetic-Electrical Machine, see London and Edinburgh Phil. Mag. for October 1836 ; Poggendorff's Annalen der Physick, No. 10, 1836 ; Silliman's American Journal of Science, No. 2, January 1838 ; Pouillet's Traité de Physique, 1837 ; Higgins's Experimental Philosopher, 1838 ; Noad's Lectures on Electricity, 1839 ; Monthly Times, No. 2, 1839 ; El. Instructor, July 1839 ; Elements of Chemistry, by Dr. D. B. Reid, 1840 ; Elements of Materia Medica and Therapeutics, by Dr. Pereira, 1841 ; and the following, as published in Sturgeon's Quarterly Annals of Electricity for January, 1837.

A DESCRIPTION

OF A

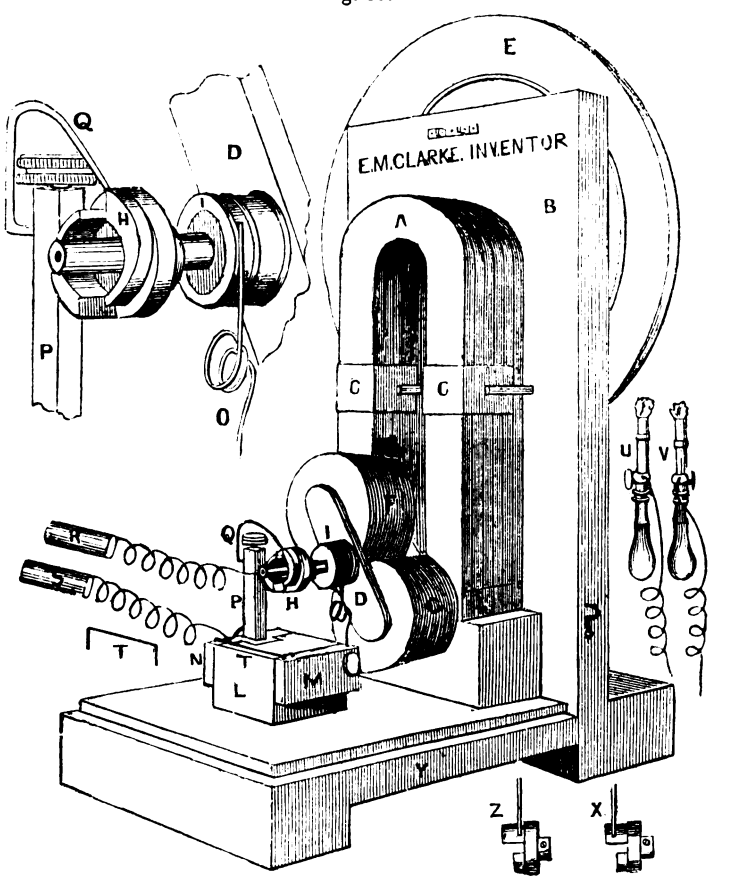
MAGNETIC ELECTRICAL MACHINE,

INVENTED BY E. M. CLARKE, MAGNETICIAN, OF 428, STRAND, LONDON.

This apparatus, with the exception of there being *rotating armatures* and a *magnetic battery*, differs from any magnetic machine which has hitherto been constructed.

The October number of the *London and Edinburgh Philosophical Magazine* * for 1836 contains a brief account of this machine; it being the intention of the inventor to reserve a more detailed description for insertion in the "*Annals*," † in consequence of its being the aim of the editor of the latter named periodical to make this deservedly interesting branch of science one of the leading features of the work. Since that time, a most important improvement has been made, by the rejection of the mercury box. By the inventor's present arrangement, the necessity of using mercury is superseded.

Fig. 38.

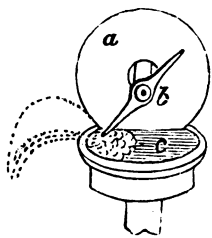


* I beg leave also to direct attention to No. 55, p. 360, and No. 63, p. 455, of the same Magazine.

† Annals of Electricity, edited by Wm. Sturgeon, Esq., Superintendant of the Victoria Gallery of Practical Science, Manchester.

A is the battery of bent bar magnets, placed *vertically*, and resting against four adjusting screws, which pass through the mahogany back-board B (two of them are shown at M, N. fig. 51, page 82). C C is two stout brass straps passing through openings in the back board, through which passes bolts and nuts, the purpose of which is to draw the magnetic battery to the board B. By these means, the battery can readily be disengaged from the machine, without taking asunder the entire apparatus, and the battery is thus also freed from that vibration which must necessarily be occasioned by the attachment of the rotating apparatus to the battery itself. D is the intensity armature, which screws into a brass mandril seated between the poles of the battery A ; motion being communicated to it by the multiplying wheel E. This armature has two coils of fine insulated copper wire, 1500 yards long, coiled on its cylinders, the commencement of each coil being soldered to the armature D, from which projects a brass stem (also soldered into D), which carries the break-pieces, H and H. The break-piece is made fast in what position soever is required, by a small binding screw. I and I a hollow brass cylinder, to which the terminations of the coils F G are soldered, being insulated by a piece of hard wood attached to the brass stem. O is an iron wire spring, pressing against the hollow cylinder I at one end, and held in metallic contact, by a nurled head-screw in the brass strap M, which is fixed to the side of the wooden block L. P and P a square brass pillar, fitting into a square opening in the other brass strap N, and secured at any convenient height required. Q and Q, a metal spring that rubs gently on the break-piece H, and held in perfect metallic contact by the nurled head-screw in P. T and T a piece of copper wire for connecting the two brass straps, M, N ; then D, H, Q, P, N are in connexion with the commencements of each coil, and I, O, M with the terminations. The advantages of this arrangement must be obvious to any person who has seen the magnetic machine in action in the Royal Gallery of Practical Science, where the old arrangement of the mercury flood is still used, where both disc and blades scatter the mercury about as in fig. 39 ; *a* the disc, *b* the double blades, *c* the mercury flood. The loss of mercury is not the only evil; for as you continue working the machine, you of course lose the adjustment you had at starting, and the effect is constantly diminishing, and will at length cease, owing to the points *b* not having mercury to dip in. By the new arrangement, the metal spring Q presses gently on the break H ; consequently, the effects here are unbroken, no matter how long you may require to keep the machine acting. This is not the only advantage it possesses ; for in the mercury the surface is very rapidly oxidated ; the oxide adheres to both disc and point, and preventing so perfect a metallic contact as that obtained by the spring and break.

Fig. 39.



TO ADJUST THE INTENSITY ARMATURE.

See that the faces of the iron cylinders that carry the coils F G, are parallel to, and all but in contact with the magnetic battery, A ; if not, unscrew the nut of the multiplying wheel E, and take it off its axis : you then have at your command the four screws against which the battery rests (two of which are to be seen at M N, fig. 51, page 82) ; by means of them and the nuts of the straps C C, you can adjust the battery to the greatest nicety. The next step is to adjust the break, so that the spring Q will separate from it just at the same time that the iron cylinders of the armature have left the poles of the magnetic battery ; and lastly, see that the iron wire spring, O, presses gently against the hollow brass cylinder I.

TO GIVE THE SHOCK.

Grasp the two brass conductors, R S, in the hands,* put one of their connecting wires into the holes of either of the brass slips, M or N, the other wire into the hole at the end of the brass stem that carries the break, H. Connect M N by T, turn the multiplying wheel in the direction of the arrow, and a violent shock will be received by the person holding R S. The shock which is obtained from the intensity armature having 1500 yards of fine insulated wire, is such that a person, even of the strongest nerves, will not readily volunteer to receive a second shock. Indeed the effects are so violent, that the inventor has proposed to many of his military customers that this

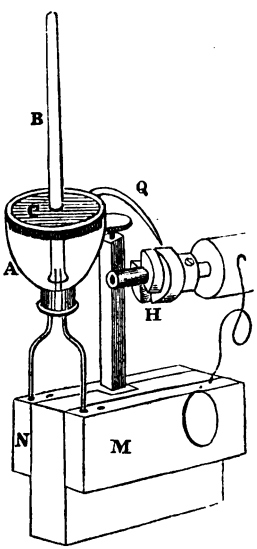
* If the hands are wetted with vinegar, or salt and water, the effect is considerably increased.

instrument would be a good substitute for the lash, being capable of producing even greater torture than that brutal instrument, without producing any corporeal injury to the delinquent. Place R S in two separate basins of salt and water, immerse a hand in each basin, and the shock will also be felt very powerfully; this method is to be preferred, as it leaves the person who is electrified the power of quitting when he pleases; not so with the conductors; for the muscles of the arms contract violently, so as to close the hands completely on the conductors, taking away the power of letting them go. If the two connecting wires of R S are put in M N, the shock is not so powerful. The shock can be modified in different ways. By turning the wheel E very slowly, or increasing the distance between the battery A and the armature D, or by making the break H separate from the spring Q when the armature D is horizontal. U V, a pair of directors, holding a piece of sponge, each to be used when the electricity is to be applied medicinally. The connecting wires are to be placed in the same way as the conductors are in the figure; the sponges must be wetted with a little vinegar or salt and water, so as to make them conduct the electricity. By those directors a succession of most powerful shocks can be given, when the case requires it; or they can be so modified as to be barely felt by the most nervous patient.* Remove T from M N, put the two pieces of iron wire with an end of each in its place; put other ends of them into two holes that are in the sides of the battery, A; let the wires be sufficiently long to allow the armature to rotate between them. If one wetted finger is placed on the brass stem that carries the break H, and another wetted finger is placed on the magnetic battery, the shock will be also felt. While the machine is so arranged, if you look between the face of the rotating armature and the magnetic battery, vivid flashes of light will be perceived playing between both. This light may also be frequently seen without the wires being in connexion with the battery. Sometimes it will be observed flashing between the coils, F G.

TO DECOMPOSE WATER, &c. &c.

Mr. E. M. Clarke's arrangement of the decomposition of water apparatus. (See *Phil. Mag.* for June, 1835.)—A, a glass vessel, having a brass cap with hardwood bottom, through which two pieces of copper wire pass, having pieces of platina wire soldered to them; place this in M, N; fill the tube B with water,† thrust it over the platina wires where it will be held by the cork C. Q must rub on the cylindrical part of the break, H. Here the gases are obtained mixed.

Fig. 40.

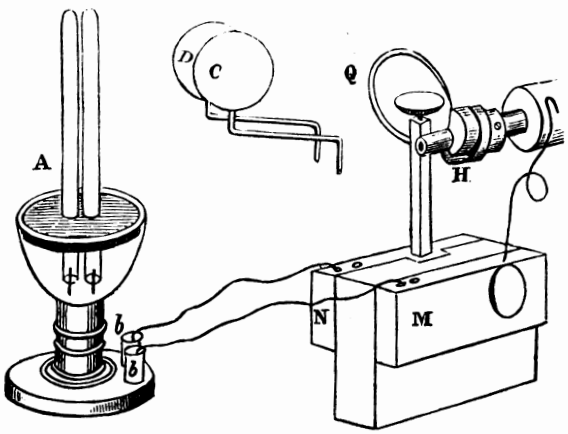


Mr. E. M. Clarke's arrangement of the apparatus for obtaining the elements of water in separate vessels, or unmixed.—A, a glass vessel having two glass tubes; here the platina wires are soldered to two pieces of copper wire, as in my other arrangement, but differing inasmuch as that they are also soldered to the two brass cups, B, B, which are intended to hold a little mercury. Connect it by copper wire; a little acid or any salt will increase the effect by forming a better conductor with M, N, as in the figure. Here Q must work on the single break, H., C, D, two platina plates, having two copper wires soldered to them to connect them with *m, n;* on placing a piece of litmus or turmeric paper between them that has been previously wetted with some neutral salt, its decomposition is shown by the alteration in the colour of the paper. You may even transpose the colours by altering the position of the break H.

* To medical gentlemen, the instrument may be strongly recommended from the following advantages. Its portability; its being always in a fit state for action, even in the dampest weather; the nicety with which the power of the shocks may be increased or diminished. Indeed it combines the advantages of the electrical machine and the galvanic apparatus; at the same time that it does not labour under the disadvantage of either; for, as has already been stated, it is not affected, like the former, by a moist condition of the atmosphere, nor like the latter, is it necessary to make use of any acids: nay, since the improvement has been effected which is alluded to in the text, even the use of mercury is superseded.

† The advantages of this arrangement are obvious to any one who has been teased with bits of platina wires made to pass through small holes drilled in a glass vessel having loops turned on the

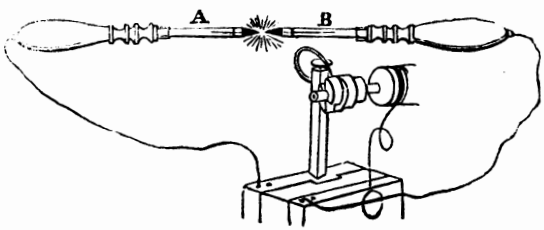
Fig. 41.



TO IGNITE CHARCOAL.

Fig. 42 represents the arrangement of the apparatus for this purpose. The same directors that are used to hold the sponges, may be used to retain the charcoal points, A, B, in the proper position.

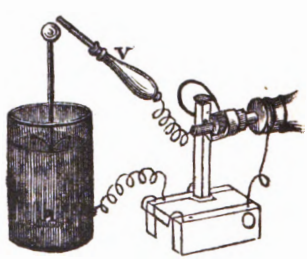
Fig. 42.



TO CHARGE THE LEYDEN JAR AND DEFLECT THE GOLD LEAVES OF THE ELECTROSCOPE.

Twist a piece of copper wire round the outside coating of the Leyden jar, A (fig. 43), connect it with the block of the magnetic electrical machine. Withdraw the sponge from the director V, and connect its wire with the end of the intensity armature, as in the figure. Rotate the armature at a moderate speed, hold the director by the wood handle, and make it touch the ball for a moment only, as on that depends the success of the experiment, as it is only one spark that shows the fact. Should the director rest on the ball so as that two or more sparks are obtained from the armature, you fail. Bring the ball of the Leyden jar in contact with a delicate gold leaf electroscope, and the leaves will be diverged. Very little practice will make you perfect in developing their effect. The jar is charged to a very low intensity indeed; but I found that after diverging the gold leaves, if I put my hand on the electroscope so as to discharge it, and the gold leaves collapse, on

Fig. 43.



projecting ends, and contact is obtained by merely placing the connecting wire in the loop: it was not only a bad connexion, but nine cases out of ten the cement that is used to fasten in the platina wires gave way, just as you were going to use the apparatus, as has frequently happened at lectures.

touching the electroscope with the ball of the jar, again the leaves diverged with as much energy as before. I again discharged the electroscope, and again produced a divergence: this I repeated thirteen times, with the same effect each time, from the one charge. I had not time to pursue the experiment further, but would be glad to know to what extent it could be carried. The jar I used was eight inches deep, five and a half inches diameter, open at the top; the tinfoil coatings were six and a half inches deep.

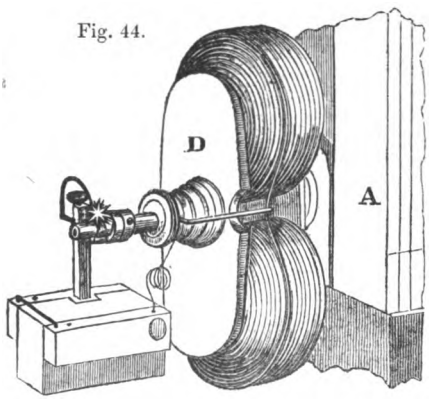
DESCRIPTION OF THE QUANTITY ARMATURE.

This armature differs materially from that which is employed for intensity. The latter, as already stated, has two coils of 1500 yards of fine insulated copper wire. The inventor has also tried silver wire, which he found to be superior to copper in the proportion of nearly 3 to 1. The quantity of iron in the cylinders also is much smaller than in the quantity armature, whose effects are greatest when the quantity of iron in the cylinders is increased, and the length of the copper wires diminished; the wire at the same time for quantity being much thicker. The quantity armature contains only 40 yards of wire.

TO ADJUST THE QUANTITY ARMATURE AND EXHIBIT THE SPARK.

A, Fig. 44, the magnetic battery, D, the armature, and F G, two coils of copper wire containing 20 yards each. Care must be taken that the spring separate from the break at the same time that the armuture is vertical, being then in a neutral position as respects the poles of the battery.

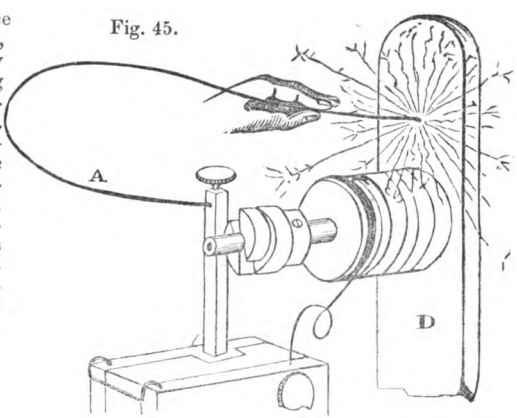
Fig. 44.



TO SCINTILLATE IRON WIRE.

Connect one end of a piece of iron wire with P, Fig. 45, pressing the other end gently on the surface of the rotating armature, and brilliant scintillations will be obtained. This effect cannot be produced by any magnetic machine unless it be constructed similarly to E. M. Clarke's; the effect depending upon the wires being *soldered* to the armature; whereas, in other armatures the wire is insulated throughout.

Fig. 45.



TO MAKE PLATINA WIRE RED-HOT.

Fig. 46.

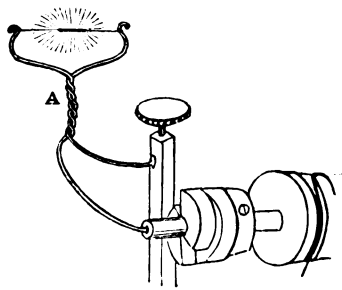
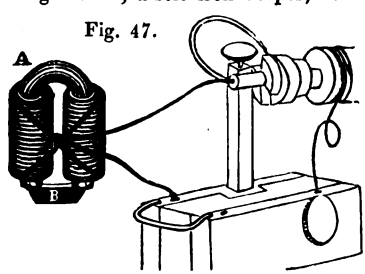


Fig. 46 shows the arrangement for this purpose, A being placed in contact with P and H. Whilst the platina wire is red-hot, ether may be inflamed, gunpowder exploded, and other experiments of a similar nature be performed.

TO RENDER SOFT IRON MAGNETIC.

Fig. 47. A, a piece of iron bent as in the figure. B, a soft iron keeper, which adheres to the iron on the connexion being made as represented, so long as the machine is in action.

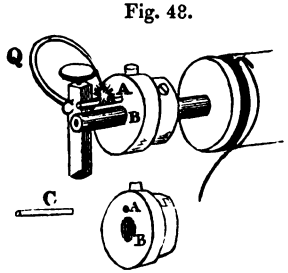
Fig. 47.



TO OBTAIN SPARKS OF VARIOUS COLOURS BY THE USE OF DIFFERENT METALS.

Remove the break, and substitute the brass piece B, Fig. 48. Into the small hole insert a piece of wire C, of any metal, for instance gold. Let the extremity of the spring Q be also of gold. On rotating the machine, sparks of purple colour will be obtained.

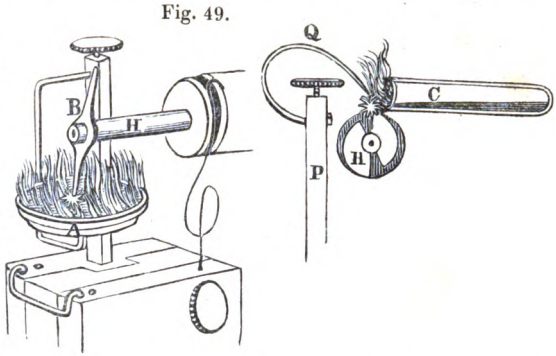
Fig. 48.



TO EXEMPLIFY THE DISADVANTAGES ATTENDING THE MERCURY FLOOD.

Remove the break, and fix the double-blades B, Fig. 49, in its place. Adjust the brass cup A so that the point will leave the surface of the mercury when the armature is vertical. The brilliancy of the spark, as thus obtained, appears much greater than it is in reality, the additional brightness being occasioned by reflection from the surface of the mercury. It is almost unnecessary to point out the evil that arises from the scattering of the mercury, not only in point of cleanliness, but expense. A little ether, spirits of wine, or naphtha being poured on the mercury, is readily inflamed. The same experiment may be satisfactorily performed, by pouring any of those liquids into a test tube C, and holding it over the break. The vapour will speedily be ignited by the magnetic spark.

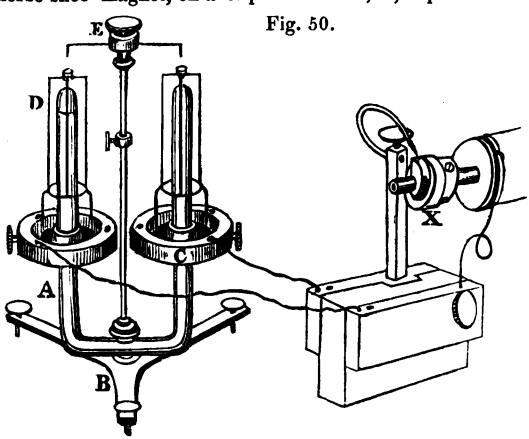
Fig. 49.



TO PRODUCE ROTATION BY MAGNETIC ELECTRICITY.

Fig. 50. A, a vertical horse-shoe magnet, on a tripod stand B ; C, improved flood-cups ; D, the wire frames, having two little cups at top to hold a drop of mercury ; E, a connecting fork. Mercury being poured into the flood cups C, and the single break X being used, on placing the connecting wires as in the figure, continuous rotatory motion will be produced by this arrangement, the current being constantly in the same direction. But the experiment may be varied by substituting the double break H, (fig. 88, page 75,) the currents now alternating.*

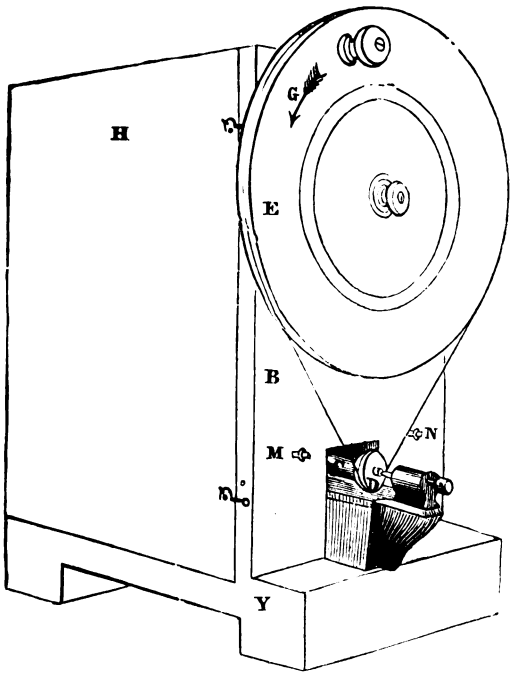
Fig. 50.



* A singular fact connected with this experiment is the rotation of the two wire frames in the same direction, owing to the passages of the electricity from one of the wire frames into one pole of the magnet, and then from the other pole of the magnet down the other frame.

Fig. 51, shows the compactness of the machine. H, a mahogany case sliding on the bottom board Y, which locks against the back-board B. The multiplying wheel is to be turned in the direction of the arrow G. D, the pulley, and C the mandril that carries the armatures.

Fig. 51.



E. M. Clarke on the occasion of his last visit to Paris, had the honour to exhibit the effects of the magnetic machine which forms the subject of the present paper, to several of the French *savans*, all of whom were pleased to express their unqualified approbation. M. le Baron Séguier brought the inventor to the French Institute, accompanied by M. Chevallier. Amongst others present, during the exhibition of the machine, were MM. Melloni, Dulong, Savary, Becquerel, and others. Professor Arago, who was that day officially engaged, having heard the result of the experiments with the machine, requested the inventor to attend the day following at the Observatory, which he did; and that learned Professor also expressed his satisfaction. On the day following, in consequence of a note received from M. Pouillet, he attended at the Conservatory of Arts and Sciences, when that learned Professor, who of course, was well acquainted with the previous magnetic machines, as Pixii's, Newman's (the name by which Saxton's machine is known on the Continent,) &c. gave the decided preference to E. M. Clarke's arrangement; in proof of which, he was pleased to direct that one should be constructed for the Conservatory of Arts, and another to be deposited in the cabinet of his royal pupil, the Duke of Orleans.

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CONTENTS.