

Descriptive catalogue of magnetic, electro-magnetic, electro-dynamic, and magneto-electric inductive instruments and apparatus : constructed and sold by Watkins and Hill, 5 Charing Cross, London.

Contributors

Watkins and Hill.

Publication/Creation

[London] : [R. and J.E. Taylor], [between 1837 and 1851]

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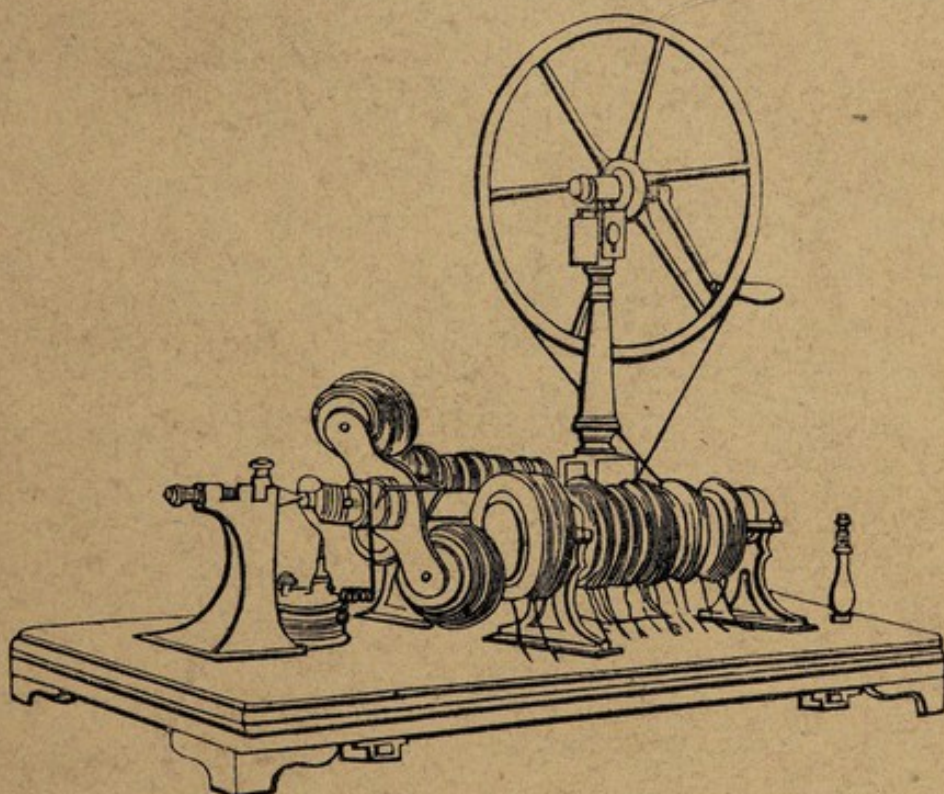
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DESCRIPTIVE CATALOGUE
OF
MAGNETIC,
ELECTRO-MAGNETIC, ELECTRO-DYNAMIC,
AND
MAGNETO-ELECTRIC INDUCTIVE
INSTRUMENTS AND APPARATUS
CONSTRUCTED AND SOLD BY
WATKINS AND HILL,
5 CHARING CROSS, LONDON.



MAGNETO-ELECTRO INDUCTIVE MACHINE.

Illustrated by Ninety-six Engravings.

Price Sixpence.

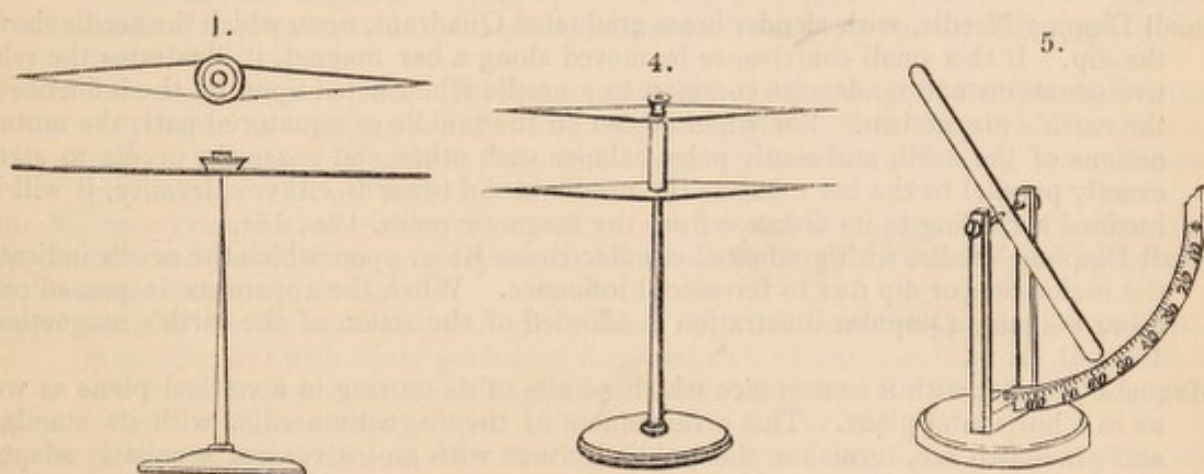
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DESCRIPTIVE CATALOGUE
OF
MAGNETIC, ELECTRO-MAGNETIC,
ELECTRO-DYNAMIC, AND
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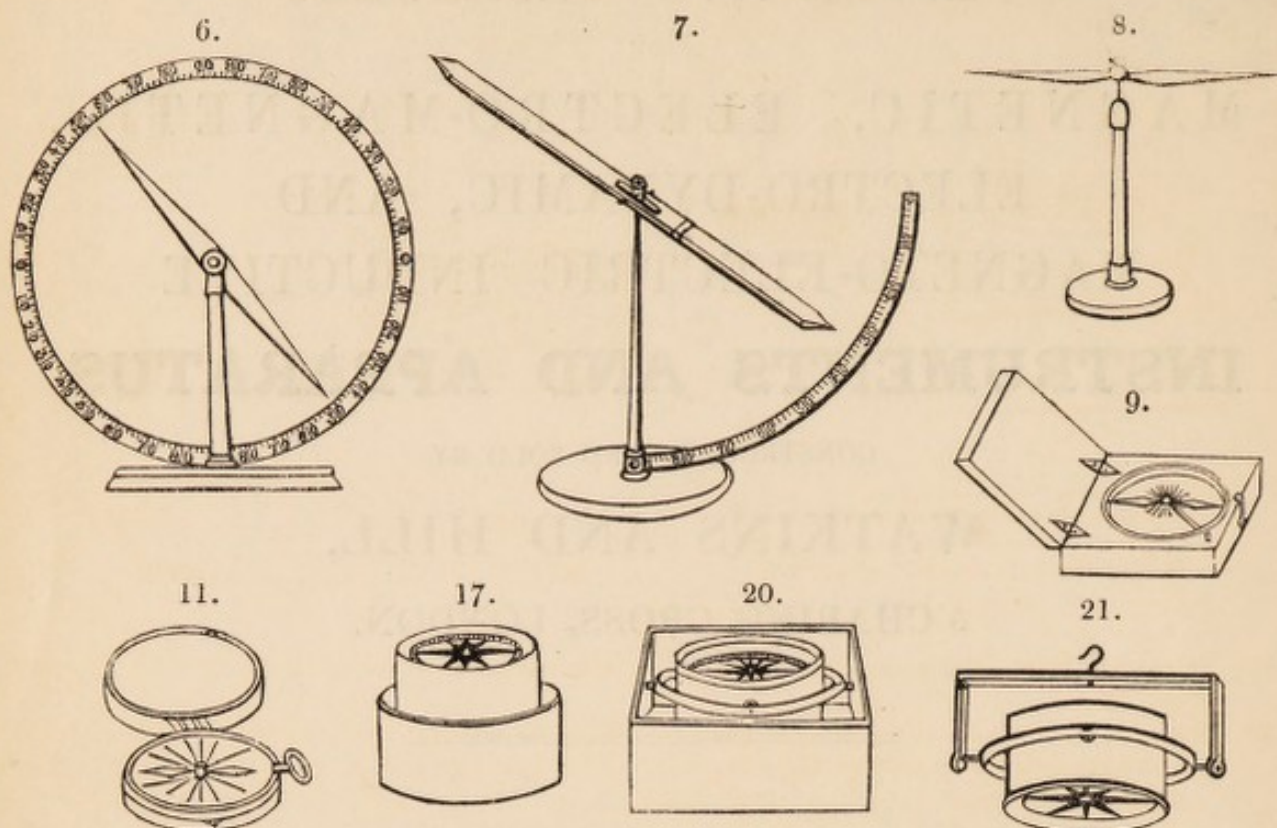
CONSTRUCTED AND SOLD BY
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MAGNETICAL INSTRUMENTS.

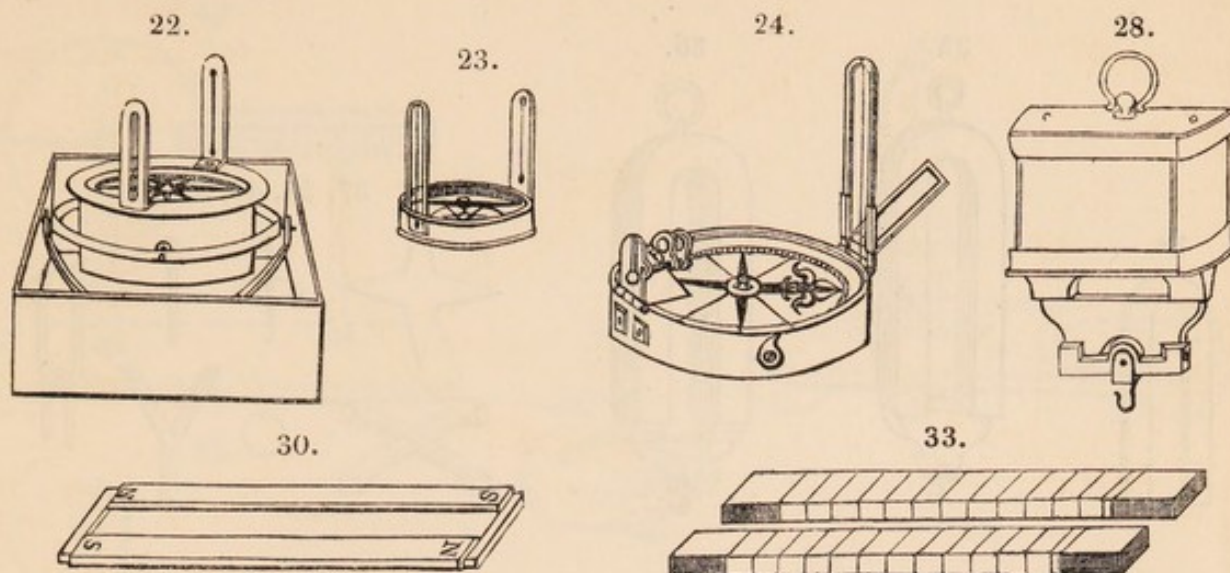


Instruments classed under the foregoing head are employed to exhibit magnetic phenomena, whether produced naturally or artificially; but more especially their relation in respect to each other, and their reciprocal action, and the direction they assume when freely suspended.

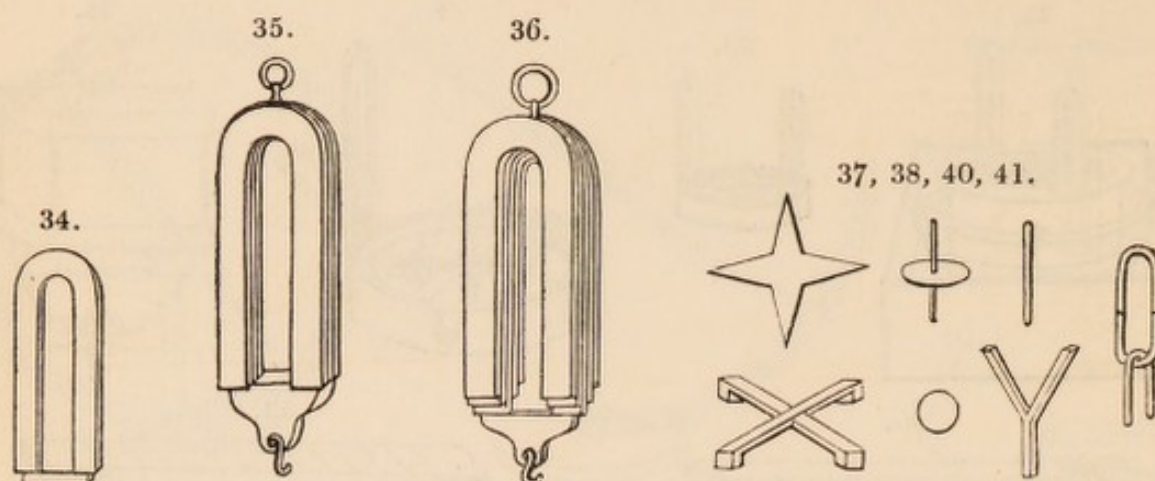
1. Magnetic Steel Needles of various lengths and forms, mounted with central hard metal caps for suspending on pointed stands, for the purpose of illustrating the influence of terrestrial magnetism as regards the horizontal directive force, also the polarity of a magnetic body, by its attractive and repulsive qualities in relation to similar and dissimilar poles, 5s., 7s. 6d., 10s., 15s.
2. Horizontal Steel Bar Needles, prepared for delicate magnetic investigations. These needles are constructed of various shapes and dimensions, mounted with central agate or ruby caps, and every precaution taken in selecting the finest quality of steel for their construction, and its treatment afterwards, in the formation of the needles, also in the method employed in the magnetisation.
3. Brass Stand, with fine steel point for the suspension of horizontal Magnetic Needles, 2s. 6d. to 6s.
4. Pouillet's Astatic Needle, composed of a pair of Steel Needles alike in their form and magnetic intensity, arranged parallel one above the other on a common centre of motion with the similar magnetic poles in opposite directions, by which means the directive tendency of the earth's magnetism is nearly neutralised if not overcome, 7s. 6d. to £1 1s.



5. Small Dipping Needle, with slender brass graduated Quadrant, upon which the needle shows the dip. If this small contrivance be moved along a bar magnet, it illustrates the relative situations and tendencies common to a needle when acted upon by the influence of the earth's magnetism. For when placed on the middle or equatorial part, the mutual actions of the north and south poles balance each other and cause the needle to stand exactly parallel to the bar; but as the needle is slid towards either extremity, it will be inclined according to its distance from the magnetic poles, 12s., 18s.
6. Small Dipping Needle, with graduated circular Brass Ring, upon which the needle indicates the inclination or dip due to terrestrial influence. When the apparatus is passed over a bar magnet, a popular illustration is afforded of the action of the earth's magnetism, 18s., £1 1s.
7. Magnetic Needle, with a contrivance which admits of its moving in a vertical plane as well as in a horizontal plane. This arrangement of the magnetic needle, with its standard and graduated arc, furnishes the public lecturer with an instrument peculiarly adapted for the illustration of the real influence of terrestrial magnetism upon magnetic bodies, having free motion in all directions, £1 1s. to £1 5s.
8. Magnetic Needles, mounted on stands, for ascertaining the polarity of mineralogical specimens, 5s.
9. Pocket Compass, in square or circular wood case, with and without lever stop to the magnetic needle, 3s. 6d. to 10s.
10. Pocket Compass, in circular brass box, with pull-off top, with and without lever stop to the magnetic needle, 3s. to 15s.
11. Pocket Compass, mounted in gilt or electrum metal case, with and without lever stop to the magnetic needle. Morocco case, 9s. to £1 1s.
12. Pocket Compass, in best gilt metal case, enamelled dial, and lever stop to agate cap magnetic needle. Morocco case, 16s. to £1 16s.
13. Pocket Compass, in best silver case, enamelled dial, and lever stop to agate cap magnetic needle. Morocco case, £2 2s. to £3 13s. 6d.
14. Pocket Compass, mounted in gilt metal hunting case, with full divided enamelled dial, and lever stop to agate cap magnetic needle. Morocco case, £2 12s. 6d., £3 3s.
15. Pocket Compass, mounted in silver hunting case, with full divided compass, enamelled dial and lever stop to agate cap magnetic needle. Morocco case, £3 13s. 6d. to £4 14s. 6d.
16. Trinket and Seal Compass, in metal gilt, silver or gold case, 7s. 6d. to £2 2s.
17. Two-inch Brass Boat Compass, with nautical floating card in circular wood case, 13s.
18. Two-inch Boat Compass, with nautical floating card in brass box with gymbals, 13s.

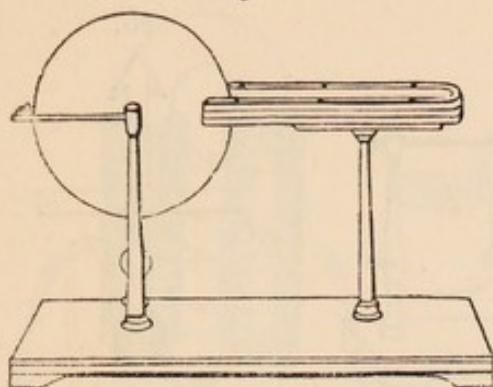


19. Two-inch Boat Compass, with nautical floating card, in silver plated box with gymbals £1 5s.
20. Sea or Steering Compass, with the needle affixed to floating card, on the surface of which is engraved the points of the compass. The floating card is suspended upon a point fixed in the bowl which is itself hung in gymbals in a wooden square box, £1 5s., £1 10s. to £4 4s.
21. Hanging or Cabin Compass. In this compass the bowl is hung up with the face downwards and the magnetic floating card with engraved points of the compass, is suspended upon a point attached to the glass. This compass is furnished with gymbals, £1 16s. to £3 3s.
22. Marine Azimuth Compass. This instrument differs from the ordinary Mariner's compass, only in the circumference of its inner box being provided with sights for determining the angular distances of objects from the magnetic meridian and being hung in detached gymbals, £2 12s. 6d. to £15 15s.
23. Military Compass, consisting of a small cylindrical brass compass box, a floating magnetic card and two folding open sights, with horse-hair lines for determining horizontal angular distances, £2 12s. 6d.
24. Horizontal Surveying Compass. It consists of a circular brass compass box, floating magnetic card with silver graduated ring and two folding sights; that one towards the eye being furnished with a triangular prismatic lens; and the other, an open sight, with a hair line in its centre. With a morocco case, £4 14s. 6d.
25. Kater's Azimuth Compass, with floating magnetic card and folding sight. This instrument is very portable and well adapted for the purpose of estimating angular distances, whether at sea or on land, £2 12s. 6d.
26. Miner's Compass. This instrument consists of a large engraved compass dial with best mounted magnetic needle, and a pair of folding sight frames with horse-hair lines for taking horizontal angles; contained in a mahogany case, with a moveable cover upon hinges, £1 11s. 6d. to £2 12s. 6d.
27. Superior Miner's Compass, with best magnetic compass, sight frames, cross levels, telescope and mahogany staff, £7 7s., £10 10s.
28. Loadstone or natural Magnet, mounted with soft iron cheeks for concentrating the magnetic power, and with a soft iron armature for increasing the means of sustaining weights. The armature is also useful in preserving the magnetic virtue in the loadstone when not in operation, £1 5s., £3 3s. to £10 10s.
29. Sliced pieces of Loadstone or natural Magnet, 1s. 6d. to 7s. 6d.
30. Bar Magnets. These instruments are adapted for the experimental elucidation of that peculiar property conferred on bodies essentially composed of iron, whereby, under certain circumstances, they acquire the powers of polarity, attraction of unmagnetic iron, attraction and repulsion of magnetic iron, and the influence of inducing magnetism in other iron not previously magnetic; single, and in pairs, 1s., 2s. 6d., 3s. 6d., 5s., 7s. 6d., 10s., 15s. to £2 2s.
31. Bar Magnets of cylindrical steel, for sustaining rotating apparatus, or revolving on their

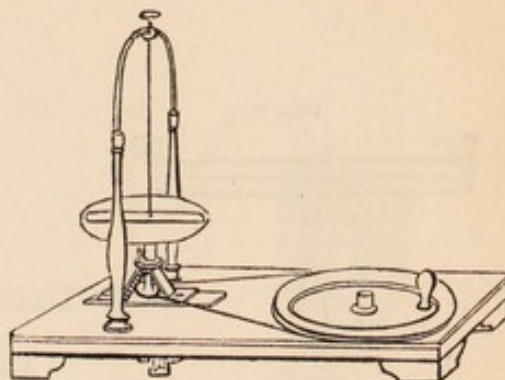


- axis, or inserting within hollow wire coils to illustrate the elementary experiments on Magneto-Electricity, 5s., 7s. 6d., 10s., 15s.
32. Magazine or Battery of straight bar Magnets, combined together by screws or otherwise; a useful arrangement for impregnating other bars with the magnetic virtue, £1 1s. to £3 3s.
33. Scoresby's Magnets, composed of many magnetised laminated steel plates, combined together so as to act uniformly as one bar; by which means a powerful magnetic arrangement is obtained, 15s., £1 1s., £2 2s.
34. Horse-shoe Magnets. In this form of the artificial magnet both poles are brought near to each other, and the extremities being made smooth and furnished with an armature, the magnet under these conditions acquires an increased power of sustaining weights, 1s., 2s., 4s., 5s., 7s. 6d., 10s., 15s. to £1 1s.
35. Compound Horse-shoe Magnet or Battery of single horse-shoe magnets held together by screws or other contrivances. The association of several bars in a set mounted with an appropriate armature, greatly increases the magnetic power, not only for suspending weights but also the capability of making other magnets, 15s., £3 3s., £5 5s., £10 10s.
36. Magnetic Magazine or Battery, composed of an odd number of horse-shoe bars of different lengths. The union of unequal bars produces a step-like arrangement at the poles, the longest bar being in the centre, with the pair of bars next longest on each side, and so on progressively. This peculiar arrangement of magnetic battery possesses several advantages, particularly when employed in the process of magnetisation. The soft iron armature accords in thickness with the central bar, £4 4s. to £10 10s.
37. Circular and Star Discs of soft plate iron, for illustrating the distribution of magnetism on ferruginous bodies. When the pole of a magnet is placed on or near the centre of the discs the extremities exhibit dissimilar polar states to that developed at the centre, 2s. to 10s.
38. Slender Cylindrical Rods and half links to form a chain of soft iron of various dimensions, to illustrate that inductive influence renders soft iron a temporary magnet, while in approximation with a permanent steel magnet, per dozen, 3s. 6d., 5s., 7s. 6d.
39. Flat Steel Bars, straight and circular, to illustrate the effect of division and fracture in the distribution of magnetism. When the magnetic bars are suddenly separated in the centre or a portion broken off from either end each piece will be a complete magnet.
40. Robinson's forked or Y-shaped soft iron armature, for demonstrating the neutralization or destruction of induced magnetism by two equal and opposite magnetic actions. If one branch be suspended to a pole of a horse-shoe magnet, the lower end of the fork will attract and support a piece of iron; but if both branches of the fork be applied to both poles of the magnet, the attractive power of the lower end is neutralised or destroyed, for it no longer suspends the piece of iron, 2s., 5s.
41. Armature consisting of a cross bar of soft iron which, when attached by attraction to the pole of a permanent magnet, suspends soft iron balls at each end of the bar and exhibits a pleasing variety in magnetic inductive phenomena, 2s. 6d., 5s., 7s. 6d.
42. Soft iron Cylindrical Armature, which, when placed upon an inclined horse-shoe magnet, descends by its own weight, rolls over the face and partially ascends again on the under side, 10s. to £1 1s.

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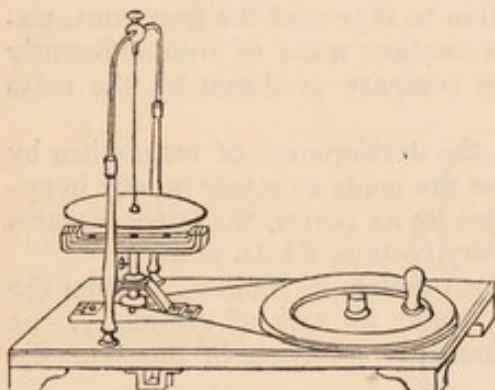
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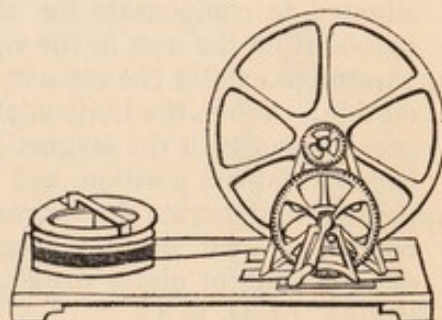
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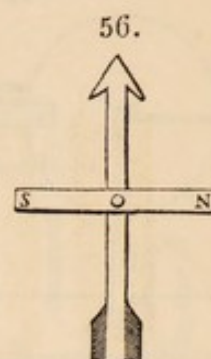
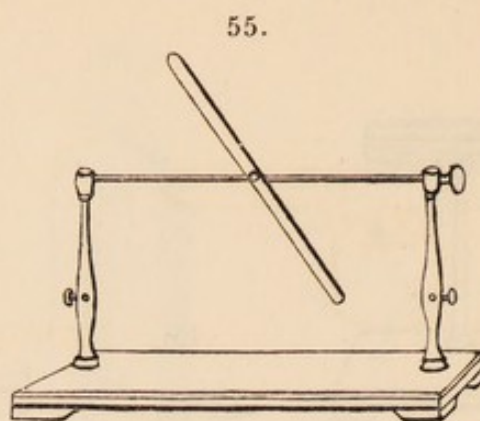
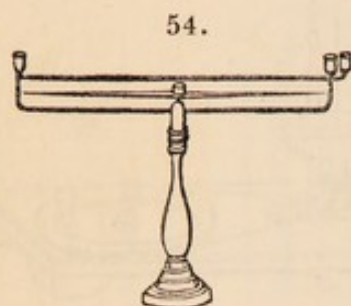
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43. Clean pieces of soft iron, varying in form to exhibit the effects of induction produced by permanent steel magnets on ferruginous bodies, not magnetic. Spinners, 2s. Slender cylindrical rods, 1s. Rings, 3d. Polished balls, 1s. Half links, 3d. Cubes.
44. Gratings for sifting soft iron filings on paper or glass discs placed over the poles or centres of action of a magnetic bar, to exhibit the beautiful and systematic arrangement of the magnetic curves, 4s. 6d., 5s. 6d.
45. Hollow japanned floating figures representing fishes, ships, mermaids, aquatic birds, etc. The hollow figures when floating on water illustrate in a simple and pleasing manner magnetic attraction and repulsion upon the application of a small bar magnet, 6d. to 5s.
46. Pith figures of Men and Women, with a soft iron wire passed vertically through the centre of the figure, to illustrate in a pleasing manner magnetic attraction, 2s. 6d., 5s.
47. Assortment of Magnetic Apparatus, consisting of permanent steel magnets, to show attraction and repulsion. Soft iron balls, rings, cylindrical rods, swans and fishes to illustrate the action of the magnet on ferruginous bodies. Horizontal and dipping needles to exhibit their magnetic directive polarity and inclination or dip. With this apparatus many interesting experiments may be performed to elucidate the facts in magnetic science, £2 2s., £3 3s.
48. A Set of Magnetical Apparatus on a more extended scale, for illustrating the leading facts in magnetism, by a series of interesting and instructive experiments. The set consists of steel bar and horse-shoe magnets, to show the attractive and repulsive qualities of magnetic forces. Pieces of soft iron, varying in form and dimensions, to demonstrate the inductive action of magnets on ferruginous bodies, not magnetic. Mounted magnetic needles to show the horizontal directive force and the inclination or dip produced by terrestrial magnetism, £5 5s. to £10 10s.
49. Sturgeon's Magnetometer, for showing the magnetic properties of different metals in motion. It consists of a circular copper and zinc disc, each with an axis in its centre formed so as to play freely when laid on the arms of the brass column. A small weight or bob being attached to the lower edge, the discs vibrate in their own plane, and the apparatus illustrates the difference between the number of oscillations made when the vibrations are between the poles of a horse-shoe magnet and when the magnet is not present, £2 2s.
50. Apparatus to illustrate Barlow's correcting plate or magnetic compensator for neutralising the effect of local attraction on the ship compass. The apparatus consists of a magnetic



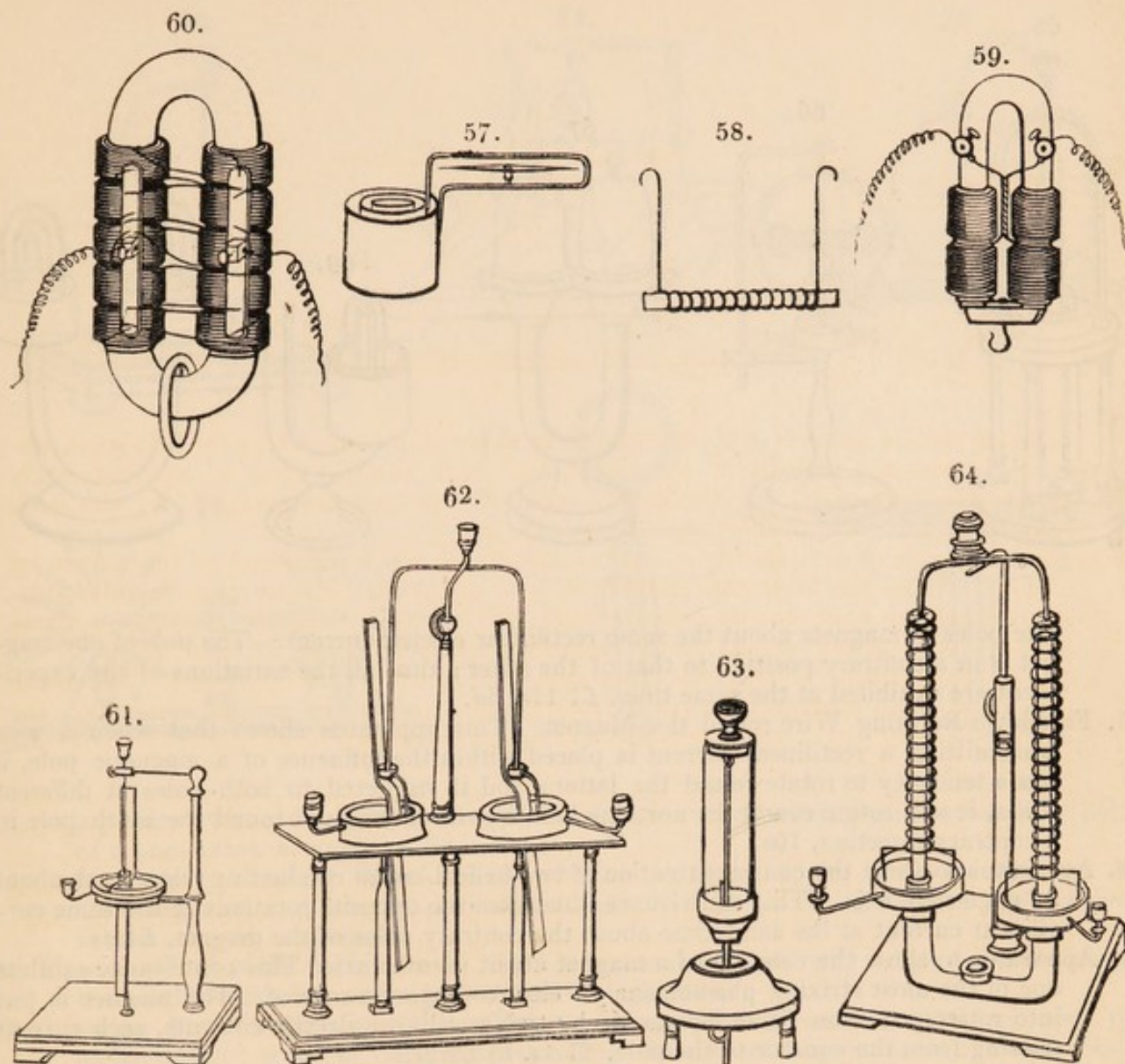
compass with a piece of soft iron placed in a position to represent the iron guns, anchors, cables and utensils of the vessel, etc., with another mass of iron differently situated to compensate for the derangement of the compass produced by the mass representing the iron in the vessel, £3 3s., £5 5s.

51. Apparatus to exhibit the capacity of various metals for the development of magnetism by motion. When the horizontal metallic discs or plates are made to rotate rapidly in approximation with the magnetic needle freely suspended by its centre, the latter deviates from its natural position, and finally assumes a rotatory motion, £3 3s. to £5 5s.
52. Apparatus to illustrate the magnetic properties of different metals by motion. When the compound bent magnet is made to rotate rapidly about its axis of symmetry, the circular discs or plates suspended above the poles commence revolving in the same direction, £4 4s. to £7 7s.
53. Harris's Apparatus to illustrate the transient magnetic state induced upon metallic substances, and also to exhibit the influence of screens of different metals in arresting the progress of magnetic induction. The apparatus is furnished with a contrivance for experiments in the air and in vacuo. The discs of various metals may be made to rotate beneath magnetic bars, or vibrate about them, and the converse experiments, the magnetic bars to vibrate and rotate above metallic discs, £10 10s. to £18 18s.

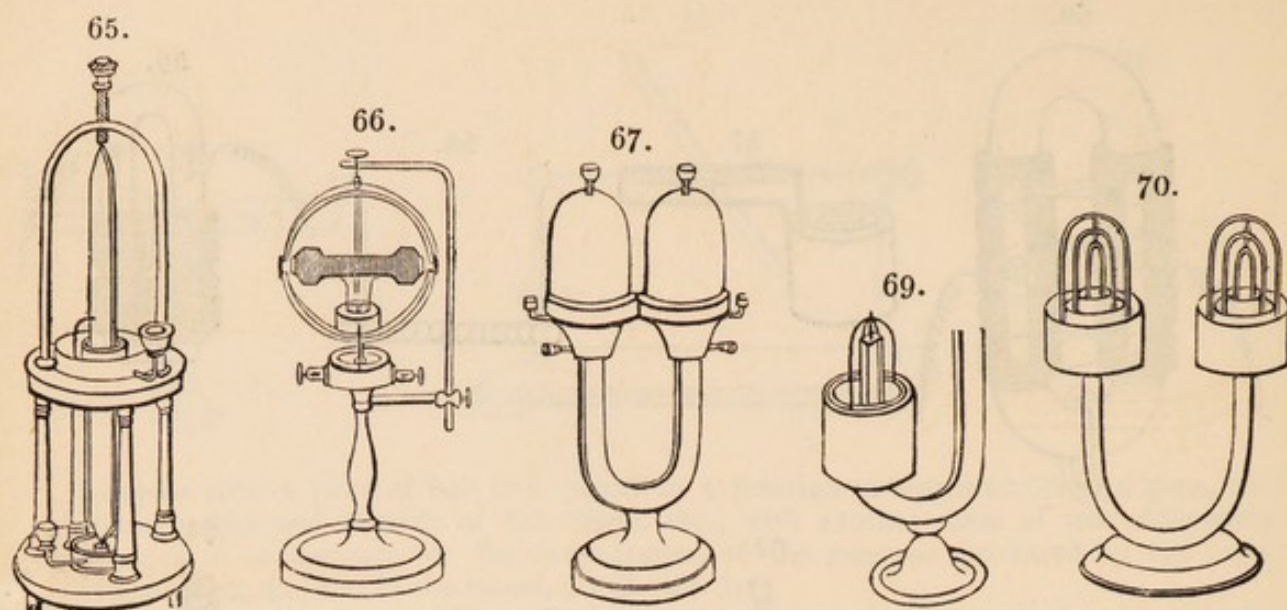
ELECTRO-MAGNETIC, ELECTRO-DYNAMIC, AND MAGNETO-ELECTRIC INDUCTIVE INSTRUMENTS AND APPARATUS.

Instruments and Apparatus thus denominated are employed for the exhibition of the relation which subsists between Magnetism and Electricity; to illustrate the phenomena produced by their combined action and the power each possesses of inducing the principle opposite to itself.

54. Apparatus to show Ørsted's experiments. By means of this contrivance the deflection of the magnetic needle from its natural position (when opposed to a straight portion of a connecting wire) is conveniently shown, whether the *electric current* be transmitted either above or below the needle. The arrangements are such, that nothing more is necessary than to remove the connecting wire from one cup to another, when it will be seen that in every case the magnetic needle has a tendency to form a right angle with the wire transmitting the *current* of electricity, 13s.
55. Apparatus to exhibit Ørsted's elementary fact in Electro-magnetism. It consists of a horizontal metallic wire capable of being turned on its axis while forming part of the conjunctive wire of a voltaic battery. The magnetic needle is attached to the wire with free motion in a plane parallel with it, so that when the electric current pervades the wire, the deflection of the magnetic needle will be the same in all positions of the revolution of the wire on its axis, 18s.
56. Wooden model to illustrate in a familiar manner the relative positions of the magnetic needle and electric current. The arrow represents the current, and the cross piece the magnet, 3s. 6d., 5s.

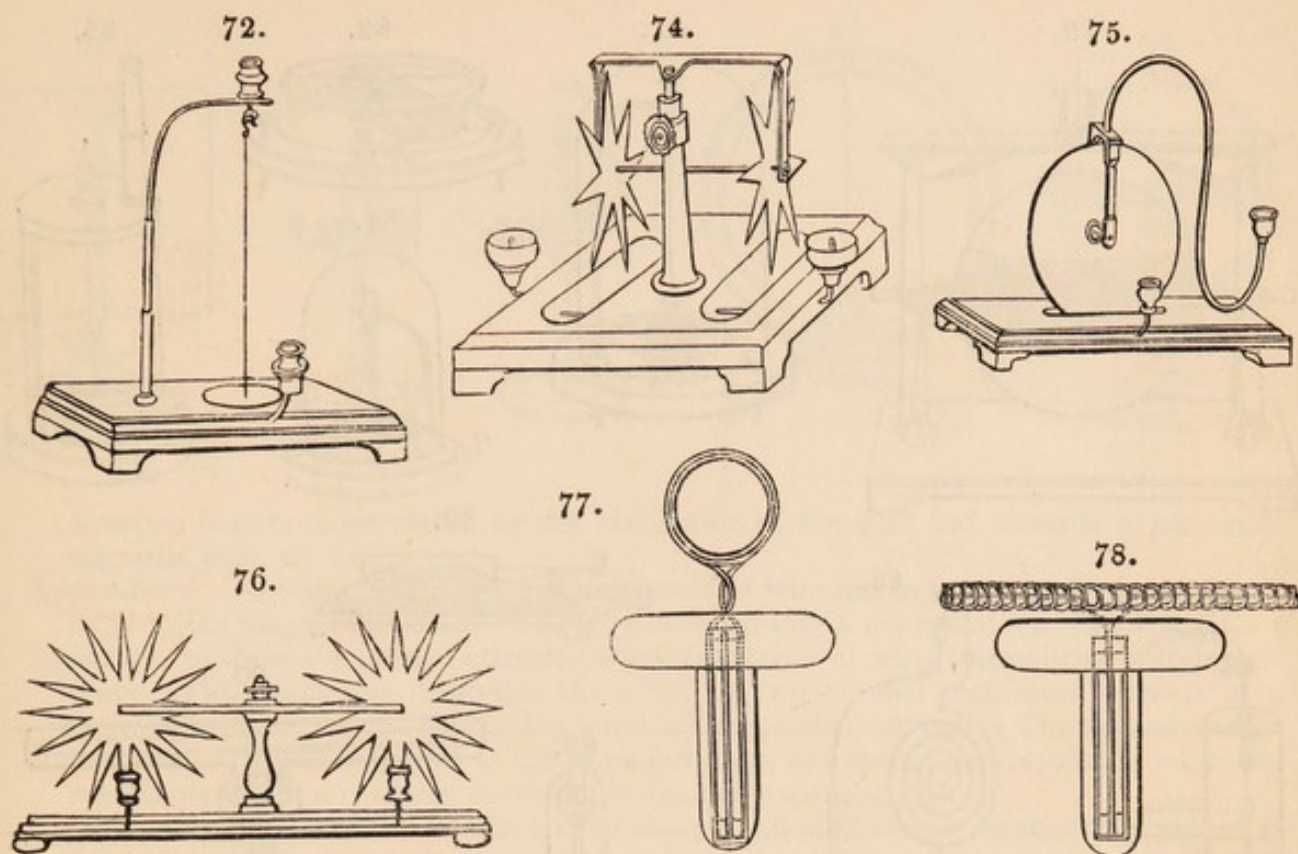


57. Small Cylindrical Voltaic Battery, with fixed bent connecting wires, for illustrating the elementary experiments of electro-magnetic science. When the magnetic needle plays freely between the bent arms of the wire and the battery is excited, the electro-magnetic effect is manifested by the deflection of the needle. The advantage of this combination consists in avoiding the use of mercury and the amalgamation of wires, 10s. 6d.
58. Glass Tube and a copper wire coiled round it for magnetizing steel needles, by the induction of an electric current, 2s. 6d.
59. Apparatus to show the magnetic powers acquired by a thick cylinder of soft iron (bent into the form of a horse-shoe), surrounded by a coil of copper wire transmitting an electric current. The properties of voltaic electrical induction are strikingly made manifest by this apparatus; for when the electric current traverses the copper wire the cylinder of soft iron becomes a magnet; but when the current no longer pervades the copper coil, and the armature is removed, the soft iron loses altogether its transient powers, and resumes its pristine indifference, 3s. 6d., 5s., 6s. 6d., 15s., £1 10s.
60. Apparatus of larger dimensions to illustrate the magnetic force which soft iron exerts when under the influence of electric currents. It consists of a stout horse-shoe cylinder of soft iron, surrounded by many strands of insulated copper wire in short lengths. When the electric current is passing, the iron becomes powerfully magnetic, and supports by its armature many hundred pounds weight. The armature is supplied with a swivel hook or oval loop for the purpose of hanging on the weights, £3 3s., £5 5s., £6 6s.
61. Apparatus to show the continued revolution of one pole of a magnet about a vertical wire transmitting a rectilinear current. The direction of rotation may be reversed by simply changing the direction of the electric current, £1 1s.
62. Apparatus with Two Magnets. This instrument shows the opposite rotations of the oppo-



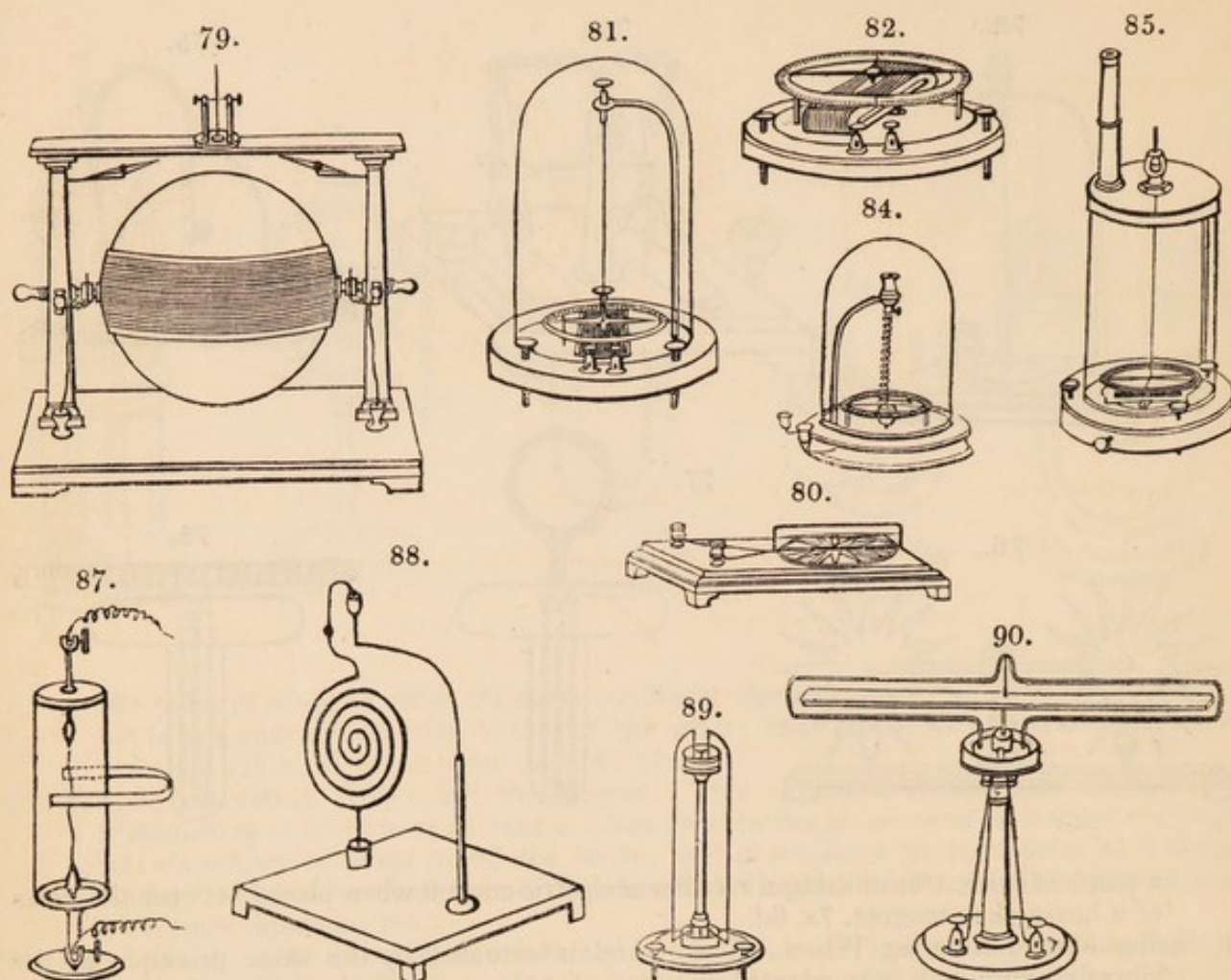
site poles of magnets about the same rectilinear electric current. The pole of one magnet is in a contrary position to that of the other; thus all the variations of the experiment are exhibited at the same time, £1 11s. 6d.

63. Faraday's Rotating Wire round the Magnet. This apparatus shows that when a wire transmitting a rectilinear current is placed within the influence of a magnetic pole, it has a tendency to rotate round the latter; and if subjected to both poles at different times, it will rotate round the north pole in one direction, and round the south pole in a contrary direction, 10s.
64. Apparatus to show the contrary rotation of two helical-coiled conducting wires, each about its respective axis. This contrivance illustrates the opposite rotations of the same curvilinear current at the same time about the contrary poles of the magnet, £1 4s.
65. Apparatus to show the rotation of a magnet about its own axis. This contrivance exhibits one of the most striking phenomena in electro-magnetic science. The magnet is put into rotatory motion either by one or by two rectilinear electric currents, each current passing from the equator to the pole, £1 1s. to £2 2s.
66. Apparatus to show the simultaneous rotation in opposite directions of a hooped permanent steel magnet with a straight electro-magnet. The electric current passes through the lower mercury trough previous to its entering into the upper, which is in communication with it. The two species of magnets being suspended on the same spindle rotate in opposite direction, £1 4s.
67. Apparatus to exhibit the rotation of two hollow metallic cylinders about the poles of a magnet when an electric current flows through the cylinders. If it be conceived that the cylinders consist of an infinite number of bent wires, this apparatus exhibits the rotations of wires (transmitting rectilinear electric currents) upon their axis, £1 11s. 6d.
68. Rotating Cylindrical Battery, as improved by Marsh. By means of looped wires the copper and zinc elements of the combination have the power of turning round their own centres independently of each other. The apparatus (when in action and placed upon the pole of a magnet) exhibits the rotation of the zinc part in one direction, and the copper in the contrary, 6s.
69. Rotating Cylindrical Battery, as improved by Marsh, mounted on a horse-shoe magnet, with brass foot, for showing the above-described phenomena, 15s.
70. Apparatus consisting of two Ampère's Rotating Cylindrical Batteries, mounted on a horse-shoe magnet, supported by a brass foot. This arrangement of apparatus exhibits the whole of the phenomena on both poles of the magnet at the same time, £1 4s.
71. Rotating Cylindrical Battery, composed of *cast* zinc troughs with *rolled* zinc slips suspended by separate looped wires on the poles of a horse-shoe magnet, mounted upon a brass foot. When diluted acid is placed in the troughs they rotate in one direction, and the slips in the contrary direction, showing voltaic-electric action evolved by two pieces of the same metal, but with different surfaces, £1 4s.
72. Vibrating Wire. This apparatus shows the vibratory or jumping motion communicated to



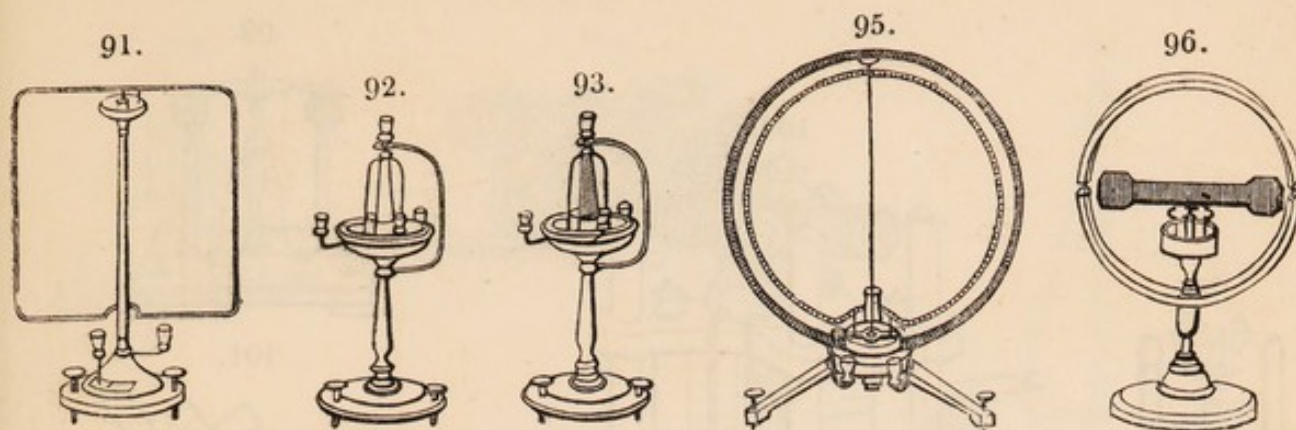
a pendent wire, transmitting a rectilinear electric current when placed between the poles of a horse-shoe magnet, 7s. 6d.

73. Stellar-formed Rotating Wheel. This wheel is actuated by the same principle as the vibrating wire, and is so adapted as to transfer the reciprocating vibratory into a continued rotatory motion, 18s.
74. Double Wheel of the Stellar form. This instrument acts precisely in the same manner as the single wheel, but rather to better advantage, £1 4s.
75. Rotating Metallic Circular Disc. This contrivance has a decided advantage over the stellar-formed wheel of Barlow, inasmuch as the contact is never broken in the revolution, the periphery being uninterrupted, 15s.
76. Apparatus to illustrate the contrary rotatory motion communicated to electrified stellar wheels when under the influence of horse-shoe magnets. When the electric current is established through the apparatus and magnets properly arranged, the wheel nearest the minus extremity revolves in one direction, and the wheel nearest the plus extremity revolves in a contrary direction, £1 4s.
77. Floating Battery. This small voltaic combination, when floating on water, clearly points out that the connecting or electrified wire has, during the interval of transmission, a tendency to place itself at right angles to the magnetic meridian. It likewise exhibits some curious phenomena by the influence of an artificial magnet, 5s.
78. Floating Battery, with elongated Helical Coil. This apparatus shows that voltaic magnets possess similar properties with those of ordinary magnets, 5s.
79. Apparatus to illustrate the probable electric origin of all the phenomena of terrestrial magnetism. It consists of a distribution of wires over an artificial globe in parallel lines of latitude, etc. When an electric current pervades the wires, a magnetic needle, freely suspended above the globe, arranges itself in a plane passing from pole to pole through the centre, and takes different angles of inclination according to its situation between the equator and either pole, £3 13s. 6d., £4 14s. 6d.
80. Magnetic Galvanometer for measuring feeble electric forces, consisting of a rectangular frame of coiled insulated wire, within which is suspended on a point, a magnetic needle surrounded by a graduated card in manner of the compass, on a mahogany base board, 7s. 6d., 10s. 6d.
81. Magnetic Galvanometer for estimating the force of feeble electric currents. It consists of rectangular frame, of many reduplications of very fine insulated wire, a silkworm thread suspension for the astatic needle, which plays within a graduated metallic ring, and a



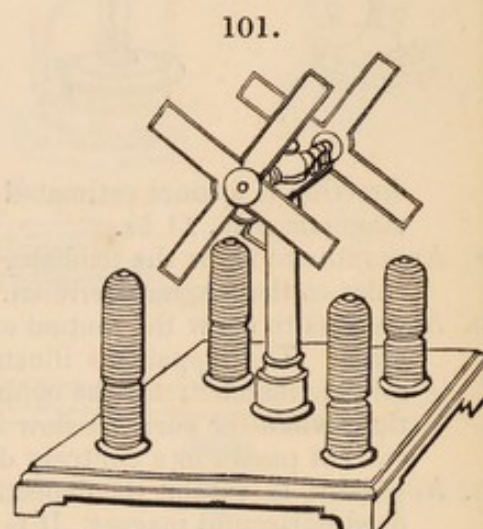
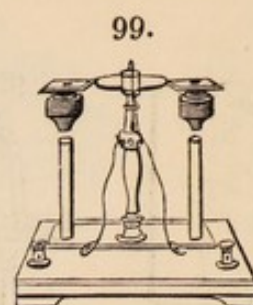
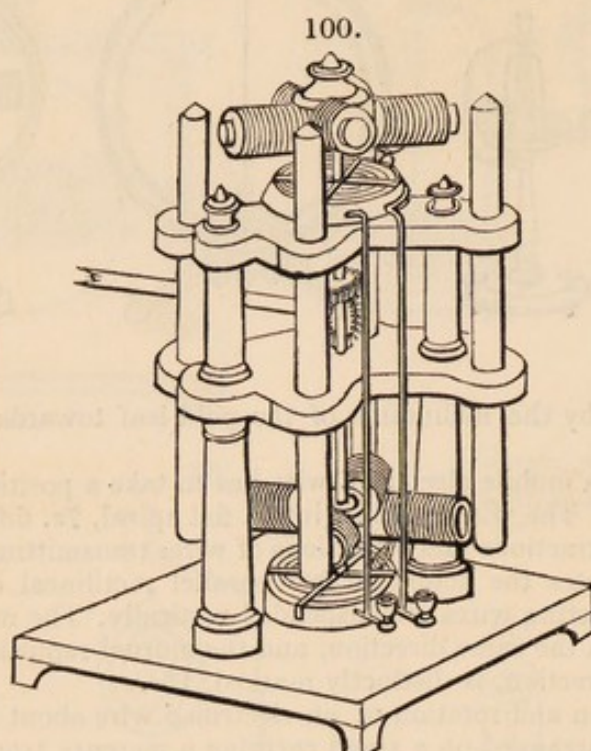
circular mahogany base fitted with three levelling screws. A glass shade covers the coiled frame, needle and support, £2 2s., £3 3s.

82. Large Magnetic Galvanometer, adapted for lecturing purposes, and yet sufficiently sensible to exhibit in a marked manner feeble voltaic electric action. The astatic needles are six inches long, suspended on a point, and vibrate on a graduated ring, attached to the rectangular coiled wire frame. The galvanometer is mounted on a firm circular mahogany base with levelling screws, £3 3s., £4 4s., £5 5s.
83. Magnetic Galvanometer, with a coiled frame of a short length of insulated wire for detecting, measuring and multiplying the effects of electric currents of low tension, 5s. 6d., 7s. 6d., 10s. 6d.
84. De la Rive's Calorific Galvanometer. This apparatus consists of a Breguet's metalline thermometer, with contrivances added for conducting a voltaic current through the vertical pyrometrical compound metallic spiral.
85. Melloni's delicate Magnetic Galvanometer, for measuring very feeble electric forces, fitted up with a reading microscope as suggested by Professor Wheatstone. The galvanometer consists of a heavy brass base with three levelling screws and a coil of insulated fine wire on a moving frame, by which means the layers of the coil may be arranged parallel to the astatic needle without at all disturbing its direction. The astatic needle is suspended from above by a film of silkworm thread with the necessary means of adjustment to allow perfect freedom of motion. The addition of the microscope is found of great utility in reading off minute deflections of the needle, which is performed with great facility and much more accurately than by any other method, £6 6s.
86. Melloni's delicate Magnetic Galvanometer complete, fitted up with the necessary care for accuracy, but without the reading microscope, £4 4s., £5 5s.
87. Cumming's gold leaf Galvanometer, consisting of a glass tube with a narrow slip of gold leaf enclosed within, and attached to metallic connexions at each end. When the arms of a horse-shoe magnet embrace the tube and a voltaic current is passed through the gold leaf slip, the indications become at once manifest by the flexure of the slip, and its



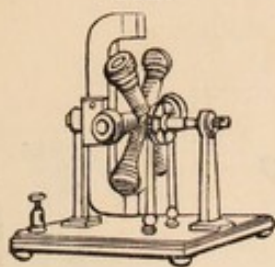
direction is at once estimated by the inclination of the gold leaf towards a particular magnetic pole, £1 5s.

88. Apparatus to show the tendency a mobile electrified wire has to take a position perpendicular to the magnet meridian. The wire is coiled into a flat spiral, 7s. 6d., 10s. 6d.
89. Apparatus to show the mutual attractions and repulsions of wires transmitting voltaic currents. This apparatus illustrates the action of two parallel rectilinear currents in a forcible manner; for the connecting wires are suspended vertically. The mutual attraction, when the currents flow in the same direction, and the mutual repulsion, when the current passes in a contrary direction, is distinctly marked, 15s.
90. Apparatus to exhibit the deflection and rotation of an electrified wire about the pole of a fixed horizontal magnet. It is arranged on a stand carrying a mercury trough with two separate compartments. A wire frame parallelogram is suspended on the bar magnet with its pendent ends dipping into the mercury trough. Deflection occurs when the electric current passes, and rotation is produced by making and breaking the battery contact in correspondence with the swing of the wire frame, 15s., £1 1s.
91. Apparatus to show the mutual attraction and repulsion of electric currents. It consists of a rectangular wire frame freely suspended on a vertical standard, with a contrivance for passing the electric current through the frame. If a magnet be brought near the sides of the electrified wire, attraction or repulsion will be the consequence, dependent upon the pole; approached also when another electrified parallel rectangular wire is approached, attraction or repulsion will be observed: for polarity is shown by the sides of wires, whereas in steel magnets it is exhibited at the ends, £1 11s. 6d.
92. Apparatus to show the mutual action of rectilinear and curvilinear currents. This contrivance shows that a mobile vertical connecting wire may be made to rotate by the influence of a fixed horizontal curvilinear connecting wire, 15s.
93. Apparatus to exhibit the continued rotation of a metallic wire whilst transmitting a rectilinear current by the action of a fixed wire transmitting a curvilinear current. The apparatus shows the fact in a decided manner, and the manipulatory process is very simple, 15s.
94. Very light hooped wire frames with platinum capsule for placing on the poles of a horse-shoe magnet to illustrate rotation produced by voltaic, magneto-, or thermo-electric currents, 5s.
95. Ritchie's Apparatus to illustrate continued rotation by the action of electric currents. This contrivance consists of two wire frames. One of the frames has the power of moving round on a vertical axis, and is placed within another frame which is stationary. There are arrangements, so that the direction of the current is changed in the mobile frame at the proper period; hence a continuation of alternate attractions and repulsions takes place in the currents, and by the disposition of the frames rotatory motion is the consequence, £1 5s.
96. Apparatus to exhibit the rotation of a long straight bar electro-magnet about its centre. This is effected by rapidly reversing the poles of the bar at a particular part in the apparatus, where the poles of two permanent steel magnets nearly approximate. The steel magnets are bent and form a circle, within which the long straight bar revolves, £1 10s.
97. Ritchie's Apparatus to exhibit the rotation of a straight bar electro-magnet about its centre, between the poles of a horse-shoe magnet. This is effected by rapidly reversing the poles

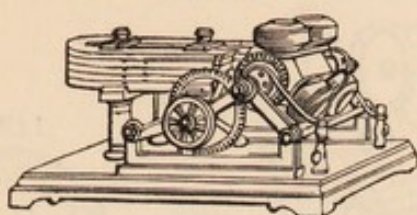


- of the bar at the proper period, attraction being then changed to repulsion: the revolution of the bar is continuous, 12s., 15s.
98. Ritchie's straight bar electro-magnet, to rotate between the poles of the permanent steel horse-shoe magnet; divided mercury chamber and mahogany standard, 7s. 6d.
99. Henry's Apparatus to illustrate reciprocating motion, produced by magnetic attraction and repulsion. It consists of a horizontal electro-magnetic beam poised upon a central axis, with two permanent magnets placed vertically, one under each pole; by a contrivance provided the polarity of the electro-magnet is made and reversed at proper periods, so as to produce vibrations in the beam, £2 2s., £2 12s. 6d.
100. Electro-Magnetic motive Model, consisting of vertical permanent steel magnets and horizontal soft iron electro-magnets, with contrivances on the main spindle for reversing the directions of the currents, and thus to produce rotatory motion by the electric and magnetic forces, £6 6s., £8 8s., £10 10s.
101. Electro-Magnetic motive Model, consisting of two soft iron electro-magnets and four bent permanent steel magnets attached to a horizontal moveable axis, supported on a hollow wooden column. The arrangement for changing the direction of the current cannot be shown, but it so affects the order of polarity in the soft iron magnets at the right period, that the continued revolution of the permanent steel magnets is produced, £2 2s.
102. Electro-Magnetic motive Model, consisting of a bent permanent magnet, with straight bar electro-magnets attached to a main horizontal spindle, which also carries the battery contact breaker. The advantage proposed in this form of model is that no repulsion takes place, but that the motive power is due to the sum of the attractions, and not the difference, as in many other combinations, £3 13s. 6d.
103. Electro-Magneto motive Model, in which a stationary horizontal compound permanent steel magnet is employed, and revolving electro-magnets, with the necessary contact breaker arranged that no repulsion occurs, the motive power being the sum of the attractions, and not the difference, £16 16s.
104. Electro-Magnetic Pendulum, with soft iron ball suspended from a cross piece at the top of the vertical standard. A contrivance lets on and cuts off the electric current in the electro-magnets, so as to produce at the extremities of the pendulum oscillations, the requisite alternate attractions by which means the vibrations are continued as long a time as the voltaic action is maintained, £5 5s., £9 9s.
105. Electro-Magnetic Verge, consisting of a horizontal helical spring, balance, and pallet, which being actuated by the alternate attraction of a small electro-magnet, produces

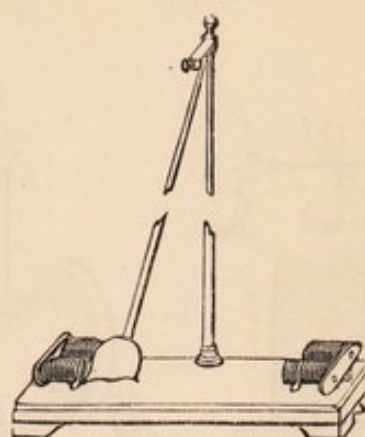
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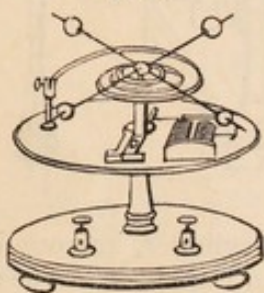
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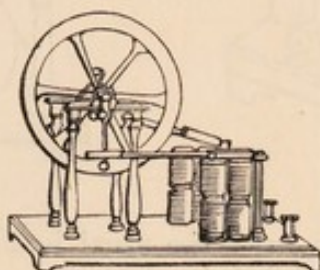
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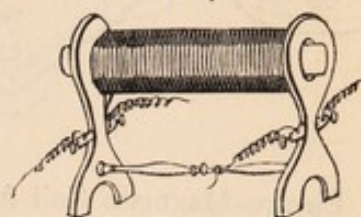
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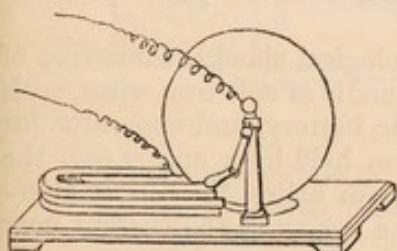


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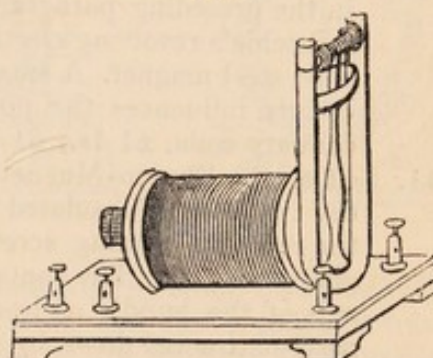
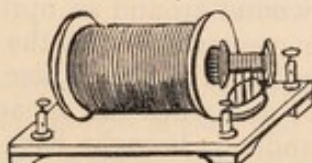


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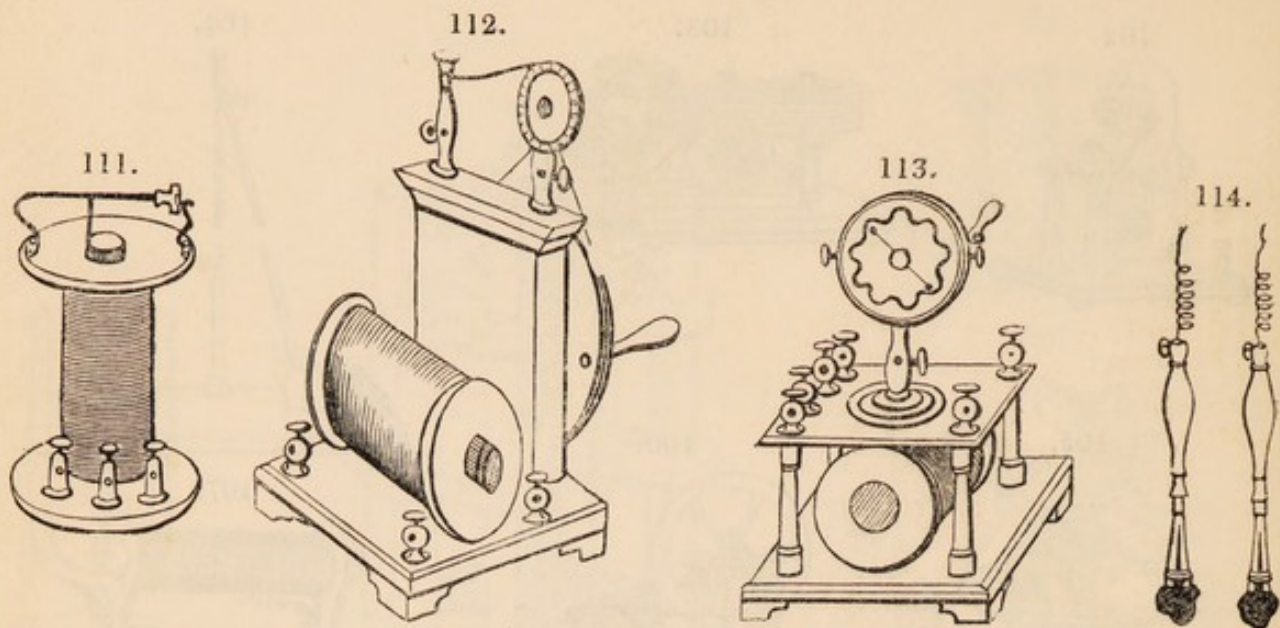
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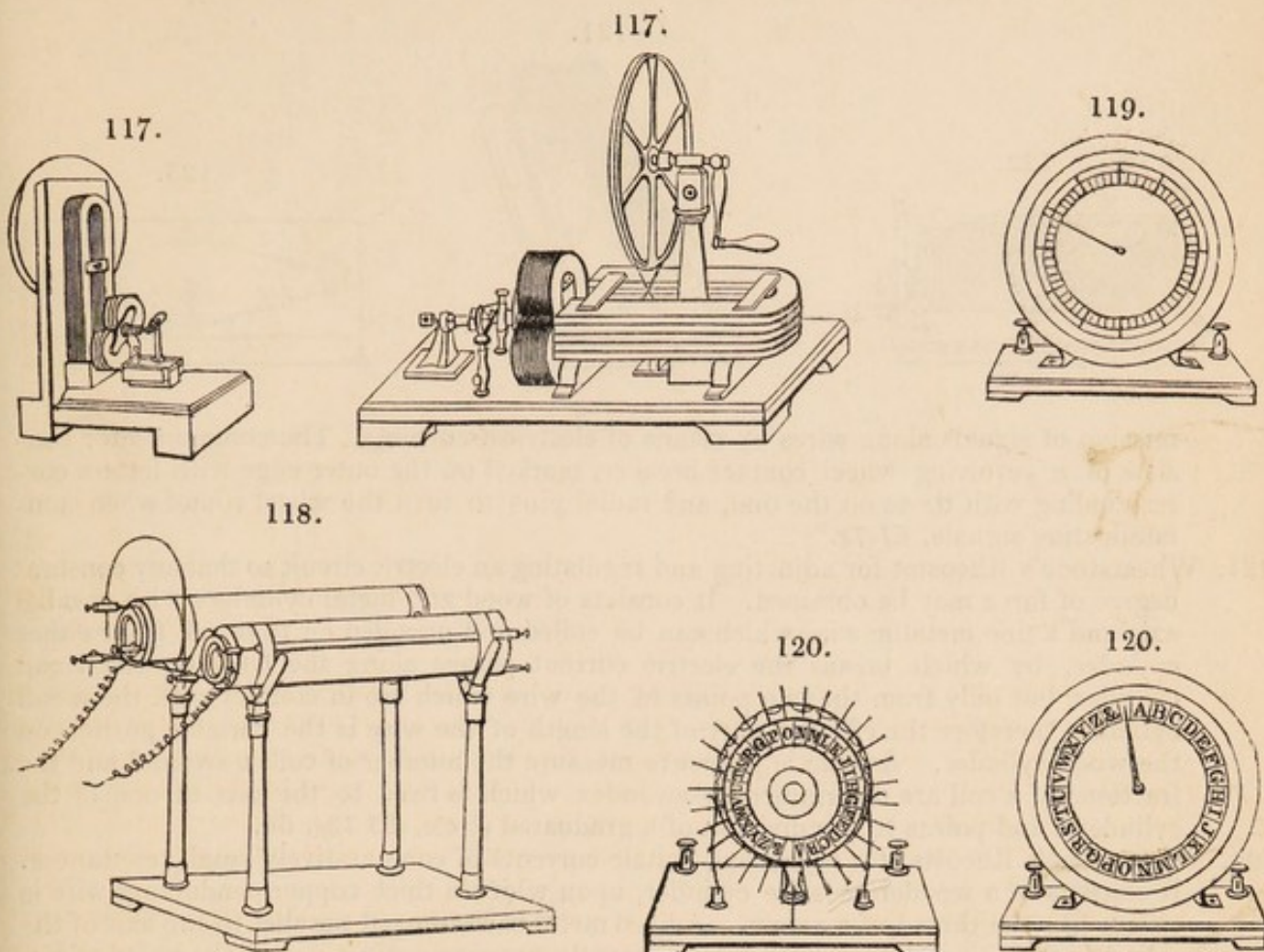
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- vibrations the same as the balance-wheel of a watch. The time of vibration is regulated by the extension and contraction of the balls on the arms of the balance, £1 15s.
106. Electro-Magnetic motive Machine, consisting of two bent electro-magnets, with parallel branches. To a branch of each electro-magnet is attached by a hinge, a soft iron lever armature; the long arm of each lever being connected by a crank to the spindle carrying the fly wheel and a contact breaker suitably arranged to produce alternate actions in the electro-magnets, £4 14s. 6d.
107. Apparatus to illustrate electro-dynamic induction, and the evolution of electricity by magnetism, consisting of two helices of covered copper wire of different diameters and lengths, coiled perfectly distinct from each other, around a hollow wooden reel with a cylindric steel bar magnet and rod of soft iron to pass in and out of the axis of the cylinder. Sundry binding screws for making connexions with the voltaic battery and galvanometer, by the aid of which the phænomena are made manifest, £1 11s. 6d., £2 2s., £3 3s.
108. Apparatus to illustrate permanent currents of electricity produced by ordinary magnets. The apparatus consists of a circular copper disc moveable upon its axis by a winch between the two poles of a horse-shoe magnet. One conducting wire is in metallic contact with the axis, and the other with the circumference immediately between the poles of the magnet, and the current passes from the centre to the circumference of the disc. The direction of the electric induced current depends upon the order of the revolution of the copper disc and polar arrangement of the magnet, £1 11s. 6d., £2 12s. 6d.
109. Small Self-acting Electro-Magnetic Coil Machine for medical purposes, consisting of a hollow wooden cylinder surrounded by a primary or thick wire coil, upon which is wound a secondary or long fine wire coil and a bundle of thin iron wire for placing in or out the axis of the wood cylinder. The small rotating electro-magnet makes and breaks the battery contact, and the machine is actuated by a small constant battery, 18s.

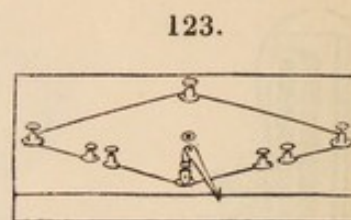
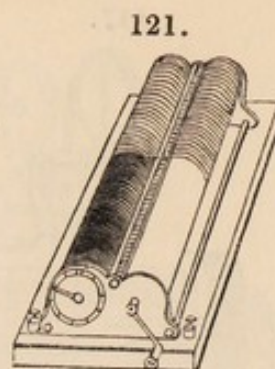
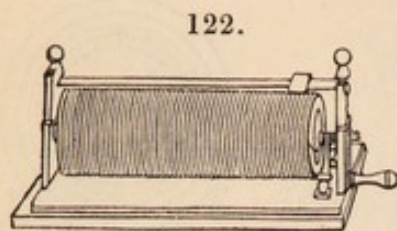


110. Electro-Magnetic Coil Machine, with the usual hollow wood cylinder, surrounded by additional lengths of insulated coiled wire with that employed in the apparatus described in the preceding paragraph. The contact breaker in the present instance consists of a Ritchie's revolving electro-magnet, situated between the poles of an upright horse-shoe steel magnet. A small constant voltaic battery actuates the electro-magnet, which in turn influences the power of the shock whether received from the primary or secondary coils, £1 1s., £1 15s., £2 2s.
111. Self-acting Electro-Magnetic Coil Machine for giving physiological shocks, consisting of the two coils of insulated wire wound around an upright bundle of soft iron wires, with the requisite binding screws for connexions with the voltaic battery, and apparatus for giving shocks. The contact breaker is a tinned disc of iron held by a spring over the axis of the bundle of iron wire, and when the apparatus is in action the disc is alternately attracted down by the bundle or brought back by the spring as the current may or may not pervade the coil, 16s., £1 1s.
112. Manual Electro-Magnetic Coil Machine for medical purposes. It consists of a wooden reel with a hollow axis and two helices of covered wire of different diameters and lengths wound around it independently of each other. By means of binding screws the terminals of the primary coil of wire are united to the voltaic battery; but this union is alternately interrupted and restored by the multiplying wheel actuating the circular contact breaker which produces the electro-dynamic shocks; the intensity of which are modified by receiving them either from the primary or the secondary coils, and by depositing in or removing from the core of the wooden reel the bundle or faggot of soft iron wire, £3 3s.
113. Compound Electro-Dynamic Coil Machine, for illustrating the properties of induced currents. It consists of a hollow wood reel surrounded by two separate helices of insulated wire of different diameters and lengths. The effects of electrical heat and light and its colour are exhibited by the combustion of portions of different metallic notched rings and circular steel file disc fitted to the apparatus on the stage. The physiological effects are produced by the revolving spring and either notched wheel acting as the contact breaker. From the great length of wire coiled on the wood reel, the shocks produced on the human frame are agonizing, but they may be modified in the usual way from the utterly insupportable to the slightly tremulous £5 5s. to £7 7s.
114. Insulated hand Directors, with sponge holders for transmitting shocks through particular parts of the human body, without the medical operator being in any degree affected, 3s. 6d.
115. Magneto-Electric Machine fitted up with suitable arrangements for medical purposes. No voltaic battery is here necessary, for the induced magneto-electricity is employed instead of induced voltaic electricity and it is found to be equally efficacious in mild cases, £7 7s., £8 8s.
116. Magneto-Electro inductive Machine or Magnet Electrometer, in which the permanent steel magnet is replaced by an electro-magnet of soft iron. The armature of soft iron surrounded by spirals of copper wire is rotated by means of a multiplying wheel, in front



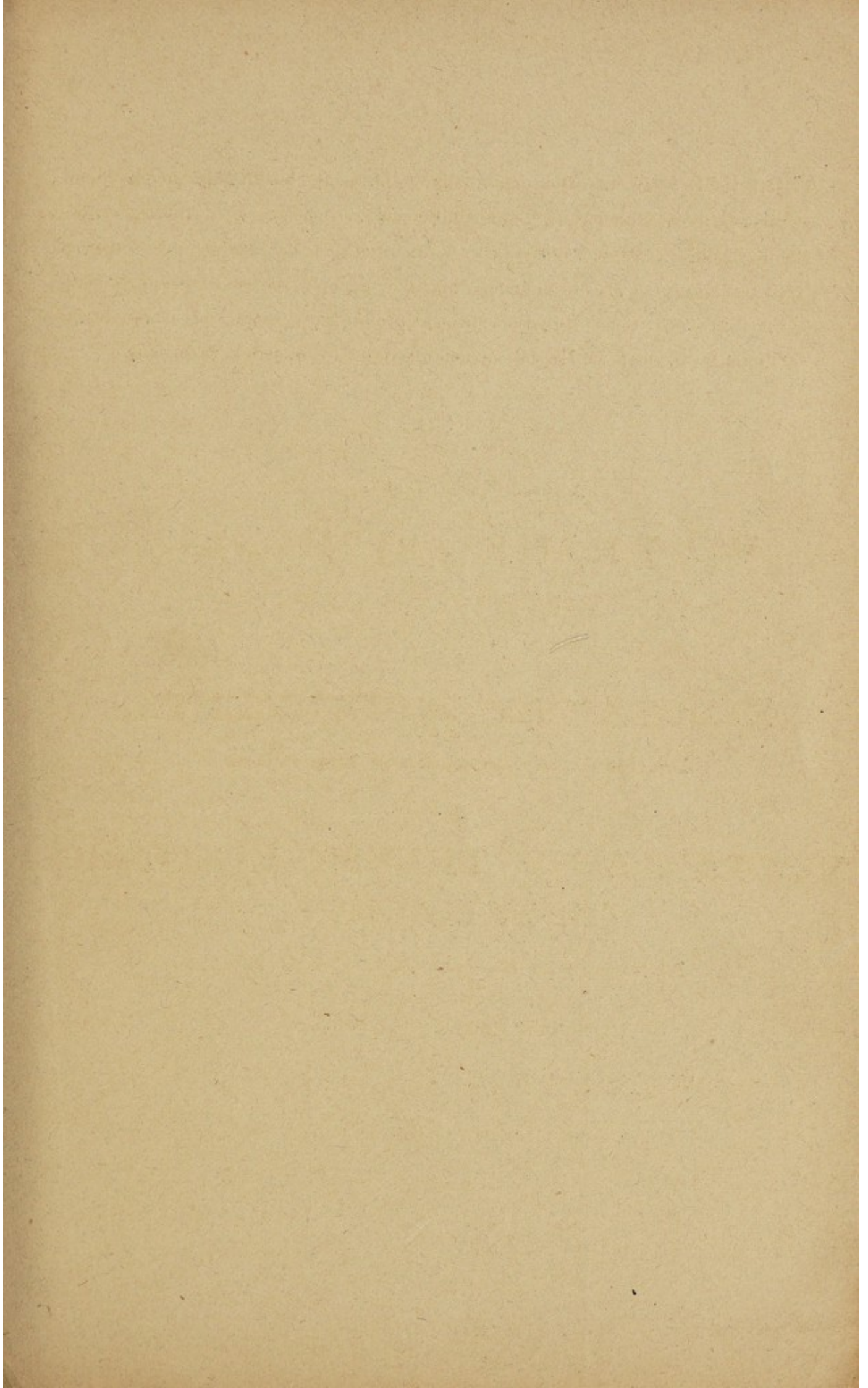
of the polar ends of the electro-magnet, by which means the machine is brought into good operation. The manipulation is easy and convenient, and with a constant voltaic battery to actuate the electro-magnet, the performance of the construction is uniform and durable and exhibits the whole class of electrical phenomena by induction with great energy and brilliancy. See frontispiece, £8 8s. to £31 10s.

117. Magneto-Electric Inductive Machine, with the compound magnet arranged either horizontally or vertically, and supplied with a rotating armature for "quantity" effects, and a rotating armature for the effects of "intensity."—This instrument illustrates the electrical, chemical, physiological, and mechanical powers evolved by magnetism. With it electrical light and heat are rendered apparent, chemical constituents separated, muscles of the body powerfully acted on, and rotatory motion produced, similar to those effected by electricity derived from the other sources of that agent, £10 10s., £12 12s.
118. Dove's differential Inductometer, consisting of two similar hollow wooden cylinders surrounded by exactly the same length and thickness of stout insulated copper wire; each primary coil is enveloped by secondary wooden cylinder coil of long fine wire of equal length and dimensions. The object of the apparatus is to exhibit the comparative inducing effects produced by inserting within the hollow wood cylinders, various forms of ferruginous and other metallic bodies; the results of which are extremely interesting and rendered evident by the aid of a delicate galvanometer, £5 5s.
119. Large working Model to illustrate Wheatstone's Electro-magnetic Clock. The object of this ingenious contrivance is to transmit the time of one standard clock simultaneously to numerous dials placed in different parts of a public building. The model is composed of a ten-inch painted dial with seconds marked, and a revolving hand, connected with which at the back is the peculiar electro-magnetic arrangement for actuating the hand by periodically establishing and arresting the battery current, at intervals necessary for indicating periods of time, £2 12s. 6d., £3 13s. 6d.
120. Working Model to illustrate Wheatstone's Electro-magnetic Telegraph, with communicator. It consists of a circular dial with the alphabet painted round the edge of the face, and the escapement with electro-magnet fixed at the back. A revolving hand affixed to the central axis points successively to the letter signalled by the communicator, which may be placed in an adjoining apartment, thus showing the almost instantaneous trans-



mission of signals along wires by means of electrical currents. The communicator consists of a revolving wheel contact breaker, marked on the outer edge with letters corresponding with those on the dial, and radial pins to turn the wheel round when communicating signals, £7 7s.

121. Wheatstone's Rheostat for adjusting and regulating an electric circuit so that any constant degree of force may be obtained. It consists of wood and metal cylinders with parallel axis and a fine metallic wire which can be coiled and uncoiled on to or off from either cylinder, by which means the electric current passes along the coils on the wood cylinder, but only from the two points of the wire which are in contact with the metal cylinder, therefore the effective part of the length of the wire is the variable portion on the wood cylinder. A scale is placed to measure the number of coils unwound and the fractions of a coil are determined by an index which is fixed to the axis of one of the cylinders, and points to the division of a graduated circle, £3 13s. 6d.
122. Wheatstone's Rheostat for regulating voltaic currents of comparatively small resistances. It consists of a wooden or slate cylinder, upon which a thick copper conducting wire is coiled, like the thread of a screw. A fixed metal bar arranged parallel to the axis of the cylinder carries a sliding spring piece constantly pressing against one of the coiled wires. By turning the handle the cylinder revolves, and according to the direction either lengthens or shortens the conducting portion of the copper wire coil, which produces a corresponding difference in the resistance of the electric current, £7 7s. to £9 9s.
123. Wheatstone's differential Resistance Measurer of metal wires and other conductors of electricity. This apparatus is applicable to any galvanometer, and consists of a mahogany base board, with an arrangement of four wires and brass binding screws, so that two galvanometer wires may be placed in the electric circuit. A contrivance is supplied for restoring the equilibrium produced by slight differences in the lengths of the wires, £1 11s. 6d., £2 2s.



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