

A
CATALOGUE

OF

PHILOSOPHICAL, ASTRONOMICAL, CHEMICAL AND
ELECTRICAL

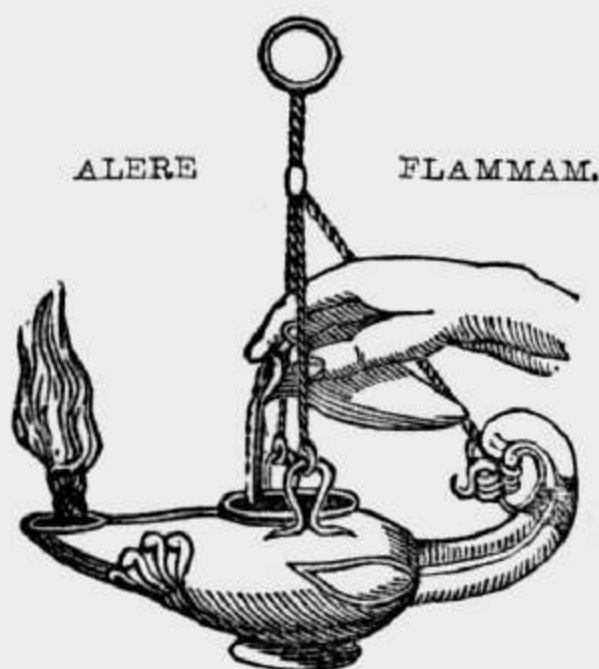
APPARATUS,

IMPORTED, MANUFACTURED AND SOLD BY

JOSEPH M. WIGHTMAN,

Successor to Claxton & Wightman,

No. 33 CORNHILL, CORNER OF FRANKLIN AVENUE, BOSTON.



B O S T O N :

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1846.



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1846

WIGHTMAN'S
CATALOGUE
OF
PHILOSOPHICAL INSTRUMENTS.



SINCE the commencement of this establishment, in 1830, a constant effort has been made to perfect and simplify, as far as possible, the construction and use of the various instruments. That these efforts have been successful may be inferred from the great increase of business, and the very general satisfaction expressed by customers at the material improvements in the form, finish, and construction of the apparatus ever since the issue of my last Catalogue, in 1842. The very many kind friends, whose encouragement has aided me, I can only refer to the past as an evidence of the future, and assure them that no effort will be spared to continue and merit their confidence.

The peculiar character of this business, much of it derived from distant sections of the country, and the inability of the purchaser

personally to inspect or select what he wishes, render a reliance upon the integrity of the dealer highly necessary. This having been the first establishment to publish a catalogue and list of prices, it has been my aim to furnish the purchaser through this channel, and by illustrative 'Manuals,' with the best means of acquainting himself with the Apparatus, and thus to assist him in selecting such articles or Sets, as may be most useful to him; and definite prices being affixed, he can readily see how far his desires conform to his means.

That this has been appreciated by my customers generally, I have the testimony of many, who have expressed their satisfaction with the arrangement of the Sets in the various departments; and also with my method of conducting business; and from *none* have I heard complaint. I select the testimony of a few from those most remote, to show that, *absent* or *present*, my endeavor has been to be equally just and honorable to *all*.

It will be apparent, that to publish a list of prices, and then make a *special bargain* with each customer, would be absurd and troublesome on my part, and of no possible advantage to them; for if discounts are contemplated, they are usually provided for, and will vary with the comparative keenness of the customer and dealer. Had I the inclination, my business prevents my adopting any other method than that I have sustained for so many years, of *one price* for the same article to *all*.

The inquiry has sometimes been made, several months or a year after a Catalogue has been issued, whether increased demand or facilities for manufacturing have not altered the price? To answer this inquiry, I must refer to the *quality* and *prices* of my instruments, and to the fact that the improvements constantly suggested during the manufacture, have more than kept pace with the decrease of labor; and I find, from a critical examination of many of the principal articles, that the prices in previous Catalogues cannot consistently be reduced in the present, and the apparatus still continue to retain the high standard character it now possesses, for beauty, efficiency, and convenience: if the quality be improved and the standard elevated without enhancing the price, surely the *purchaser* should be satisfied.

The Patent Lever Air Pumps, for which the highest premium of the Mechanics' Charitable Association,

A GOLD MEDAL,

was awarded in 1841, have continued to advance in estimation and demand, and are too well known to require an extended notice.

The selected Sets of Apparatus have been revised from the experience of teachers, combined with my own, since my last Catalogue, and are believed to furnish illustrations more complete in the various branches of science, than have before been supplied. In these sets, the great advantage of a uniformity of screws, is very apparent. But one size and one thread have always been adopted, which correspond with those of the English instrument-makers, and were procured from London at the commencement of this establishment. All parts of the apparatus are thus adapted to each other and admit of the greatest variety of *illustrations* with the smallest amount of apparatus.

As a large portion of the Apparatus is required by institutions remote from the manufacturer, it becomes important that its construction should be so simple as to prevent the necessity of frequent repair, and also to allow of its being repaired by the purchaser; many changes in the *forms* of the instruments have been made for this object, thus giving an originality to their construction, which has been constantly increasing in favor. In describing the various parts, and the method of manipulating with the Apparatus, the 'Companion to the Air Pump,' and the 'Companion to Electricity' have been found exceedingly useful. I have several 'Companions,' upon other branches equally interesting, now in progress, which will be published as soon as time will permit.

Being in constant communication with the most eminent professors, I am much indebted to them for many ideas and suggestions, but particularly to the kindness of Prof. SILLIMAN, whom I had the pleasure of assisting in the preparation of his experiments, and in the management of the Apparatus in the laboratory and lecture room, during his extensive course of Chemical Lectures at the Lowell Institute, of this city, in 1840, '41, and '42. To the experience thus acquired is due much of the improvement I have made

in the construction, convenience, and safety of the Apparatus in this department. In other branches of science I have added to my list many articles suggested by the elaborate illustrations I have made under the direction of other lecturers of the Lowell Institute.

Mr. Claxton, continuing to reside in London, enables me to receive constant intelligence respecting improvements there, to derive the advantage of his personal attention in the selection of apparatus imported from thence, and also to receive additional facilities in the manufacture of my own instruments.

The beautiful Paris Telescopes, to which I called attention in a former Catalogue, have proved highly satisfactory. Their clear defining power and reasonable price have caused an extensive sale and increased demand. For the information of purchasers, I have given the dimensions of the various sizes. I am also constantly receiving from the same house *Achromatic* Microscopes, at prices which common Compound Microscopes were sold for but a short time since. From the reasonable price of the Achromatic instruments, they are destined ere long to entirely supersede those of the common construction.

'Carpenter's Phantasmagoria Lantern' and Sliders have been greatly improved, and still hold their preëminent rank. The Sliders of Natural History have been used in many of the Colleges and the highest class of institutions in the United States. The Lantern has almost microscopic power, enlarging an object of two inches to eight or ten feet! which is clearly and distinctly defined. For Institutions or public Lectures, it is unrivalled. The extensive list of Sliders, now first published, will much assist the purchaser.

I would also call attention to the Medium Set of Mechanicals, and the New Compound Blowpipe, which I have recently added to supply a demand for Apparatus of large size, but smaller than the most expensive.

The Electro-Magnetic Apparatus, made for me by Mr. DANIEL DAVIS, Jr., for several years past, still sustains its high reputation for efficiency and simplicity. The Magneto-Electric Machines have been remodeled, by which their power is much increased; and many new articles have been added.

Personal attention, as heretofore, being given to the finishing, proving, and packing of the Apparatus, customers may depend upon having their orders executed with promptness and care.

N. B. As many of the instruments require to be taken apart to pack them safely, it is desirable that they should be put together according to the figures or marks stamped upon the several pieces.

TESTIMONIALS.

AWARDS

OF THE JUDGES ON PHILOSOPHICAL APPARATUS

AT THE

FIRST, SECOND, AND THIRD FAIRS OF THE

MASSACHUSETTS CHARITABLE MECHANIC ASSOCIATION.

FAIR OF SEPTEMBER, 1837, SILVER MEDAL.

FAIR OF SEPTEMBER, 1839, SILVER MEDAL.

Report of the Judges on Philosophical Apparatus, at the Third Mechanics' Fair, September, 1841.

No. 707. JOSEPH M. WIGHTMAN, *Boston*, whose Instruments have commanded the favorable notice of former committees, for the ingenuity of contrivance, excellence of arrangement and faithfulness of workmanship, put in six Air Pumps, and a considerable variety of other Apparatus.

No. 1 is an improved Leslie's Air Pump, well made and well finished. Mr. WIGHTMAN'S improvements in this Instrument are—1. The application of a brass box immediately under the Pump plate, so constructed as to prevent mercury or other liquid from easily passing from the plate into the pump. 2. The addition of a brass box connected with the eduction valves, to receive any oil which may be thrown out of the pump, and of a form and construction, making it secure in this respect when the pump is used for condensing; and—3. An arrangement of the safety box at the top of the Barometer Gauge, such that if the mercury is drawn into it, it falls back of itself into the cistern and cannot enter the pump.

Nos. 2 and 3* are well finished instruments, and appear to possess over Claxton's Lever Air Pump a decided advantage, derived from the application of a close cover and packing box, by means of which they are worked with greater ease even when the area of the cylinder is increased. Other improvements are made in their transferring and condensing power, and also in the application of the safety box and float-gauge.

The other Instruments exhibit improvements in form, and in the neatness of their construction. Mr. WIGHTMAN's Bell for Vacuum, his application of the Ball and Socket Handles to the Hemispherical Cups, his arrangement of Windmills for a vacuum, his large and small Transferrers of Liquids, and his mode of closing the tops of Glass Apparatus by ground plates instead of caps and cement, we consider as other instances of the successful application of mechanical ingenuity to produce decided improvements in the structure and use of these Instruments.

A GOLD MEDAL.

JUDGES.

S. P. MILES, *Principal Young Ladies' School.*
 GEORGE B. EMERSON, *Principal Classical School.*
 PROF. J. LOVERING, *Harvard University.*
 THOMAS SHERWIN, *Principal English High School.*
 PROF. D. TREADWELL, *Harvard University.*
 SOLOMON ADAMS, *Principal Young Ladies' School.*
 U. A. BOYDEN, *Engineer.*
 S. BORDEN, *Massachusetts State Surveyor.*
 N. SNELLING, Esq.

YALE COLLEGE, Sept. 1, 1841.

MR. JOSEPH M. WIGHTMAN, of Boston, has constructed for me and my friends, many articles of Chemical and Philosophical Apparatus, during the last six years.

Recently, he has, under my direction, executed an extensive order for the Lowell Institute, of Boston; and in *all* cases given me *entire* satisfaction. Among the skilful artists of Boston, Mr. WIGHTMAN holds a distinguished rank, and he is equally remarkable for his obliging disposition, and the zeal as well as efficiency with which he enters into the views of his employers.

B. SILLIMAN,
Prof. of Chemistry, Mineralogy, &c., in Yale College.

* Wightman's Patent Lever Pumps.

CAMBRIDGE, June 15, 1842.

MR. JOSEPH M. WIGHTMAN, of Boston, has made and repaired various kinds of Apparatus for me during the last six years. It gives me great pleasure to testify to his fidelity, ingenuity, and his despatch in executing the orders which I have constantly given to him during this period. At all times he has given me the greatest satisfaction and enjoyed my highest confidence; and I gladly recommend him as an ingenious, careful and courteous artist, to the patronage of scientific men.

JOSEPH LOVERING,

Prof. at Harvard University, of Mathematics and Natural Philosophy.

BRUNSWICK, Aug. 7, 1843.

DEAR SIR, — When I wrote you for information in regard to the Attwood Machine, I had not received your letter. In the mean time I had set up the apparatus, but I believe that I did not write you in regard to it, as I wished to test its merits before expressing an opinion. This I have now done, and I deem it my duty to state to you my high satisfaction with the Instrument. So far as its general aspect is concerned, my taste could not have been better consulted, and its extreme accuracy proves it to be a first rate instrument of the kind. Prof. CLEVELAND concurs with me in this opinion, as well as others alike capable of appreciating its merits. I regard the Drops you have attached as a very valuable addition and fine contrivance to start the mass from 0. at the proper instant. I have, therefore, to express to you my thanks for the attention bestowed by you upon this article of apparatus, and to assure you that my confidence in your skill has been fully met.

Yours, truly,

WILLIAM SMYTH,

Prof. of Math. and Nat. Philos. at Bowdoin Coll., Brunswick, Me.

HAVANA, Aug. 13, 1845.

DEAR SIR, — I cannot but express my most sincere thanks for the care and kind attention with which my order has been executed, and my admiration at the neatness and finish of all the Apparatus; but most especially of your elegant and beautiful Air Pump and accompanying Apparatus, which is far superior to the costly French Instruments I have in the University.

* * * * *

Yours, very truly,

FELICIANO CARRENO,

Prof. of Natural Philosophy in the College de la Union Havana.

From W. T. FEAY, Prof. Chemistry.

SPRINGFIELD, Geo., March 10, 1845.

* * * * * To say that I am pleased with the articles of your manufacture would convey but a faint notion of the estimation in which I hold them. There is nothing superfluous about them, but every thing that is *necessary*; and the mechanical execution of them unexceptionable. I have seen more *costly* instruments, but *none better suited* for the purposes for which they are designed. * * * * *

From Rev. A. H. MITCHELL, Pres. Centenary College.

SUMMERFIELD, Ala., Jan., 1846.

After using the Apparatus you furnished the College for *more than a year*, I am still highly pleased with it. * * * * *

In addition to the foregoing, I have also the pleasure of referring to

Prof. P. CLEAVELAND, *Bowdoin College, Me.*

" E. HITCHCOCK, *Amherst College, Mass.*

" E. S. SNELL, " " "

" O. P. HUBBARD, *Dartmouth College, N. H.*

" J. W. DRAPER, *University, New York City.*

" C. E. WEST, *Rutger's Institute, " "*

Rev. THERON BALDWIN, *Agent of Western Colleges, N. Y.*

Prof. E. MITCHELL, *Chapel Hill, N. C.*

" F. W. CAPERS, } *State Military Acad., Charleston, S. C.*
 " WILLIAM HUME, }

" T. B. SLADE, *Columbus, Ga.*

" B. O. PIERCE, *Mercer University, Penfield, Ga.*

" J. LOCKE, *Cincinnati, Ohio.*

" A. JACKSON, *Trinity College, Hartford, Con.*

" E. H. LEFFINGWELL, *Columbia College, Mo.*

" GEORGE W. KEELY, *Waterville College, Me.*

" J. R. LOOMIS, " " "

" A. CRITTENDEN, } *Brooklyn Female Academy, N. Y.*
 " ALONZO GRAY, }

LAWS OF MATTER.

Fig. 1. — No. 1.

INERTIA APPARATUS.

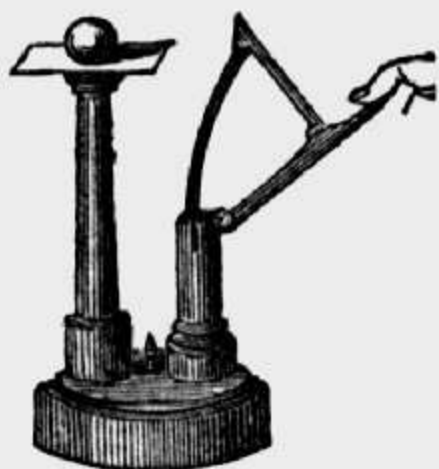


Fig. 1 represents a very convenient and striking method of illustrating Inertia. A stiff card being projected by the spring, and leaving the Ball upon the Pillar.

Price, \$1 50.

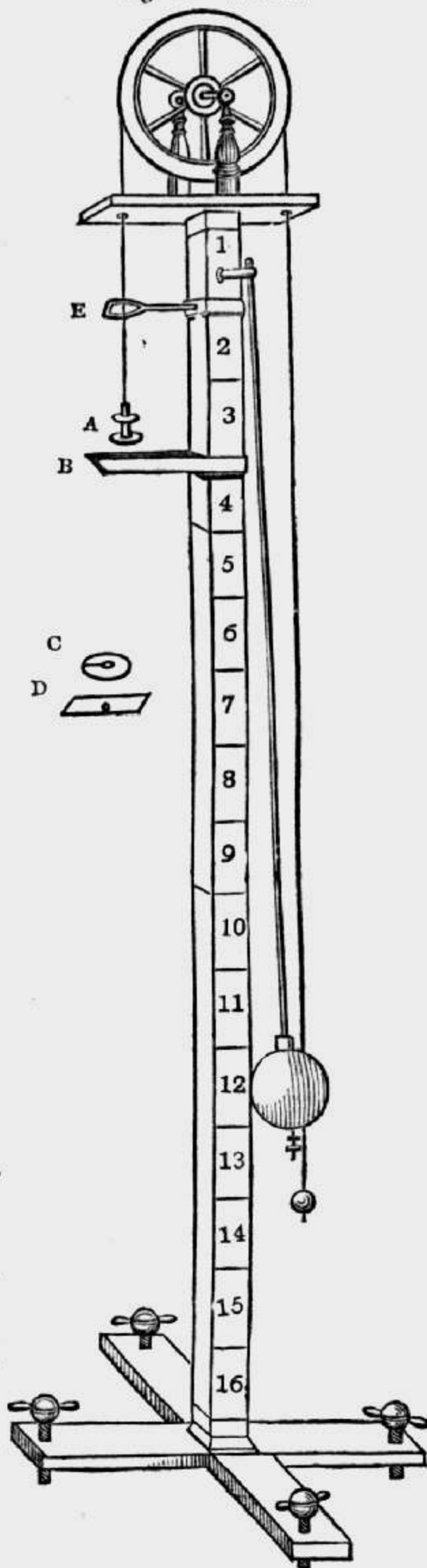
Fig. 2. — No. 11.

APPARATUS FOR FALLING BODIES.

Although simple in construction, yet the peculiar laws of falling bodies, are as readily and effectively illustrated by this Apparatus as with those more expensive. The standard is of Mahogany and six feet in height, the front of which is divided into sixteen equal spaces. On one side of the standard are figured the number of spaces passed over in each successive beat of the pendulum; and upon the opposite side, the number of beats of the pendulum.

When the Apparatus is used it should be *levelled* by the screws in the Base. Price, \$15 00.

Fig. 2. — No. 11.



MECHANICS.**SET OF MECHANICALS.**

No. 31.

Fig. 3.

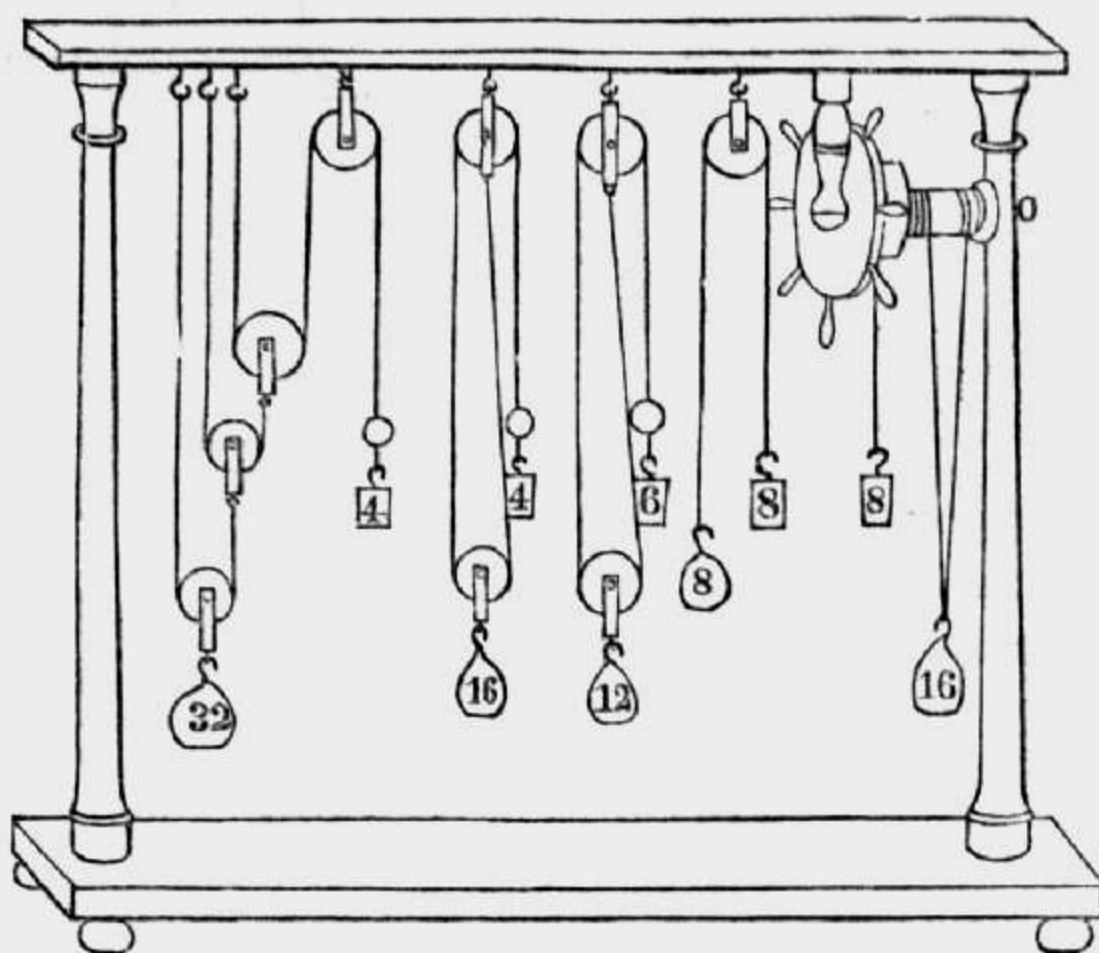


Fig. 4.

SCREW.

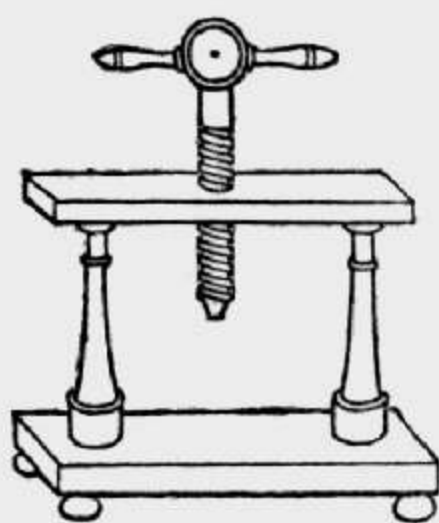


Fig. 6.

INCLINED PLANE.

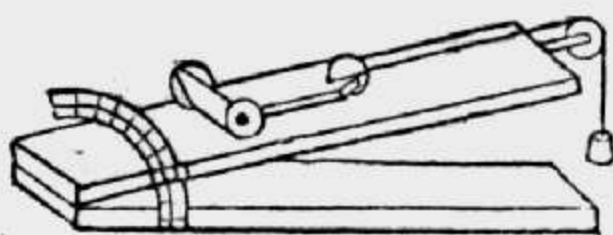


Fig. 5.

LEVERS.

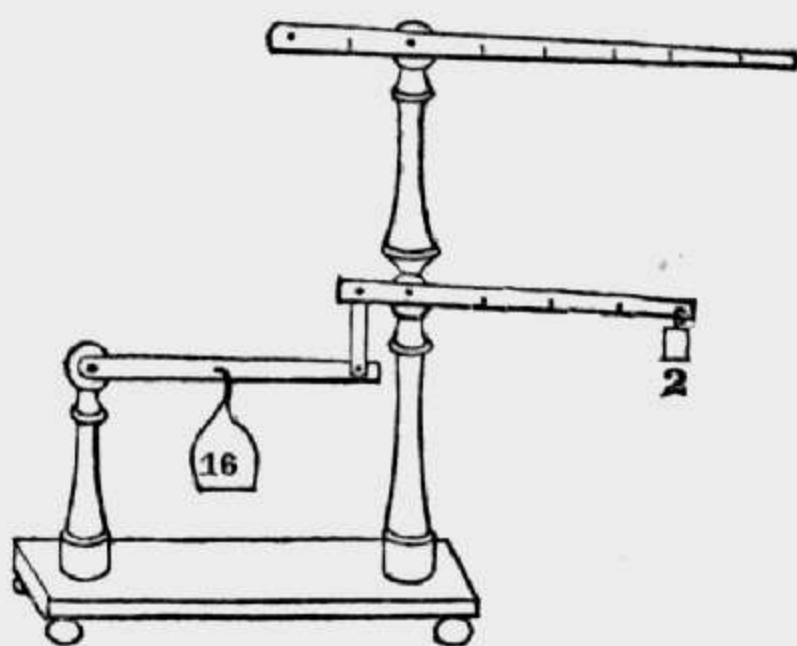


Fig. 7.

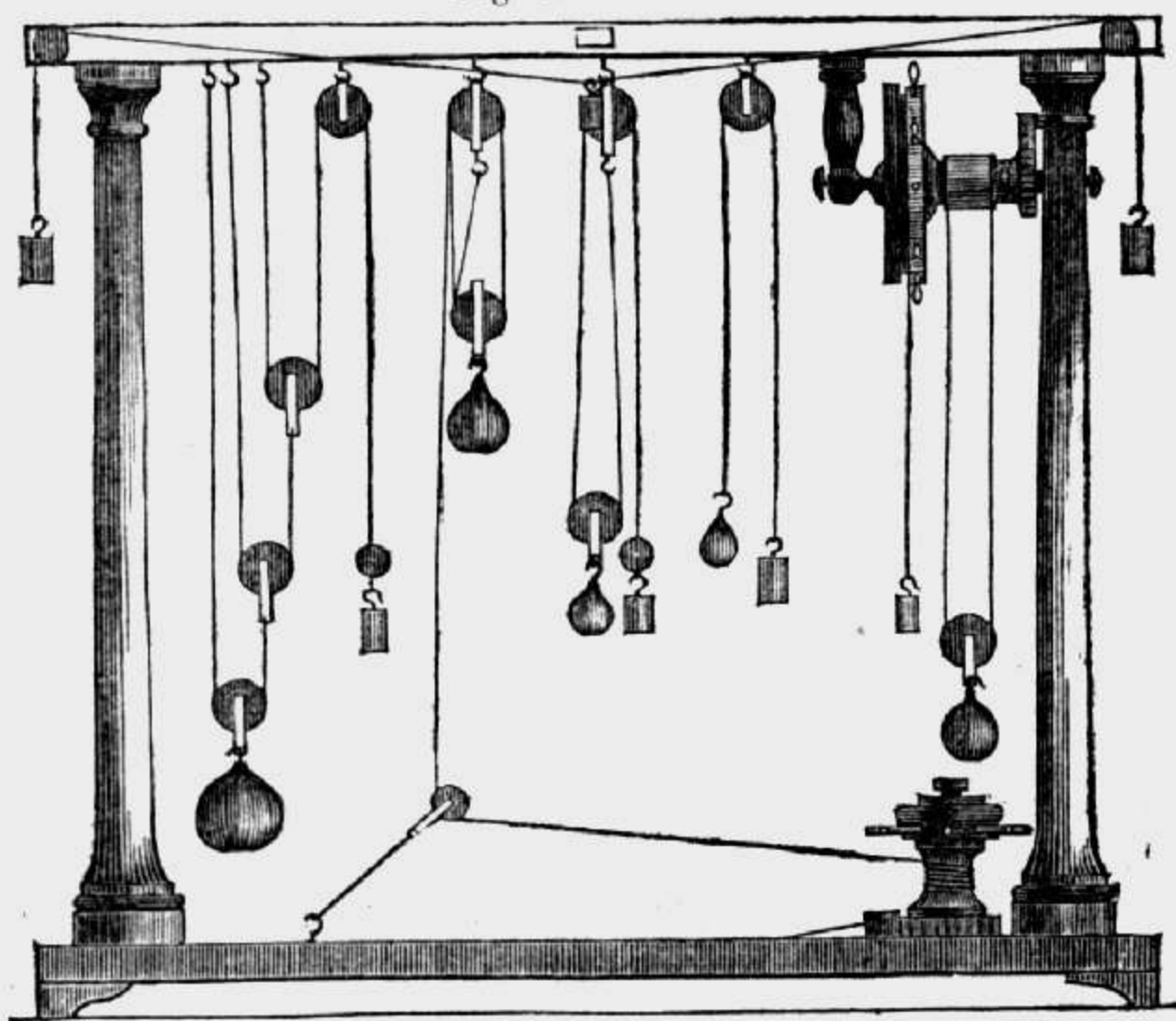
WEDGE.



Fig's. 3, 4, 5, 6 comprise a complete set of Mechanicals, which, for ease of illustration and simplicity of arrangement, have been highly approved. Being in detached parts, the teacher has no more before his class than he desires at the time. The Pulleys and Levers are of Brass, and all have Brass counterpoises or Powers. The weights are of japanned iron, to distinguish them from the Powers. All of them are graduated and marked with the ounces upon each. The movable Pulleys are balanced with brass balls placed upon the cord just above the Power, making a beautiful and convenient set. Price \$25 00.

SET OF MECHANICALS.

Fig. 8. — No. 32.



Above is shown a part of a new Set of Mechanicals of medium size, larger and more complete than those of No. 31. The Set includes Simple and Compound Levers; Metal Screw and Nut; Inclined Plane; Carriage and Weight; and Wedge; pulleys are also attached to the frame to illustrate the *Funicular* power or force of a bent Rope; a single ounce applied to the centre is superior to that of several pounds at the ends. It is an application of power much used on ship board. Price of entire Set, \$40 00.

HYDROSTATICS AND HYDRAULICS.

Fig. 9. — No. 44.

HYDROSTATIC BELLOWS AND PARADOX.

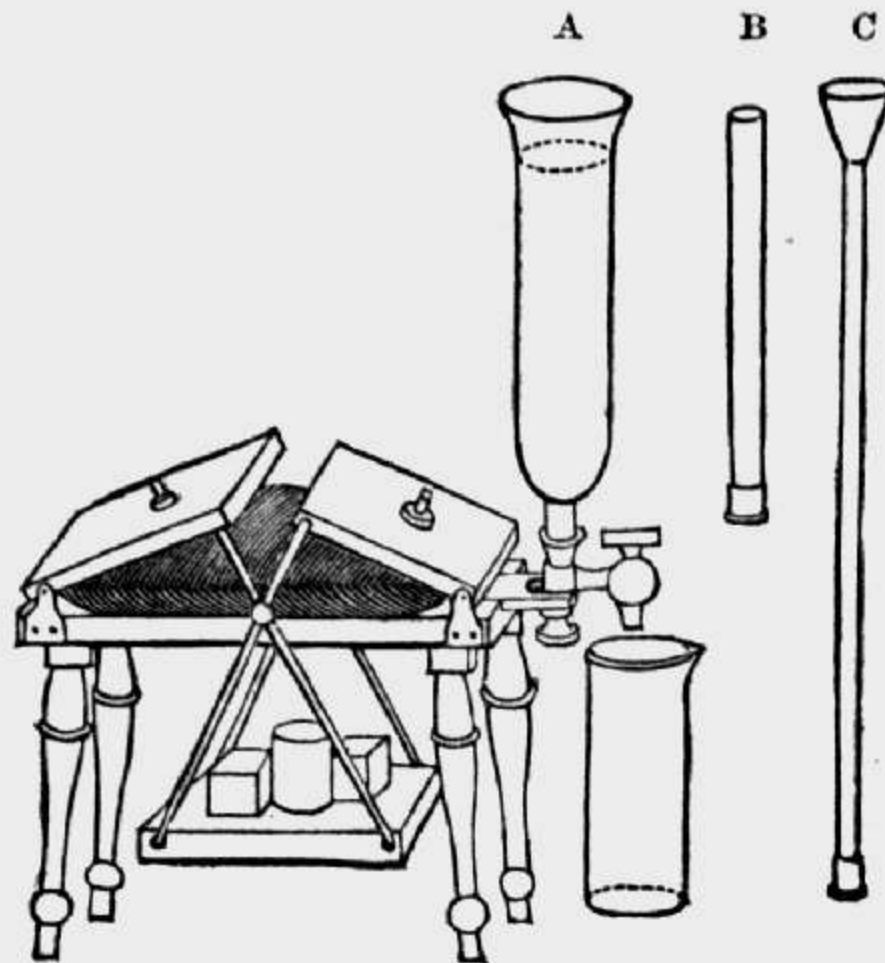


Fig. 10. — No. 47.
UPWARD & DOWN-
WARD PRESSURE.

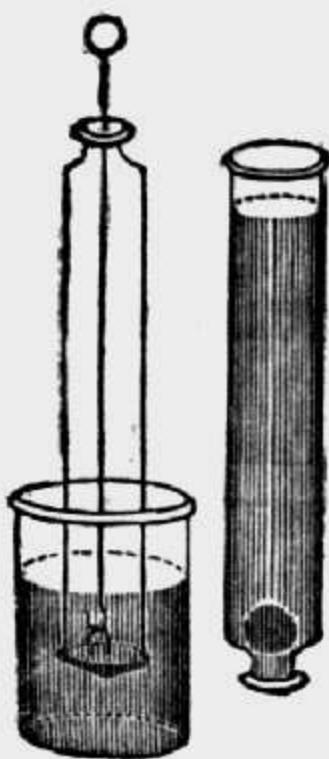


Fig. 11. — No. 59.
SYPHON CUP.



Fig. 12. — No. 62.
HERO'S FOUNTAIN*

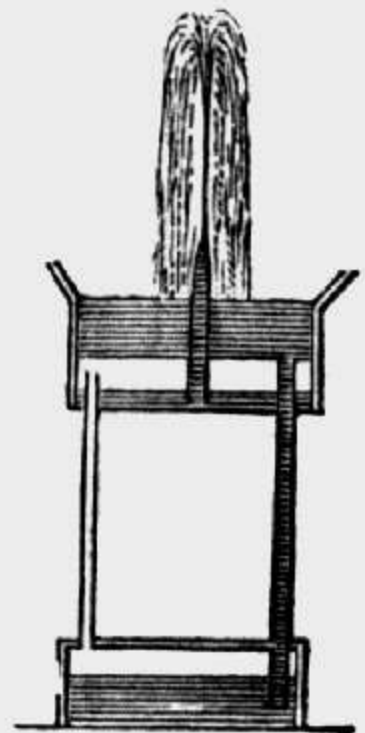


Fig. 13. — No. 56.
WATER PUMPS.



Fig. 9 is an original and much-approved Apparatus to show, in a striking manner, the interesting law that liquids press according to *height* and not to *quantity*. The vessel A is first filled with water, and weights put in the suspended scale until the pressure is counterbalanced; the water is then drawn off into the jar, and the tube B, holding one tenth as much as A, is screwed to the same place; as it is of the same *height* as A, the same *weight* will be raised when it is filled with water. C is a brass tube, by which additional pressure may be given, and the apparatus used as a Hydrostatic Bellows.

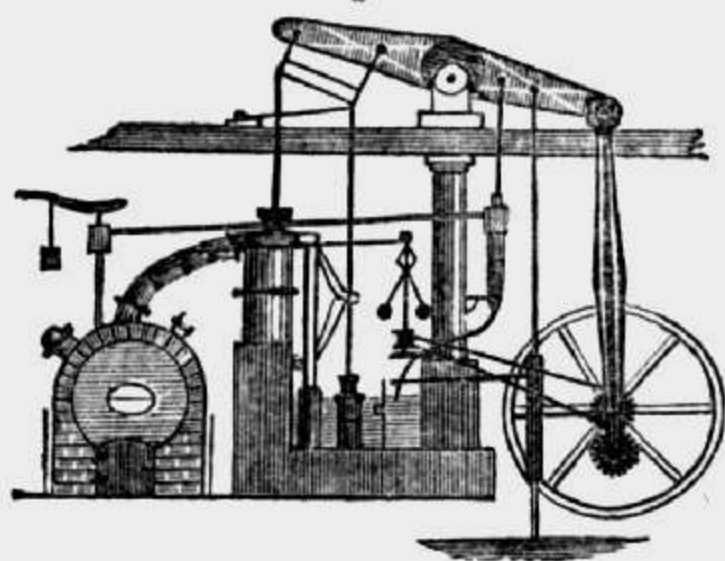
The Hydrostatic Bellows, No. 42, is of the same form, but of smaller size, and without the Glass vessels. Both of them possess the advantage of being easily repaired, as it is only necessary to replace the India Rubber Bag, which incurs but a trifling expense, and can also be used for a small gas Bag.

Fig. 10. A brass plate is held against the bottom of the glass vessel while it is plunged several inches under water. The *upward* pressure will then sustain the brass plate. Reverse the glass and put in the ball, which will act as a valve, and will remain at the bottom of the glass by *downward* pressure, if carefully filled.

STEAM ENGINES.

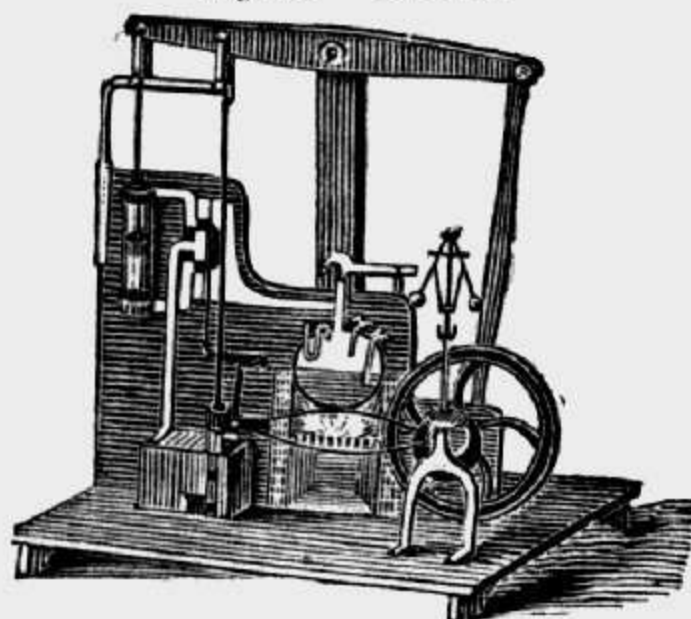
WORKING MODEL.

Fig. 14.



SECTION MODEL.

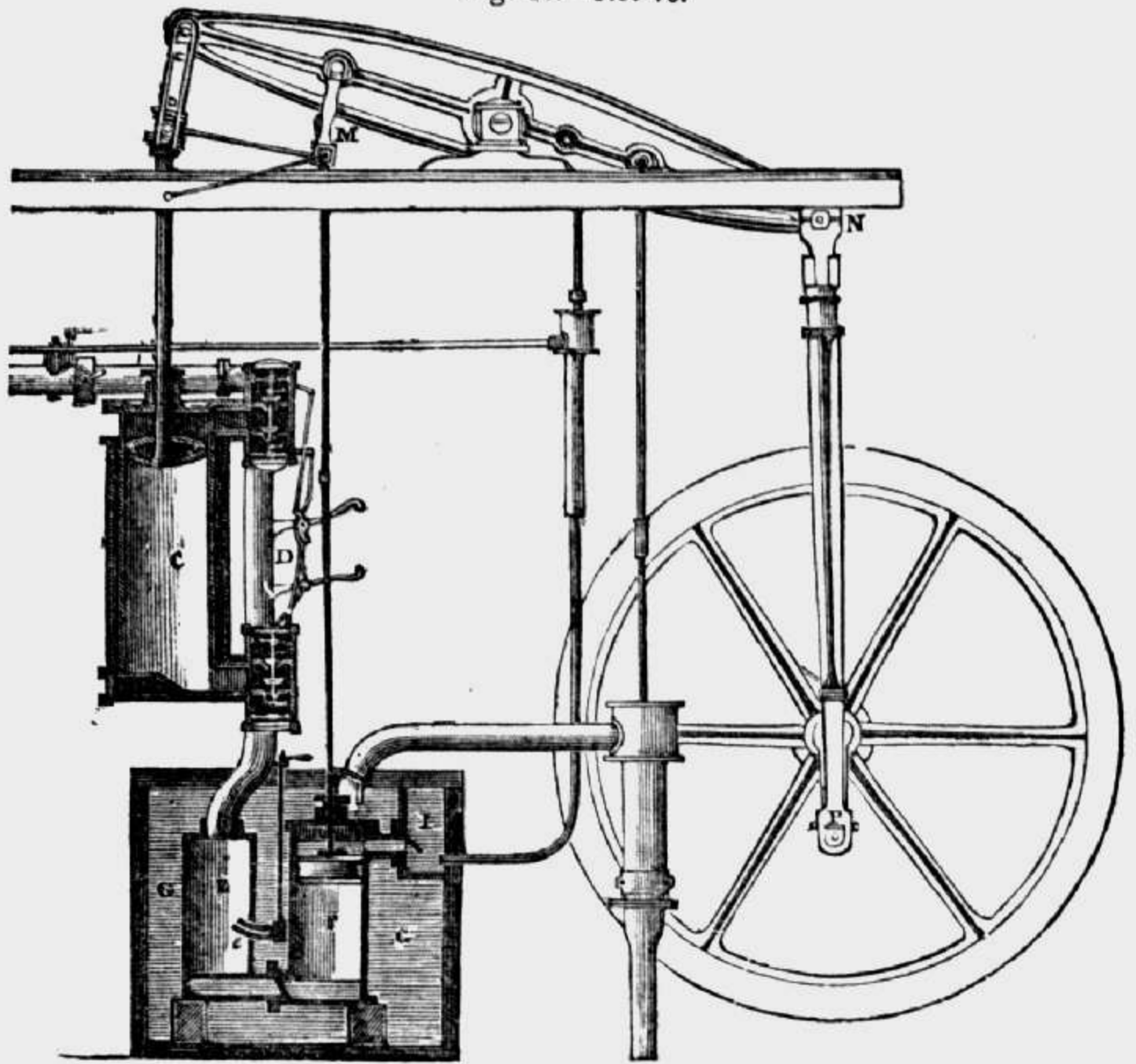
Fig. 15. — No. 75.



At Fig. 15 is shown the form of the small Section Model of the Steam Engine. It is put in motion by turning the crank of the Fly Wheel. This model is intended to illustrate not the *form* but the manner in which steam is applied to produce motion.

WIGHTMAN'S SECTIONAL MODEL OF THE STEAM ENGINE.

Fig. 16.—No. 76.

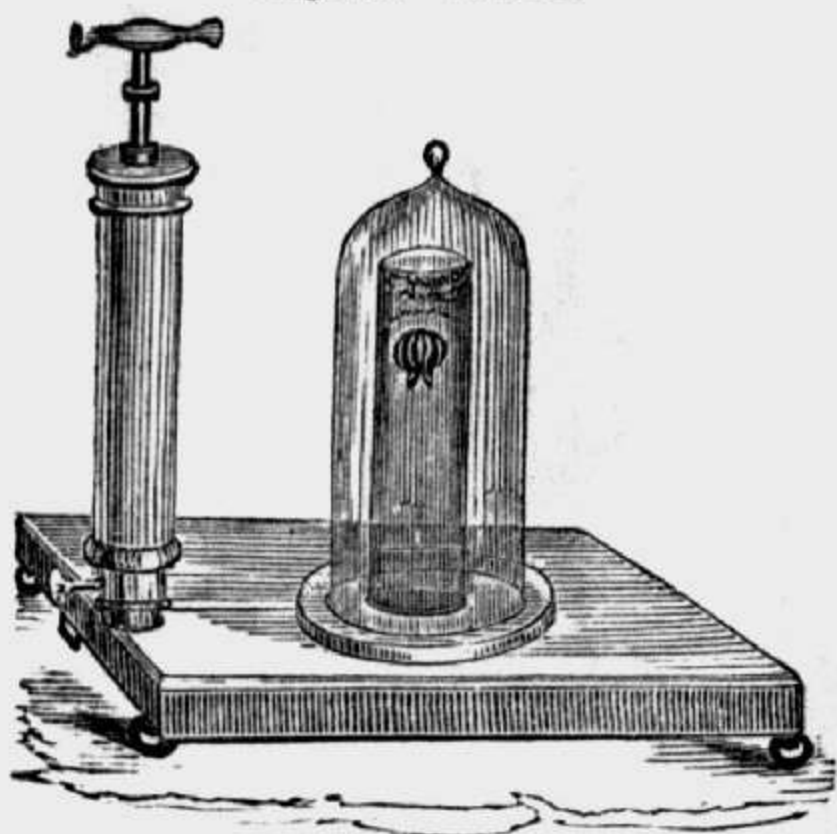


The Apparatus of which the figure above represents the moving parts, when connected with its accompanying Boiler, furnishes to the professor or teacher, the means of illustrating, in a clear and comprehensive manner, the application of steam as a power. The proper action of the pistons and valves upon the interior of the engine, is shown upon one side of the model, when the crank is turned, while the reverse exhibits the general appearance and structure of the exterior. All the cylinders, pumps, and pistons; the boiler with its gauges, furnace, safety valve, flues, and other appurtenances, are in *true* section, precisely as a working model would be seen if it were separated into two equal parts by a line passing through the centre. The Boiler is represented in longitudinal section, and is upon a separate base. When the Engine and Boiler are together, their entire length is three feet.

PNEUMATICS.

SCHOOL AIR PUMP ON STAND.

Fig. 17. — No. 98.



This Air Pump, by reversing the valves, may be made to exhaust or condense the Air. The Barrel is one and a half inches in diameter, and mounted on a neat Mahogany base, with brass clamp to secure it to the table. The Apparatus adapted to it is simple and efficient, and, from the low price of a complete Set, many have been sold, and in all cases given entire satisfaction.

Set No. 1.

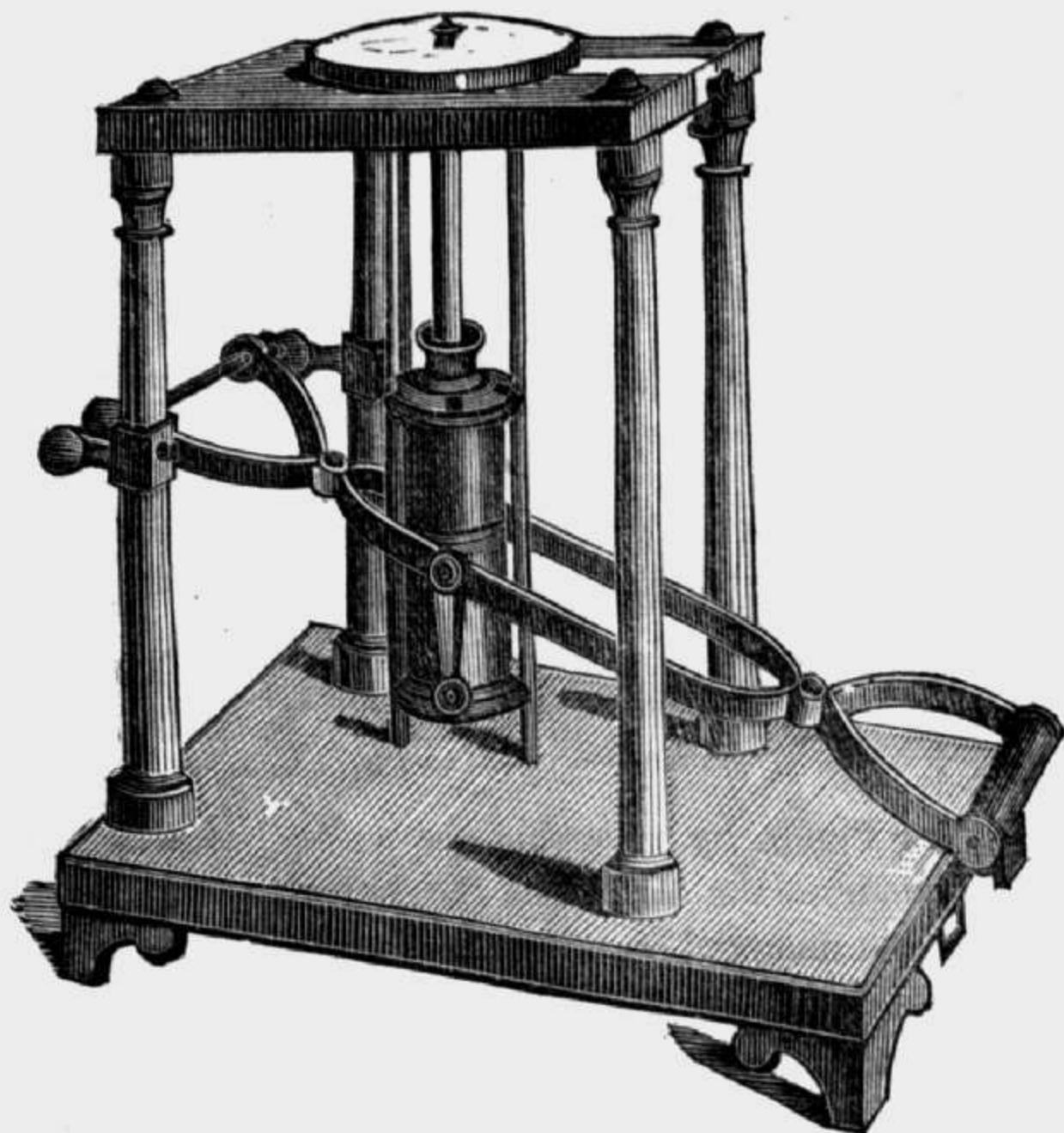
SCHOOL AIR PUMP.

Tall Open-Top Receiver, with	Revolving Jet,
Glass Cover,	Globe Stand and Bolt Head,
Plain Bell Receiver,	Improved Weight Lifter, raising
Scales; Weights; Glass Flask,	from 50 to 100 lbs. by the pres-
Stop-Cock and Stand for weigh-	sure of the Air,
ing Air,	Tall Jar and Glass Balloon,
Hand Glass,	Resisting Fans and Handle,
Brass Hemispheres and Cock,	Cylinder of Wood with Brass
Bladder Glass,	Plate for Porosity,
Glass for Fountain in Vacuo,	Glass Suction Tube,
Stop-Cock and Jet Pipe,	Syphon; Funnel;
Condensed Air Fountain,	Companion to Air Pump.

Price of Set, \$40 00.

CLAXTON'S PATENT AIR PUMP.

Fig. 18. — No. 97.



The dimensions of this Air Pump, as at present made, are, — height, 18 inches; length, 20 inches; Barrel, 7 inches long, and $2\frac{1}{4}$ inches interior diameter. The frame is of solid Mahogany, polished, and the Bolts pass entirely through the pillars and connect with nuts under the Base, rendering the whole substantial and firm. It has stood the test of ten years' trial, and probably no Instrument has been more extensively introduced into Academies, or been so universally approved. The reason of this may be found in its simplicity of construction and ease of operation, combined with rapid and accurate exhaustion. The raised Plate, besides adding beauty to the Instrument, permits all the working parts to be placed under it, and allows the experiments to be seen from all points. The former dimensions of this pump were, — height, 14 inches; length, 18 inches; Barrel, 6 inches long, and $1\frac{1}{2}$ inches diameter. Some idea may therefore be formed of the improve-

ment in size alone, which has been made without increase upon the price of the original Instrument.

Particular care has been taken in arranging the Apparatus for this pump. For Institutions desiring a complete set, the following has been selected.

Set No. 2.

PATENT LEVER AIR PUMP.

Swelled Open-Top Receiver, with Glass Cover,	Flexible Tube and Connectors,
Tall Open-Top Receiver,	Large Bolt Head with Brass Plate,
Plain Bell Receiver,	Jar for Bolt Head,
Balance, with Weights ; Glass Flask ; Stop-Cock ; and Stand,	Sliding Rod and Brass Plate,
Hand and Bladder Glasses,	Liquid Transferrer, of Glass,
Brass Hemispheres,	Guinea and Feather Tube, with Cock ; three feet long, and arranged for Aurora,
Glass for Fountain in Vacuo.	Tall Jar and Glass Balloon,
Stop Cock and Jet Pipe,	Brass Exhausting and Condens- ing Syringe,
Copper Chamber for Condensed Air Fountain,	Glass Suction Tube,
Revolving Jet,	Plain Bell for Vacuo, and
Glass Syphon and Funnel,	Companion to Air Pump.
Weight Lifter and Stand, for rais- ing 100 lbs. by pressure of air,	

Price of Set, \$75 00.

Set No. 3.

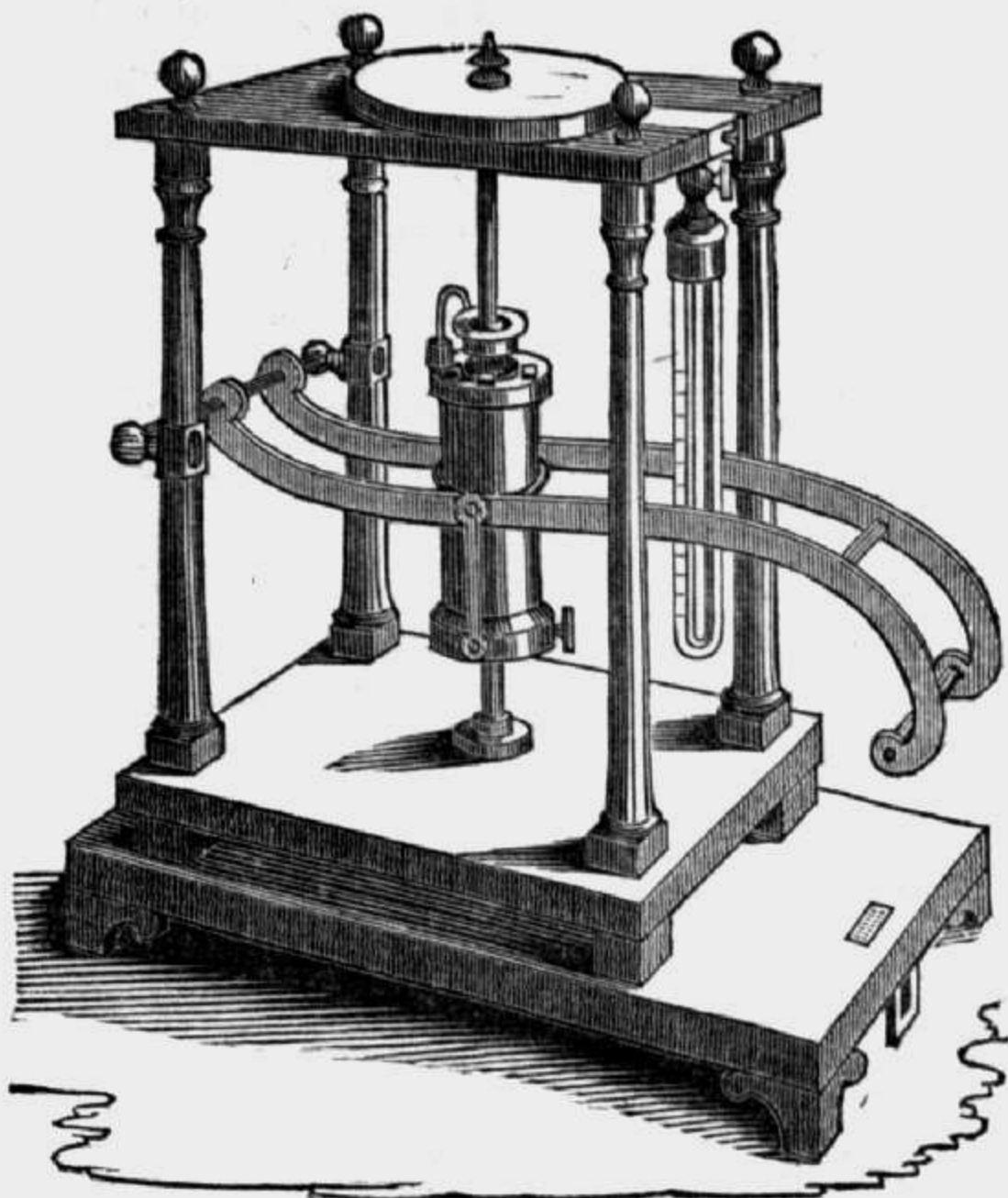
The preceding Set, together with

Brass Piston Expansion Appa- ratus,	Breaking Cubes, Caps and Guard,
Mercury Shower,	Illustration of Bacchus,
Double Transferrer and Re- ceivers,	Torreccellian Experiment, Mercury for Torrecellian Ex- periment.

Price of Set, \$100 00.

WIGHTMAN'S PATENT PORTABLE AIR PUMP.

Fig. 19. — No. 96.



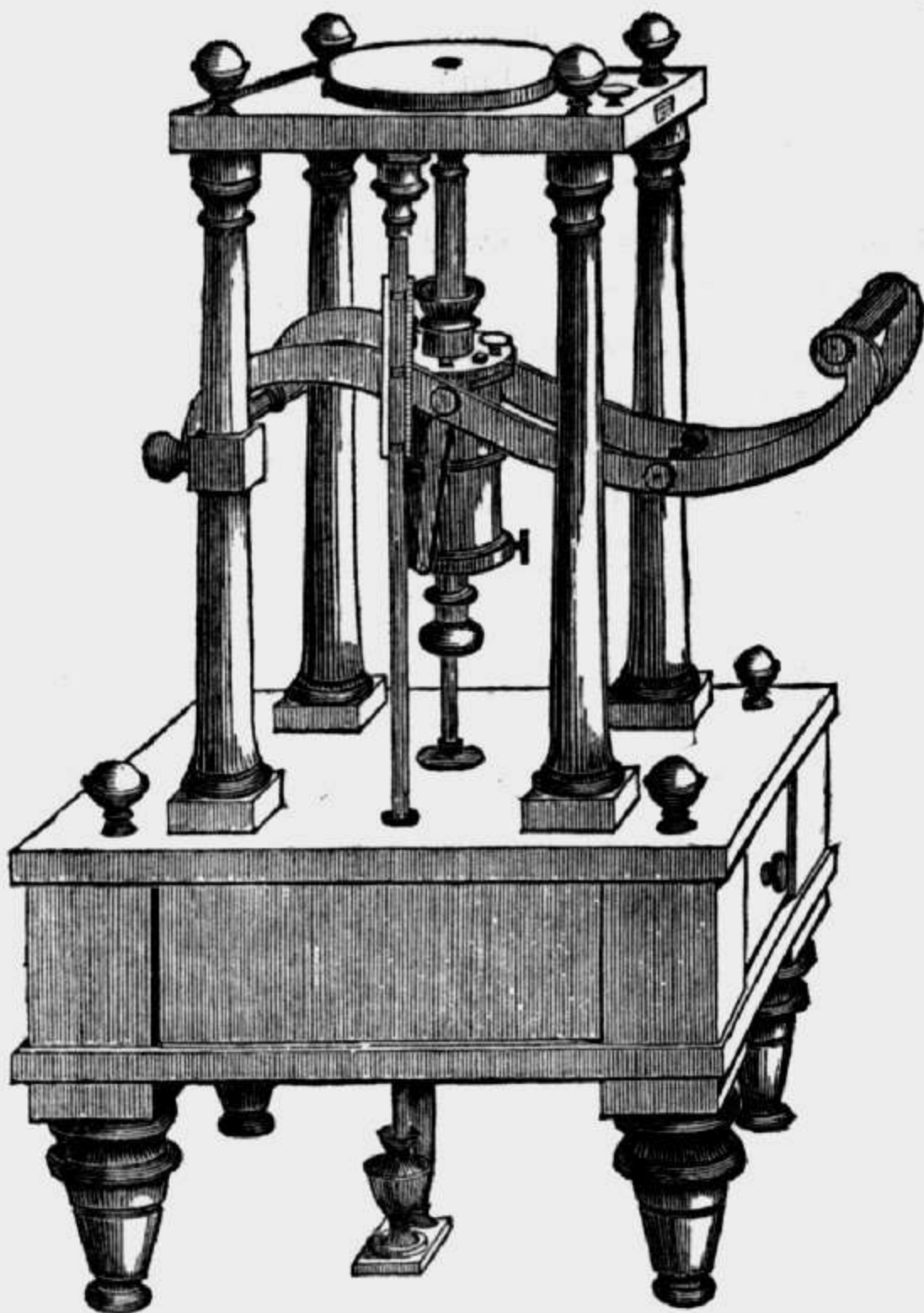
This Air Pump combines all the advantages of construction of the Table Lever Pump, Fig. 20, in a portable form. The Levers are of Brass, and every part is highly finished. The Gauge is enclosed in a glass case, with a stop cock, and should always *remain closed*, except when required for accurate experiments; as the air let in suddenly by withdrawing the hand, or breaking a bladder, would probably injure, if not break the tube.

If by accident any liquid should flow into the pump, it passes unobstructed to the bottom of the barrel, and is then easily drawn off by a screw in front.

The preceding Sets of Apparatus, recommended for 'Claxton's Patent Air Pump,' are also adapted for this pump.

WIGHTMAN'S PATENT LEVER AIR PUMP ON HIGH STAND.

Fig. 20. — No 93.



The Air Pump represented above, not only exhausts the air, but from its peculiar construction, combines both the power of condensing and transferring air or gas, while at the same time the accuracy of exhaustion and the ease of operation are increased. This is effected by the application of a tight cover and packing box to the top of the barrel; the power, therefore, required to operate it, is constantly decreasing, until the receiver is exhausted, when there is no other resistance than the simple friction of the piston in the barrel. The valve on the lower end of the piston is dispensed

with, and the bottom of the barrel is made *concave*, so that any mercury or liquid spilled in the hole of the plate can be immediately removed by a screw at the bottom of the Barrel. A Stop-Cock is situated between the Barrel and the Plate to retain the vacuum in the Receiver as long as desired. The Scale of the Guage floats upon the surface of the mercury, thus insuring accurate measurement; and a Safety Box upon the top of the tube prevents any mercury being forced into the pump.

The Barrel is $3\frac{1}{2}$ inches diameter, and the Stand is 3 feet 6 inches in height, made of Mahogany *not* veneered. The Levers are of Brass, polished, and all parts are of the best workmanship.

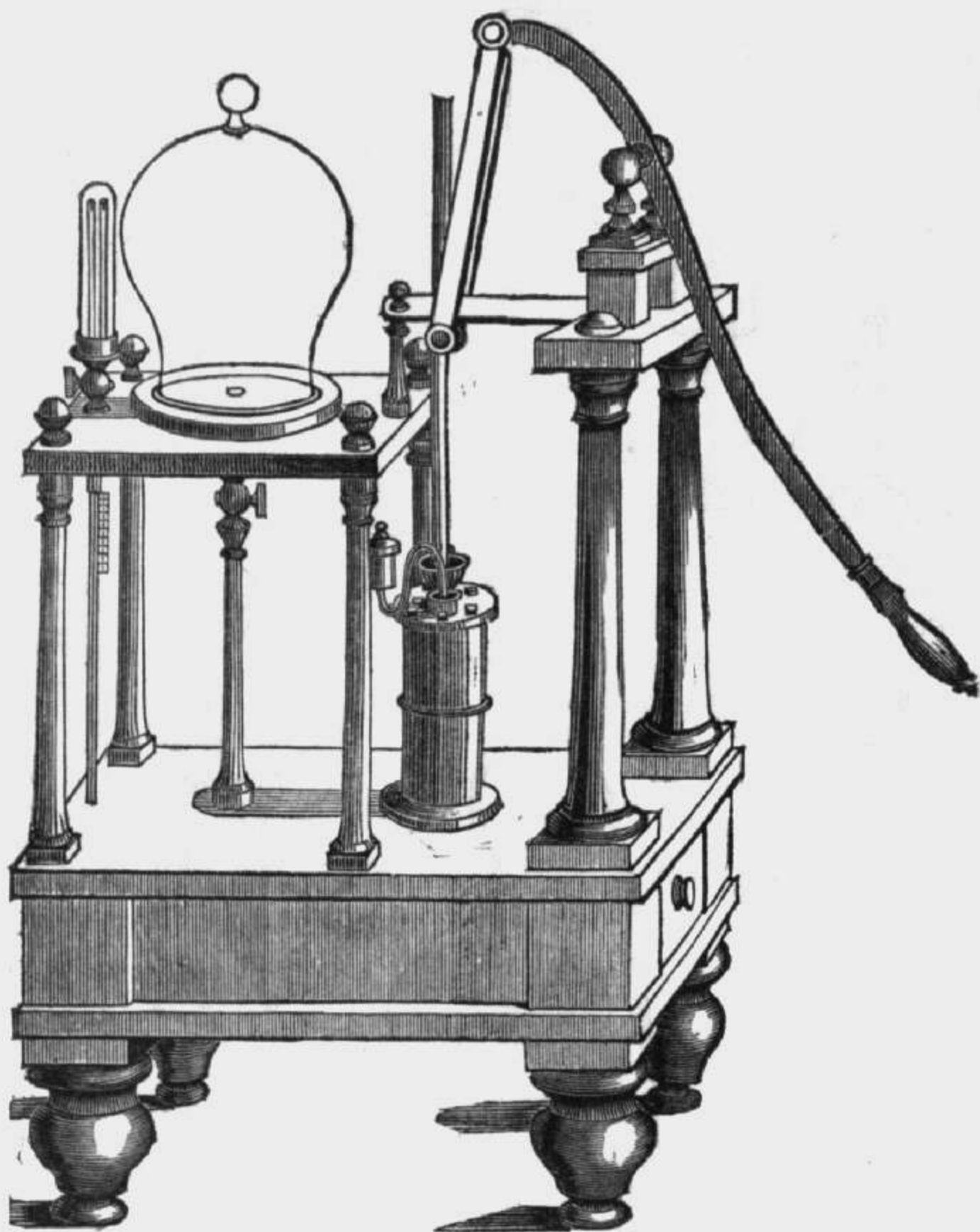
Pumps of this size have been furnished to Prof. B. Silliman, for Yale College; Lowell Institute, Boston; College of Charleston, S. C.; Newburyport High School, Mass.; Mercer University, Penfield, Geo.; Medical College, Charleston, S. C.; M. L. College, Galesburg, Ill.

WIGHTMAN'S IMPROVED 'LESLIE' AIR PUMP.

The large and powerful instrument shown at Fig. 21, is of the general construction, devised by Prof. Leslie, for his celebrated experiment for the production of ice from water by its own evaporation. The size of this pump is the same as that now made in London at £48 st'g. The finish is equal in every respect, and several additions have been made to prevent injury from accidents. The cylinder is $4\frac{1}{4}$ inches interior diameter by 12 inches high. Plate, 13 inches diameter; Brass Lever, 4 feet long. The frame is of Mahogany, firmly made and polished. It has a Barometer Gauge 33 inches long, with Floating Scale, and Syphon Gauge in Glass case, with Stop Cock to close at pleasure and prevent accident from admitting the air too suddenly. The Oil Box does not allow of the waste oil being thrown about the frame. It has a screw to attach a flexible tube for transferring, condensing, &c. All parts of these pumps are made in the most thorough manner, and for Colleges this instrument may be safely warranted *equal* to any

WIGHTMAN'S IMPROVED 'LESLIE' AIR PUMP.

Fig. 21. — No. 92.



imported, and the price at least one third less. The Apparatus designed to be used with this Pump is of the largest size, and is well calculated for a very large audience.

Fig. 22.
No. 174.



Fig. 23.
No. 133.



Fig. 24.
No. 128.



Fig. 25.
No. 142.



Fig. 26.
No. 135.



Fig. 27.
No. 150.



Fig. 28.
No. 144.



Fig. 29.
No. 149.



Fig. 30.—No 160 and 161.

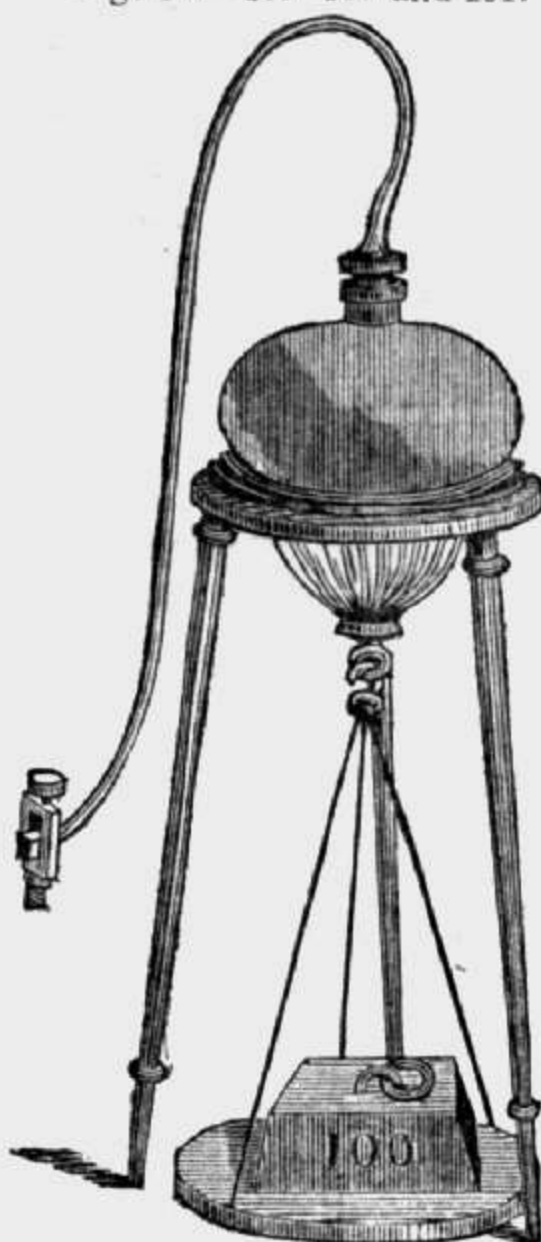


Fig. 33.
No. 130.



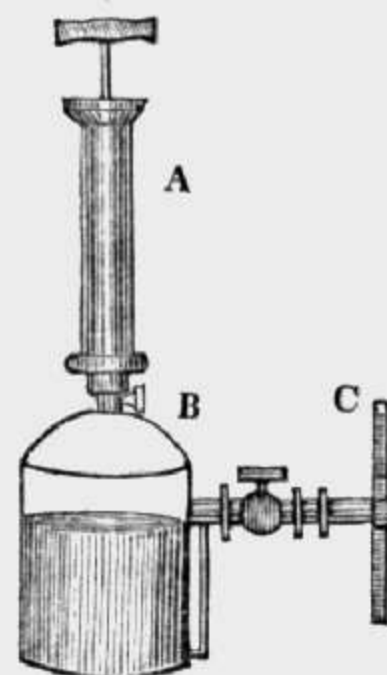
Fig. 31.
No. 151.



Fig. 32.
No. 179.



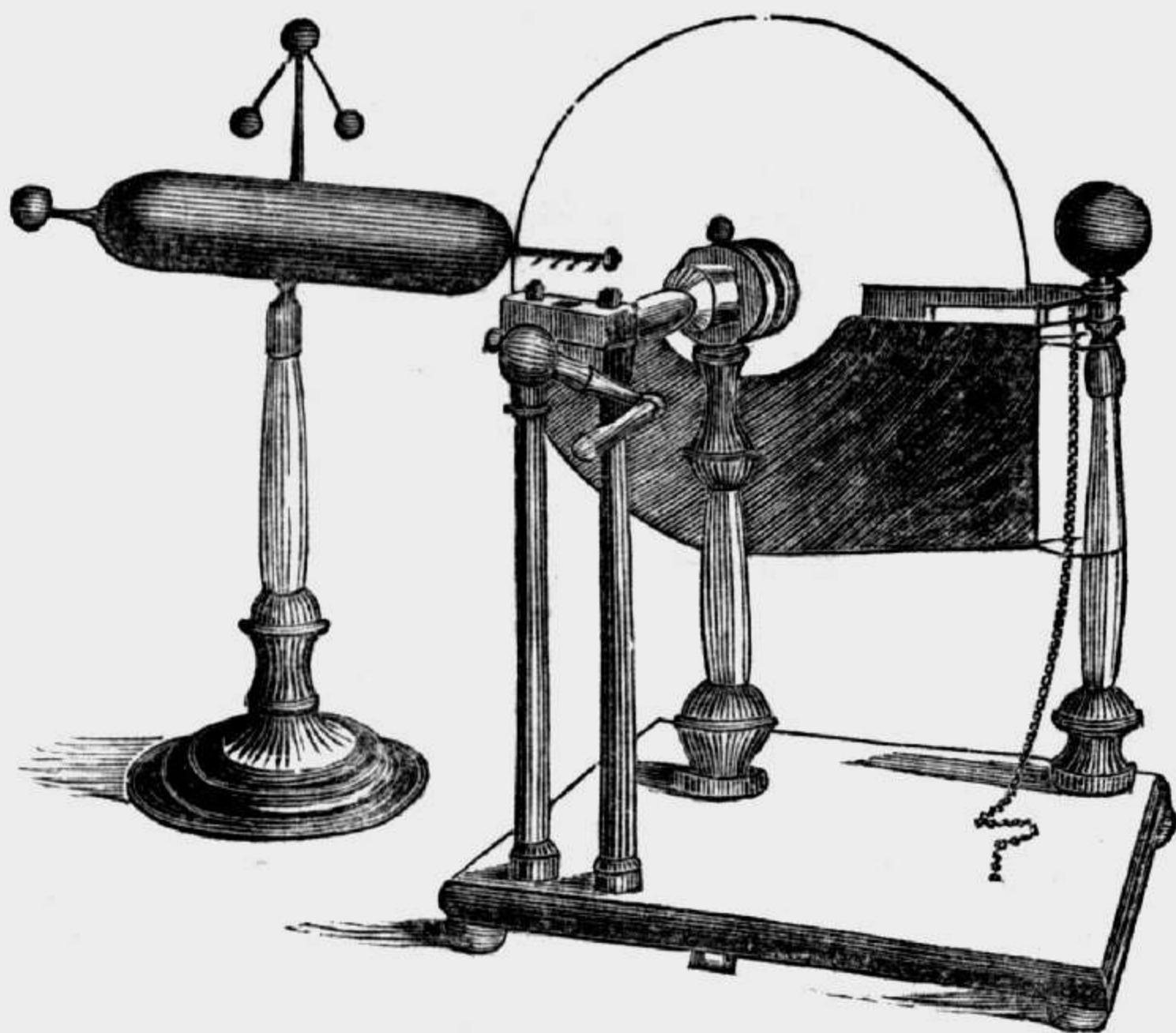
Fig. 34.—No. 136.



ELECTRICITY.

IMPROVED PLATE MACHINE.

Fig. 35. — No. 190.

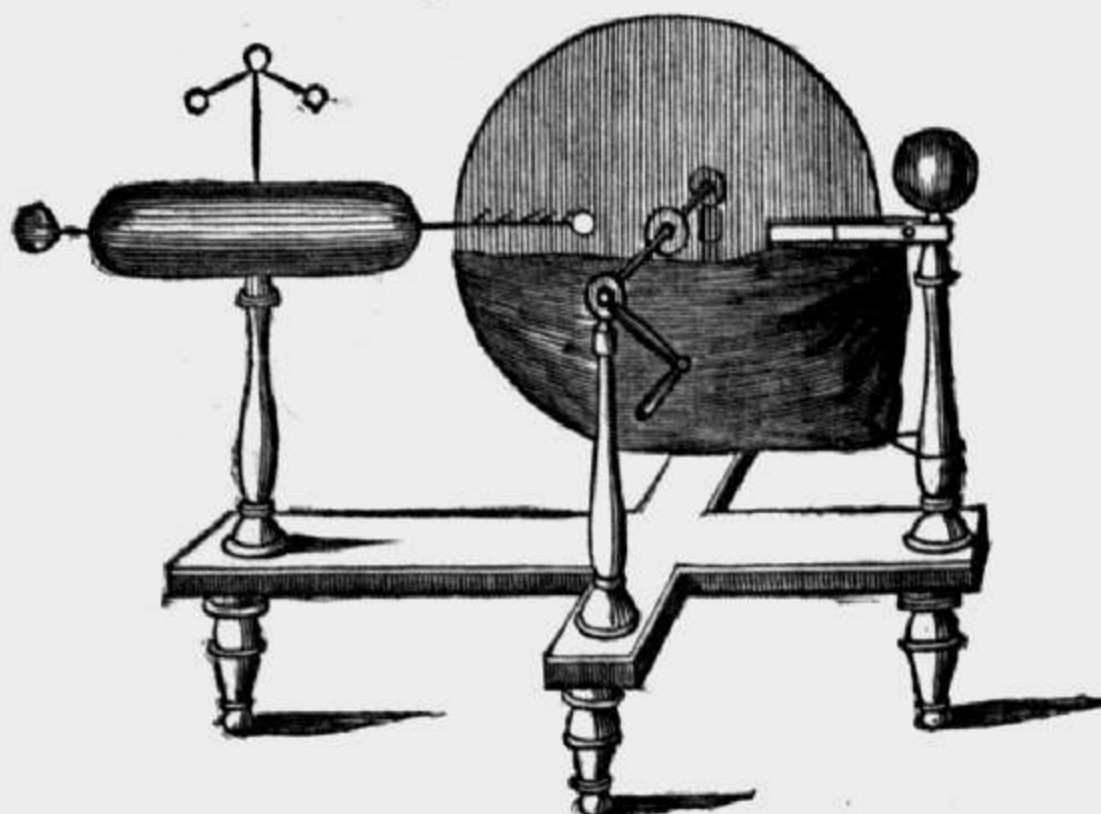


In the Improved Machine the Plate is attached by a nut and screw to one end of an axle, having a crank for turning it at the other; about six inches of the centre of the axle is of strong glass, which perfectly insulates the operator from all communication with the Conductor. This axle revolves in boxes upon the top of two Mahogany pillars next to the crank and on an insulated pillar next to the plate. The *springs* holding the *Cushions* (which are all of brass) are supported by a glass pillar, and surmounted with a large brass ball for a *Negative* Conductor. The Prime Conductor is of sheet brass, highly polished, and supported upon a separate glass pillar and mahogany base. It is furnished with appropriate points, rod, and ball at the ends, and a tube in the top for the Electrometer, Tissue Figure, Tellurian, &c.

ELECTRICITY.

BRASS MOUNTED PLATE MACHINE.

Fig. 36.—No. 191.



The above figure exhibits the form and construction of the Brass Mounted Plate Machines, from a plate 16 inches to 24 inches diameter. The Base is of Mahogany, supporting four glass pillars, mounted with Brass Bases and Caps; the Axle of the plate revolves in Brass Balls on the top of two of the pillars, and the prime Conductor and Rubber are supported by the other two. The Crank is Insulated; the Conductors are all polished lengthwise, or Telescope finished, and there is no difference in the *finish* of the several sizes.

ELECTRICAL APPARATUS.

Fig. 37.—No. 256,

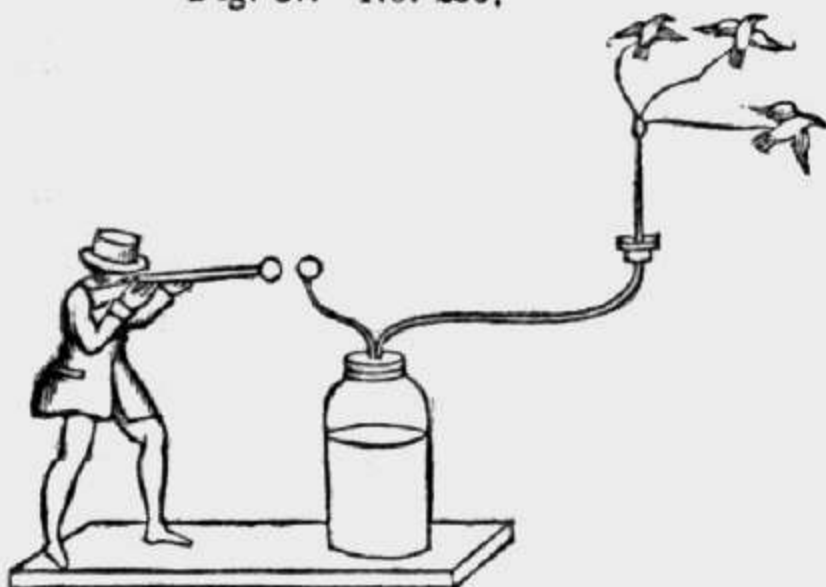


Fig. 38.—209.

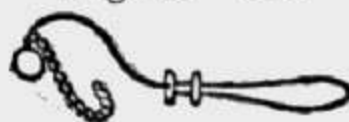
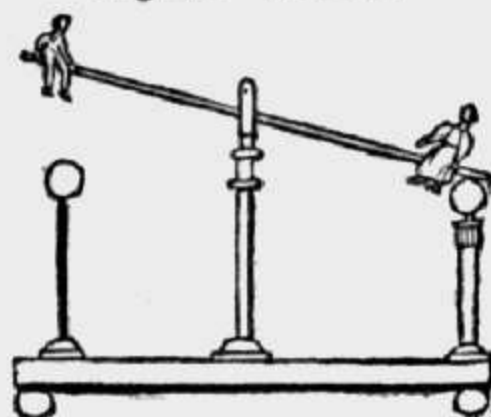


Fig. 39.—No. 253.



ELECTRICAL APPARATUS.

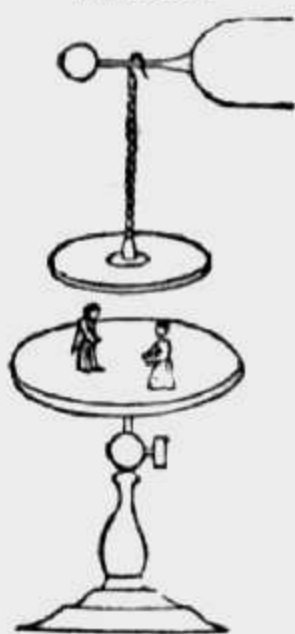
Fig. 40.
No. 250.

Fig. 41.—No. 213.

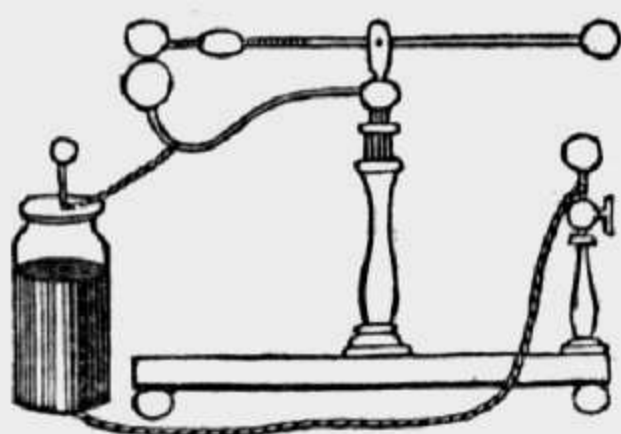
Fig. 42.
No. 279.

Fig. 44.—No. 237.

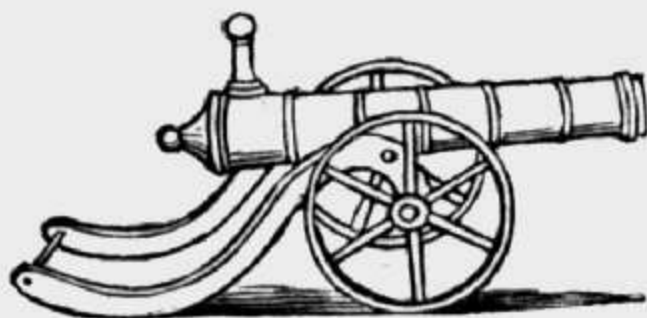
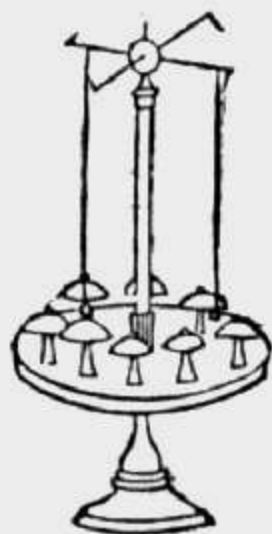
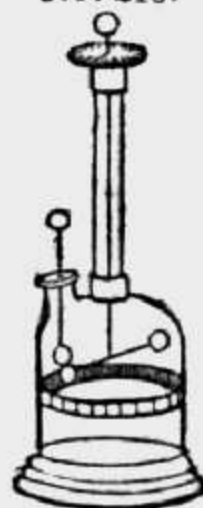
Fig. 43.
No. 245.Fig. 45.
No. 216.

Fig. 46.—No. 200.

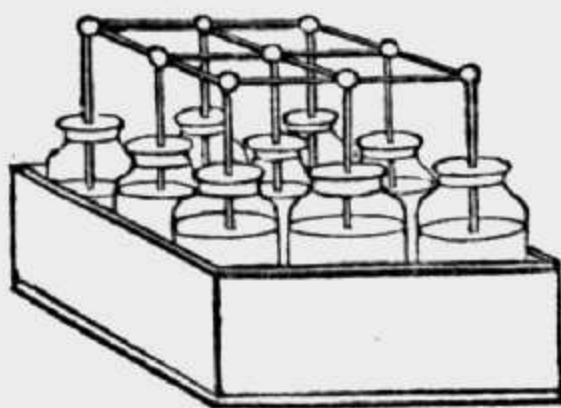
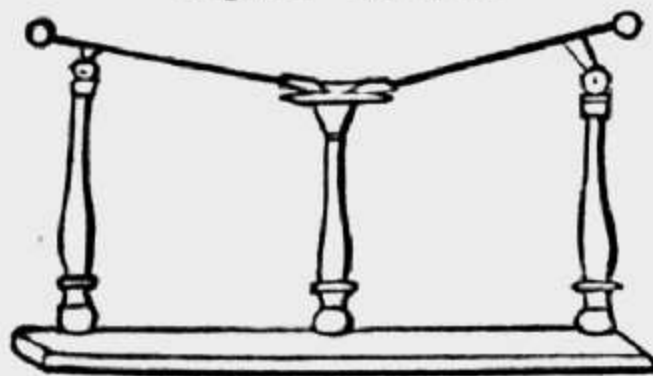
Fig. 47.
No. 217.Fig. 49.
No. 207.

Fig. 48.—No. 206.



ELECTRICITY.*Set No. 1.*

Electrical Machine, 16-inch plate, Brass Mounted on Glass Pillars,

Battery of four Jars, one with
Bent Rod,
Insulated Stool,
Image Plates,
Plain Discharger,
Pith Ball Electrometer,
Tissue Figure,
Ball and Point,
Miser's Plate,

Chime of Bells,
Electric Flier,
" Spider.
Mahogany Model of an Obelisk,
Brass Chains,
Cylinder for Dancing Balls,
Box of Amalgam,
" Pith Balls.

Price of Set No. 1, \$50 00.

Set No. 2.

Electrical Machine, 18-inch plate,

Battery of four Jars, one with
Bent Rod,
Chime of Bells,
Tissue Figure,
Electric Tellurian,
Cylinder for Dancing Balls,
Brass Chains,
Electrical Sportsman,

Thunder House and Pistol,
Pith Ball Electrometer,
Plain Discharger,
Image Plates,
Insulated Stool,
Miser's Plate,
Ball and Point,
Box of Amalgam.

Price of Set No. 2, \$65 00.

Set No. 3.

Electrical Machine, 20-inch plate,

Battery of 4, 3-quart Jars,
Quart Jar with Bent Rod,
Image Plates,
Chime of Bells,
Tissue Figure,
Jar with Movable Coatings,
Universal Discharger,

Jointed Discharger,
Electrical See Saw,
" Tellurian,
Insulated Stool,
Thunder House with Pistol,
Brass Ball and Point,
Box of Amalgam,

Price of Set No. 3, \$85 00.

Set No. 4.

Electrical Machine with 22-inch plate,

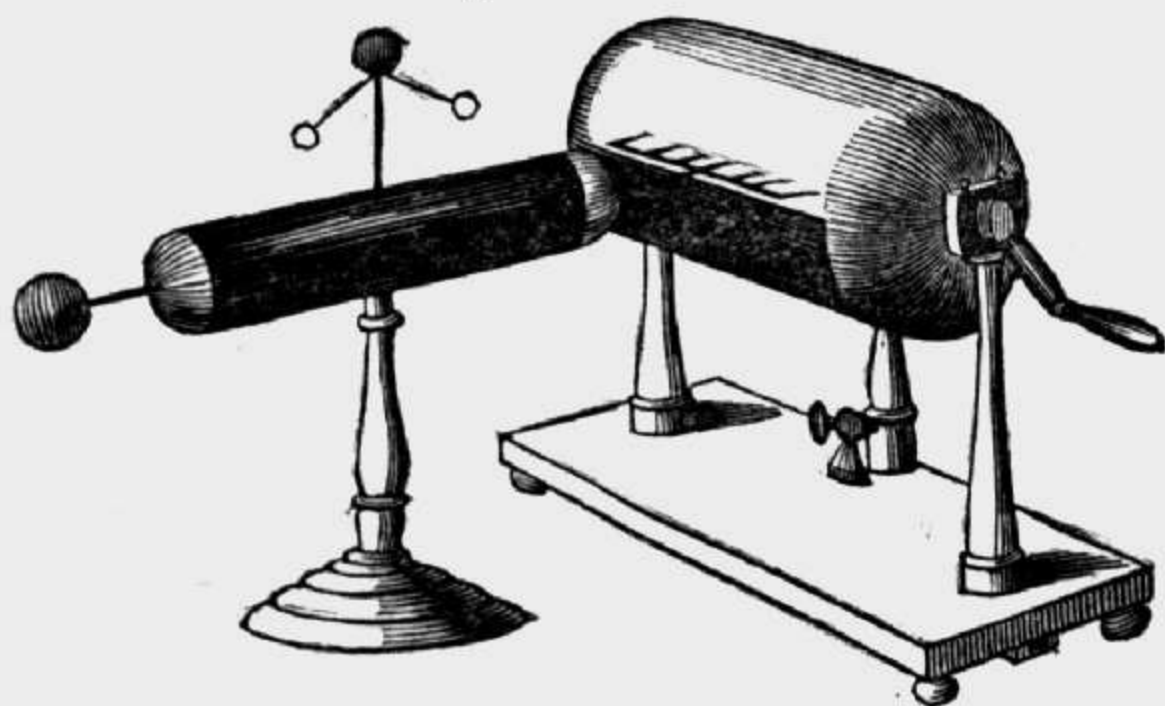
Pith Ball Electrometer,
 Battery of 4 1-gallon Jars,
 Sportsman, Jar, and Birds,
 Brass Image, Plates and Figures.
 Insulated Stool,
 Chime of Bells,
 Aurora Tube, Balls and Cock,
 Jar with Movable Coatings,
 Quart and pint Leyden Jars,
 Box of Amalgam,
 Word 'Lightning,'

Jointed Discharger,
 Universal "
 Thunder House and Pistol,
 Electric Tellurian,
 " Swan and Glass Dish,
 " Powder Bomb,
 " See Saw and Figures,
 Gas Generator,
 Tissue Figure,
 Brass Chains,
 Powder Bomb.

Price of Set No. 4, \$125 00.

CYLINDER ELECTRICAL MACHINES.

Fig. 50.—No. 196.



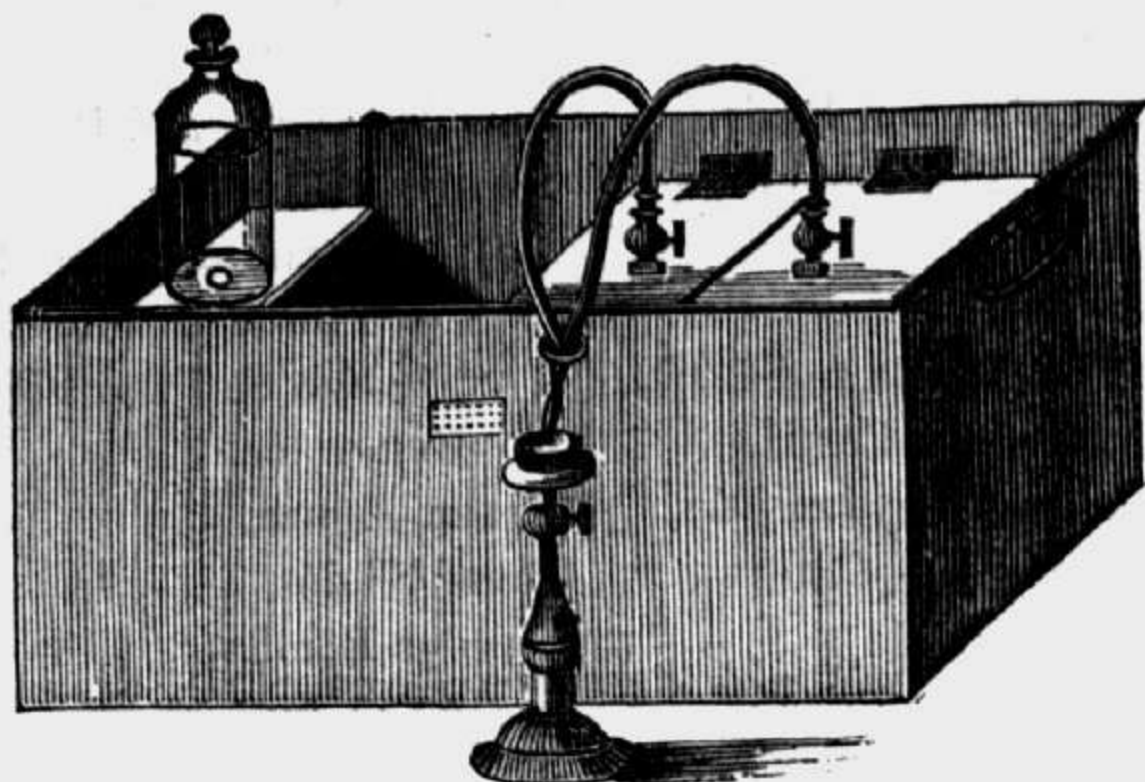
These are beautifully and effectively mounted on mahogany stands, with brass and japanned Prime Conductor, and their operation is warranted equal to any manufactured. They are all thoroughly insulated for collecting either Positive or Negative electricity.

A ten-inch Cylinder Machine may be substituted in the place of the plate Machine in Set No. 2, or an eight inch instead of the plate Machine in Set No. 1.

CHEMISTRY.

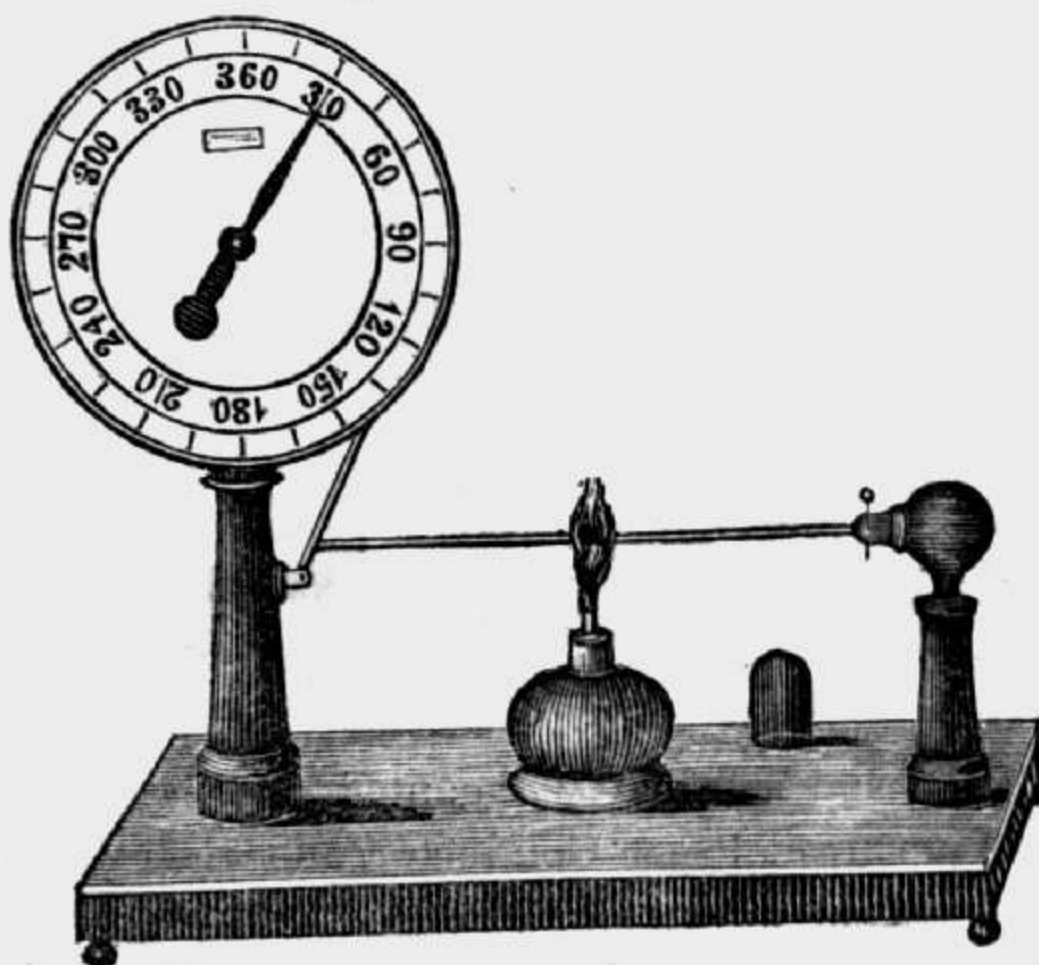
PNEUMATIC CISTERN AND COMPOUND BLOW PIPE.

Fig. 51.—No. 297.



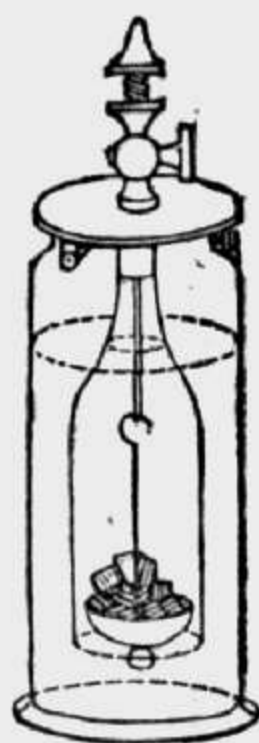
PYROMETER AND SPIRIT LAMP.

Fig. 52.—No. 325.



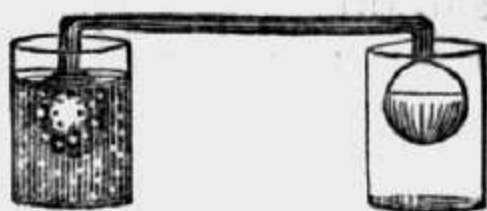
GAS GENERATOR.

Fig. 45.—No. 349.



WOLLASTON'S CRYOPHERUS.

Fig. 54.—No. 375.



EOLIPILE.

Fig. 55.—No. 88.



School Chemical Set, No. 1.

Copper Pneumatic Cistern, with Shelf,	Glass Graduated Measure.
Improved Iron Retort,	Improved Lamp Stand,
Conducting Lead Tube,	Glass-Cap Spirit Lamp,
Brass Reflectors on Stands,	Pyrometer and Rod, Fig. 52.
Iron Ball and Sliding Stands,	Brass Eolipile, Fig 55,
Leslie's Cube, as Air Thermometer,	Wire Gauze,
Three Test Glasses,	Compound Bar,
Six Test Tubes,	Three Retorts,
Long Neck Matrass,	Two Bell Receivers,
Brand's Acid Bulb and Tube.	Tubulated " "
	Stirring Rods.

Price, \$25 00.

Set No. 2.

Set No. 2 includes Set No. 1, except the Pneumatic Cistern, which the Compound Blowpipe renders unnecessary; and in addition the following:

Improved Pneumatic Cistern, & Compound Blowpipe of Copper, Fig. 51,	Transferring Receiver,
Conducting Lead Tube,	India Rubber Gas Bag,
Hydrogen Gas Bottle,	Stop Cock and Jet,
	Bubble Pipe.

Price of Set No. 2, \$50 00.

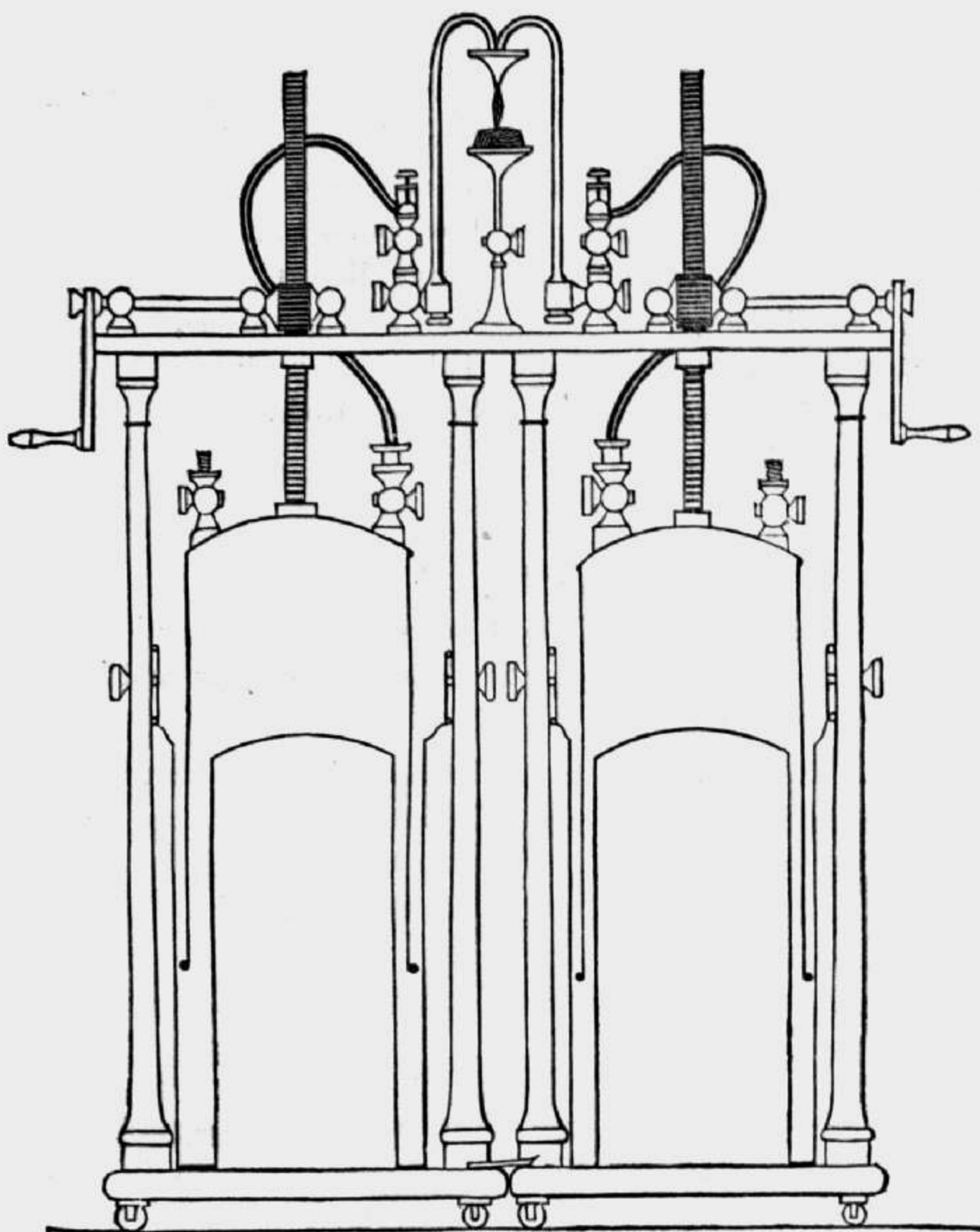
Set No. 3.

In addition to the two preceding Sets, Set No. 3 contains	
One-Quart Tubulated Bell Glass,	Porcelain Pestle and Mortar,
Two-Quart plain Bell Glass,	Two Porcelain Capsules,
Brass Mouth Blowpipe,	Brass Fire Syringe,
Two Digesting Flasks,	Hydrogen Gas Generator,
Pair of Tongs and Crucibles,	Brass Revolving Steam Jet,
Two Glass Funnels,	Two Glass Retorts,
Hydrogen Balloon,	Chemical Thermometer,
Glass Tube for Music of a Hydrogen Flame,	A variety of Acids and Chemicals for experiments.

Price of Set No. 3, \$75 00.

IMPROVED RACK COMPOUND BLOW PIPE.

Fig. 56. — No. 295.



The above is a beautiful Oxy-Hydrogen Blow Pipe, on HARE'S construction, made by me under the direction of Prof. B. SILLIMAN, for the Lowell Institute. The vessels are of copper, and the pressure is communicated by rack work, thus avoiding the trouble of heavy weights. The Gas Holders are on *separate* frames, upon strong casters, and may thus be separated when but one Gas is required. Price, complete, \$150 00.

OPTICS.

No. 493.

SET OF MODELS OF THE HUMAN EYE.

Fig. 57.

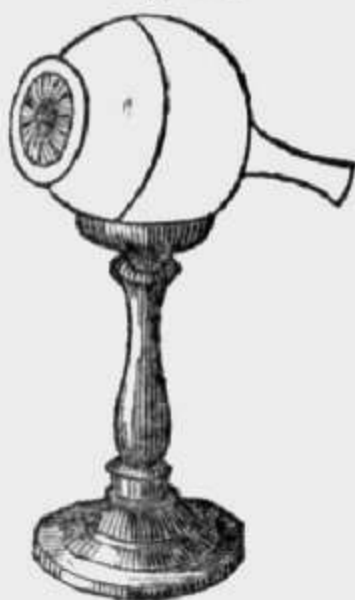


Fig. 58.

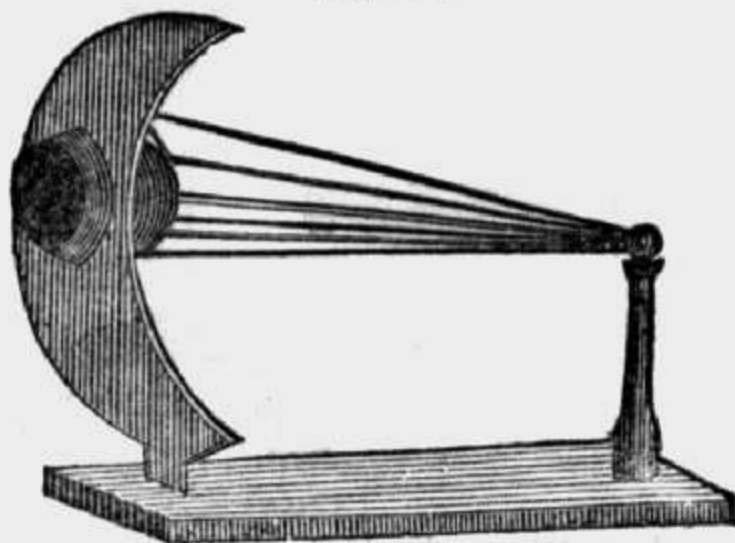
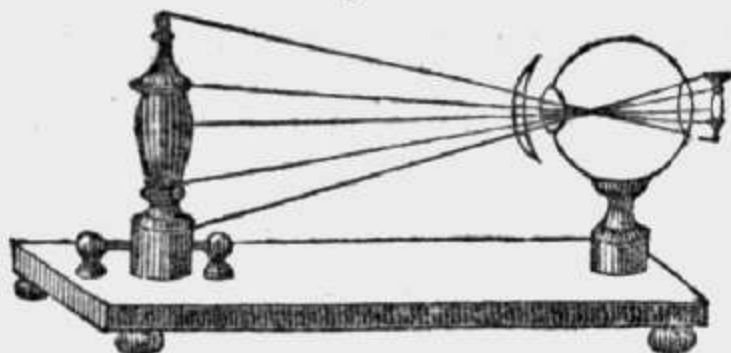


Fig. 59.



The Set of Models of the Eye has been much improved in construction and operation. Fig. 57 represents the Globe of the Eye, containing the various coats and parts which can be successively removed, showing the arrangement of the Eye as it appears on dissection. The Globe is 4 inches in diameter, and supported upon a stand.

At Fig. 58 is shown the attachment of the muscles, and the manner in which the Eye is moved in the socket.

Fig. 59 shows the form of my Apparatus for illustrating the position of the Image with regard to the Retina, in Perfect, Long, and Short Sight. The inversion of the Image by the crossing of the Rays, (shown by silk cords,) is seen much more perfectly than in any other construction.

The Set is accompanied by an explanatory pamphlet and a large colored Sectional Diagram. Price of Set, complete, \$12 00.

ACHROMATIC ASTRONOMICAL TELESCOPE.

Fig. 60.—No. 466.



Fig. 60 represents the form of the Astronomical Telescopes, with Terrestrial and Celestial Powers and Sun Glass, mounted on tripod stand and with rack adjustment. The mounting is entirely of brass, beautifully finished, and for defining power they are superior to any imported at the same prices. They are very portable, and packed in a neat case.

 SETS OF OPTICALS.
Set No. 1.

Glass Prism,
Set of 4 2-inch Lenses,
Multiplying Glass,

Convex and Concave Mirrors,
Colored Diagram of the Eye,
Flower Microscope.

Price, \$10 00.

Set No. 2.

Glass Prism,
Set of 4 Lenses,
Concave Mirror,

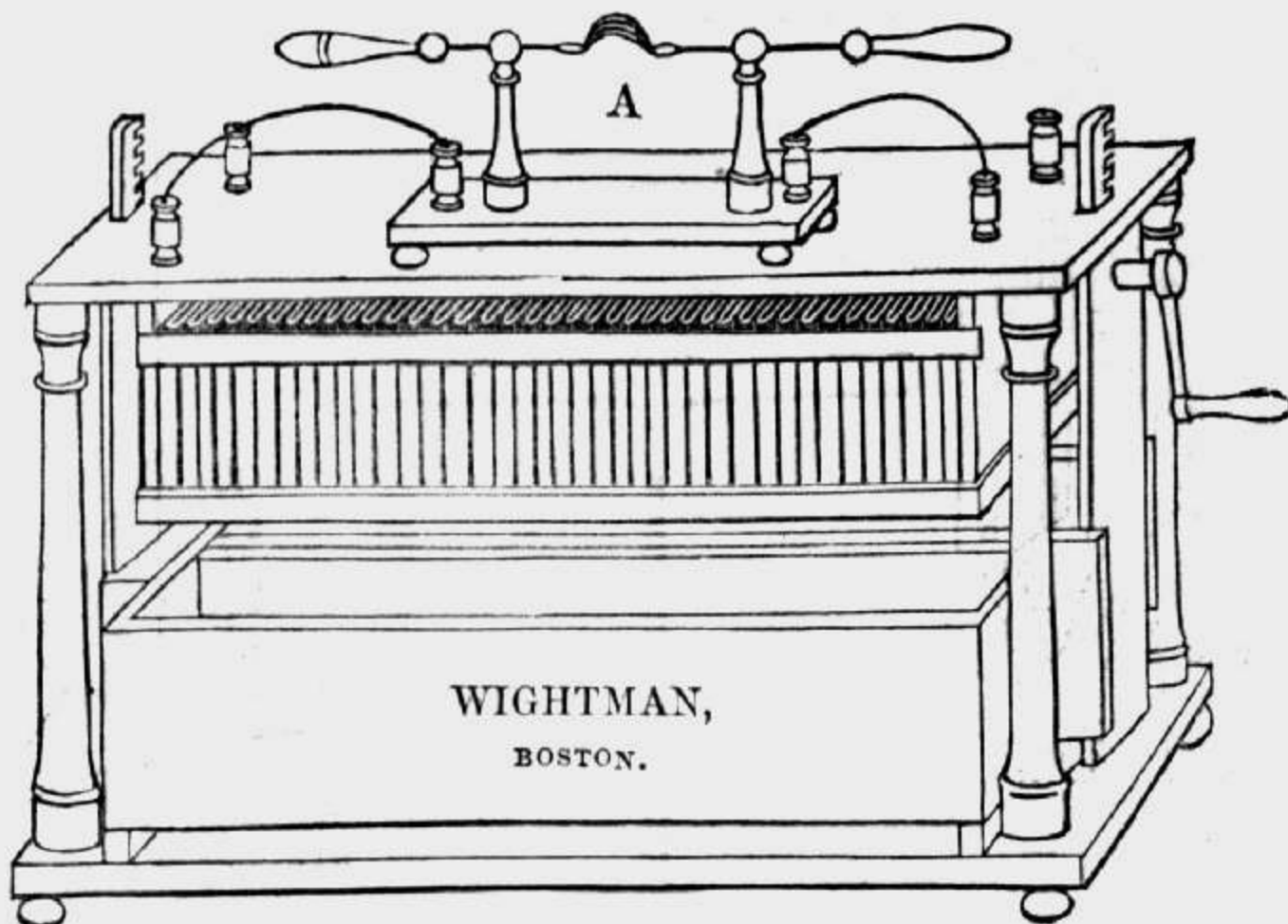
Set of Models of the Eye,
Compound Microscope,
Convex Mirror.

Price, \$30 00.

GALVANISM.

WIGHTMAN'S IMPROVED RACK GALVANIC BATTERY.

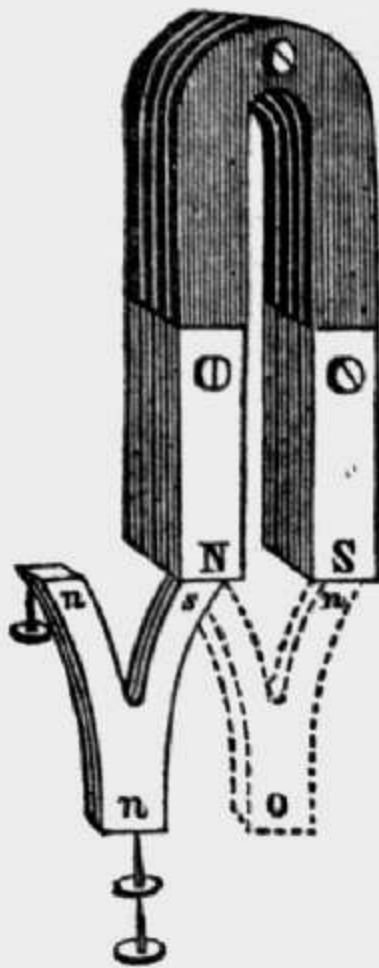
Fig. 61. — No. 568.



The Battery shown above contains 100 pairs of WOLLASTON'S Double Plates arranged for deflagration. It is entirely made of Mahogany, and is very portable and convenient. The plates being arranged in two cases of 50 pairs each, by removing one of the troughs, or not charging it with the acid solution, but fifty pairs may be used. The Racks are also very durable, and not liable to be injured, like cords; the cases with the plates are stationary, and the troughs with the liquid are raised by the Racks. The advantages are, that we thus move the *lightest* portion of the Battery, and the connections are undisturbed, which permits the very convenient Sliding Forceps to be used for holding substances for deflagration, &c., shown at A, Fig. 61. The zinc plates are amalgamated, which causes the action to be sustained much longer. Price, complete, with Sliding Forceps, Apparatus for Decomposition of Water and Alkalies, and Handles for shocks, \$100 00.

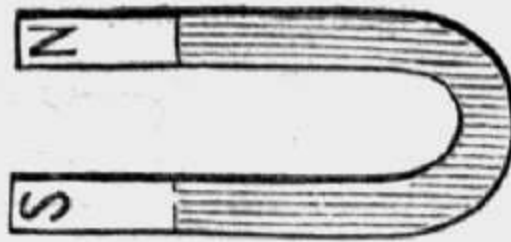
MAGNETISM.COMPOUND MAGNET
AND Y ARMATURE.

Fig. 62.—No. 578.



HORSESHOE MAGNET.

Fig. 63.—No. 579.



MAGNETIC NEEDLE.

Fig 65.—No. 584.

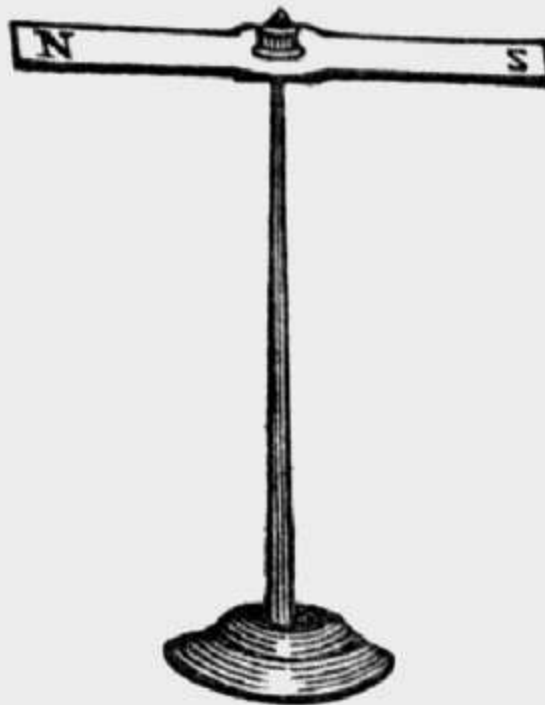
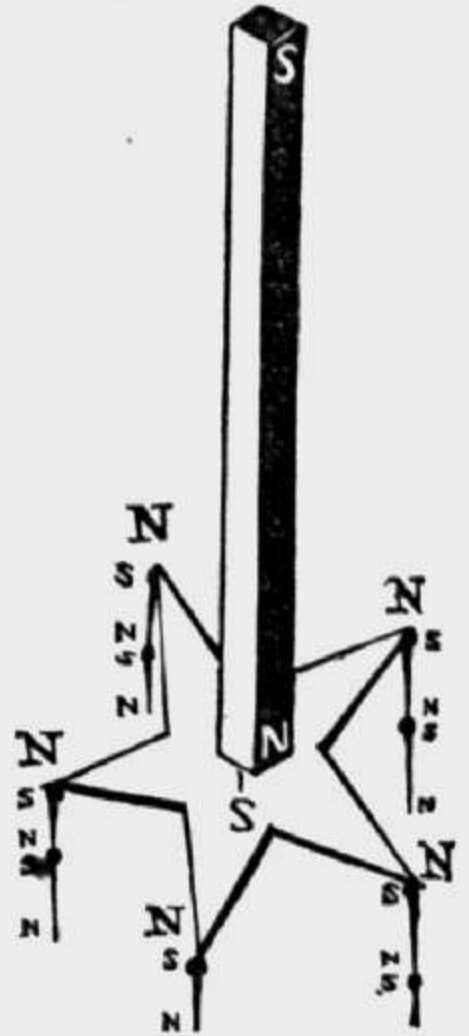
STAR PLATE AND BAR
MAGNET.

Fig. 64.—No. 581.

*Set No. 1.*

Horseshoe Magnet,
Y. Armature,
Magnetic Needle and Stand,
Pocket Compass in Box,

Magnetic Swan and Magnet,
U. Magnet and Star plate,
Box of Iron Filings,
Plate of Glass.

Price, \$5 00.

Set No. 2.

Compound Magnet,
Rolling Armature,
Magnetic Needle and Stand,
U. Magnet,
Star Plate,

Box Compass,
Swan and Magnet,
Y. Armature,
Box of Iron Filings,
Plate of Glass.

Price, \$10 00.

ELECTRO-MAGNETISM.

Fig. 66.—No. 594.

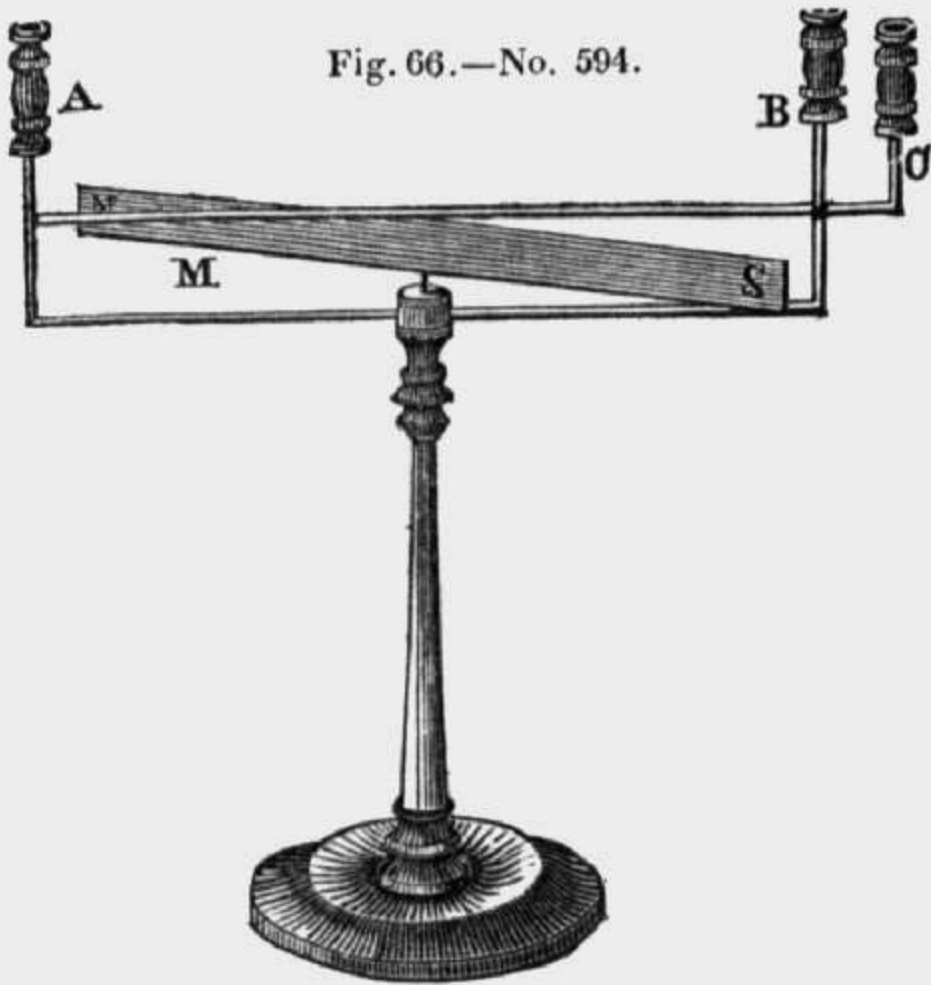


Fig. 67.—No. 596.



Fig. 68.—No. 595.

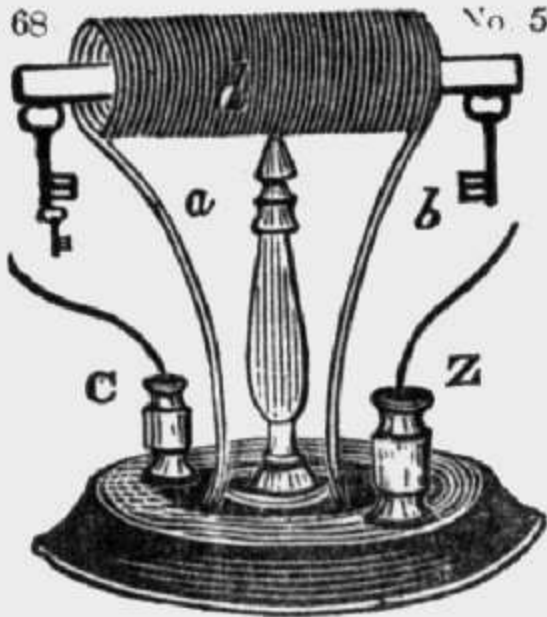


Fig. 69.—No. 602.

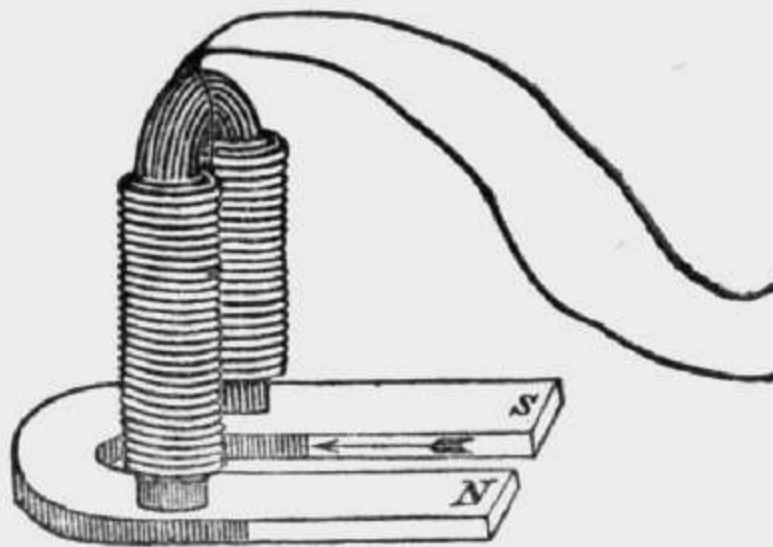
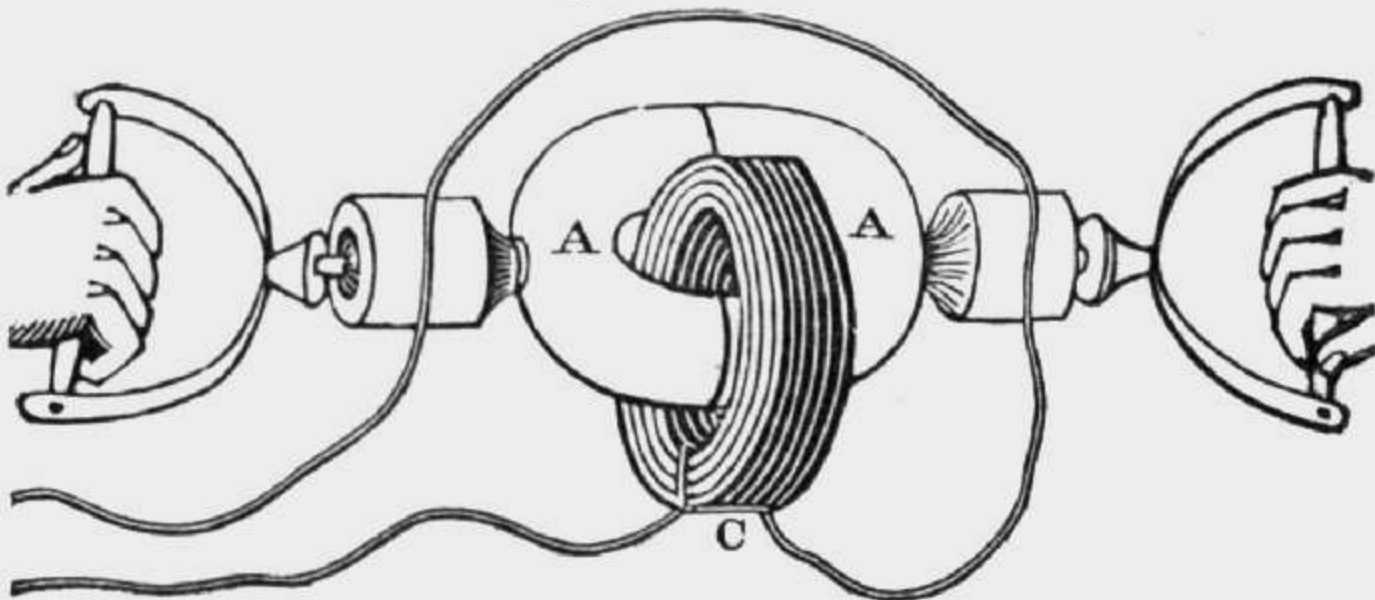


Fig. 70.—No. 601.



ELECTRO-MAGNETISM.

Fig. 71.—No. 609.

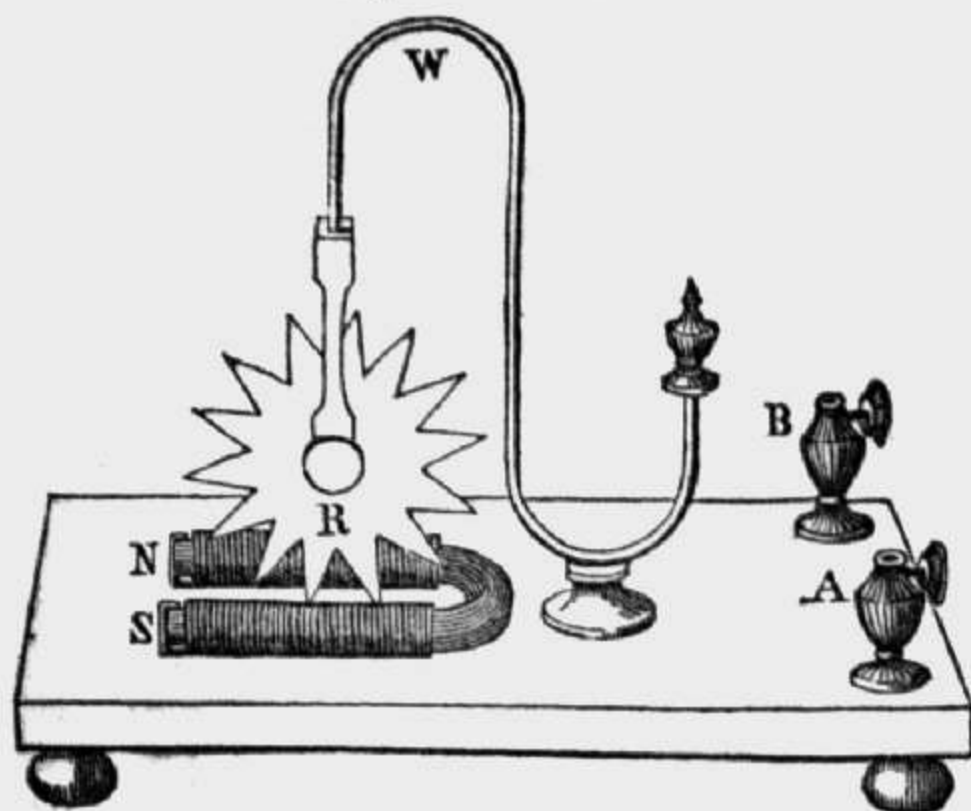
**THERMO-ELECTRICITY.**

Fig. 72.—No. 631.

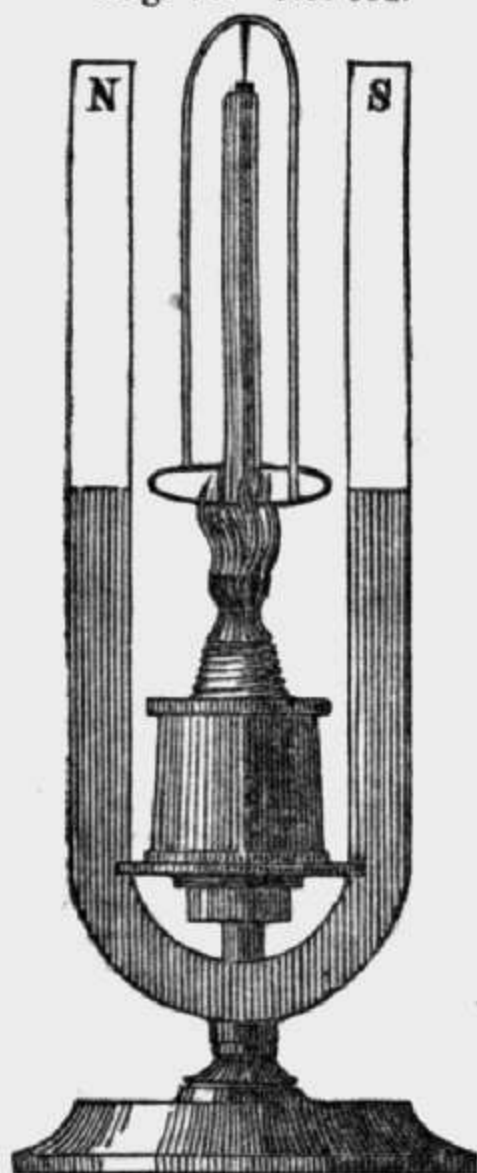


Fig. 73.—No. 586.

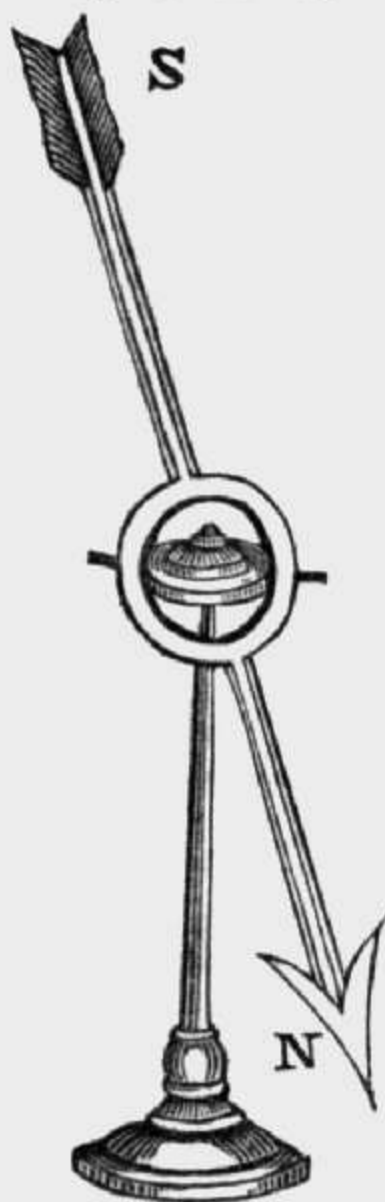
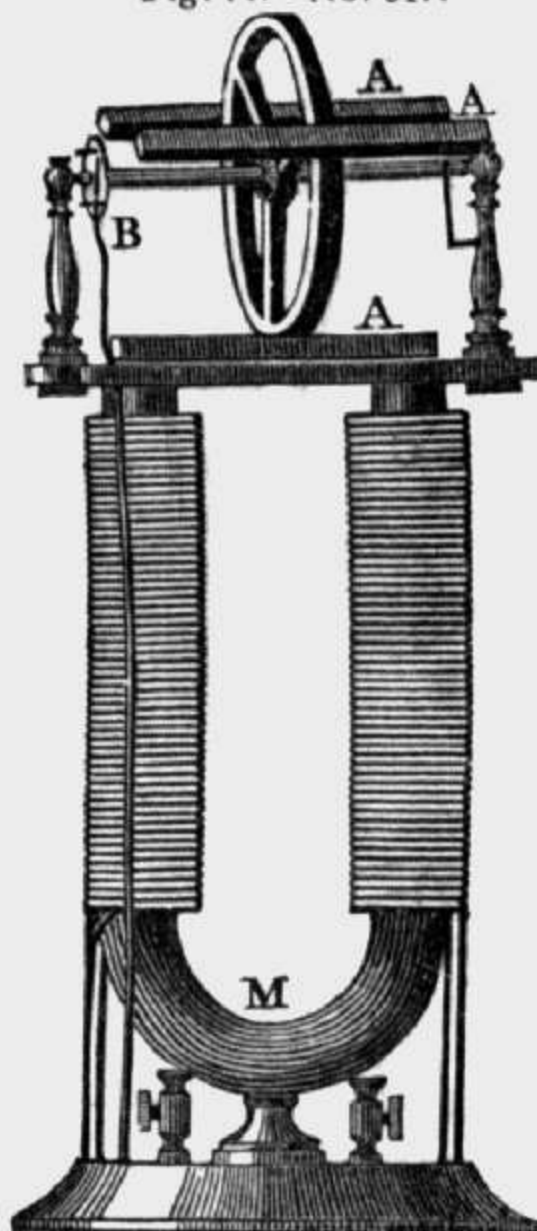


Fig. 74.—No. 617.



ELECTRO-MAGNETISM.

PAGE'S RECIPROCATING ENGINE.

Fig. 75.—No. 618.

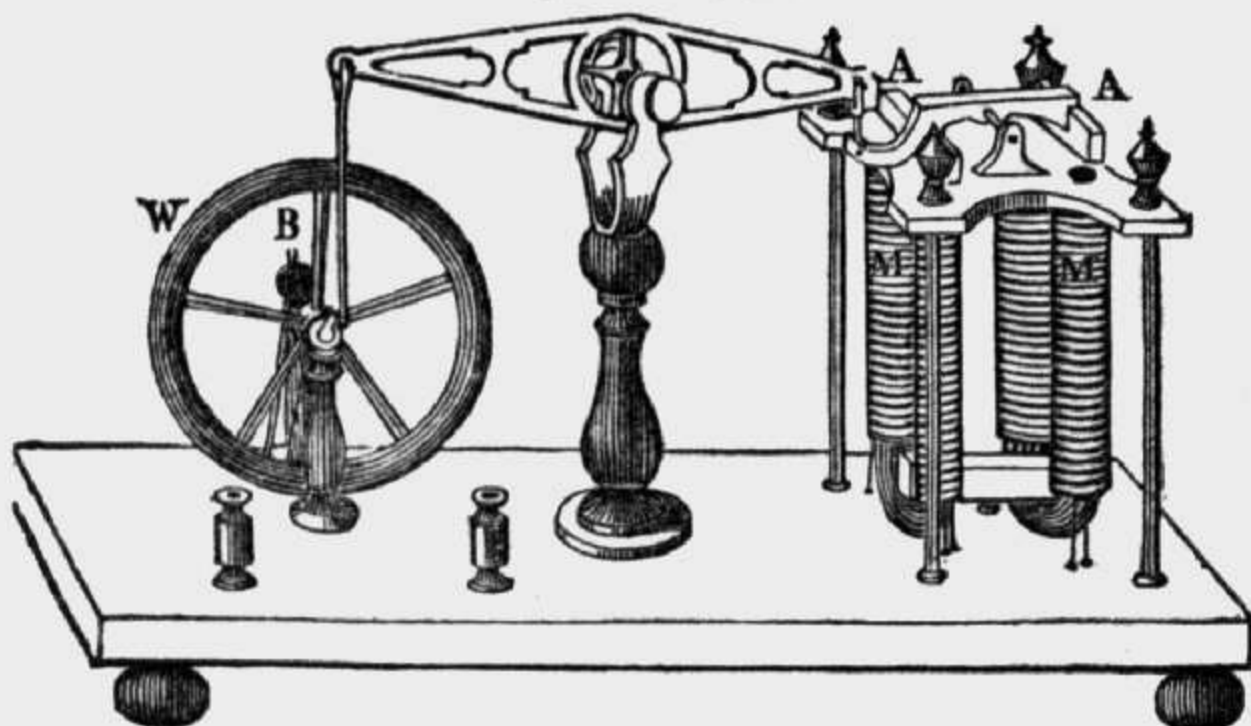


Fig. 76.—No. 614.

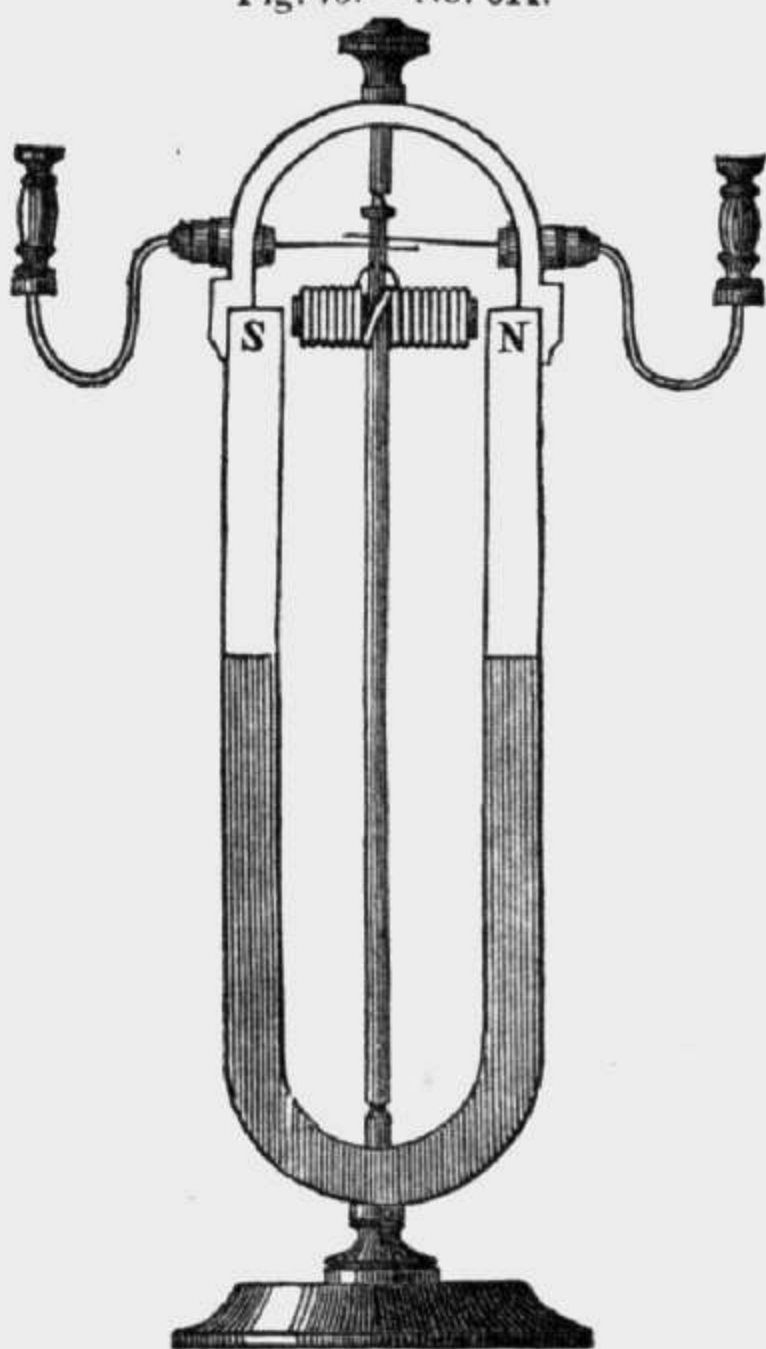
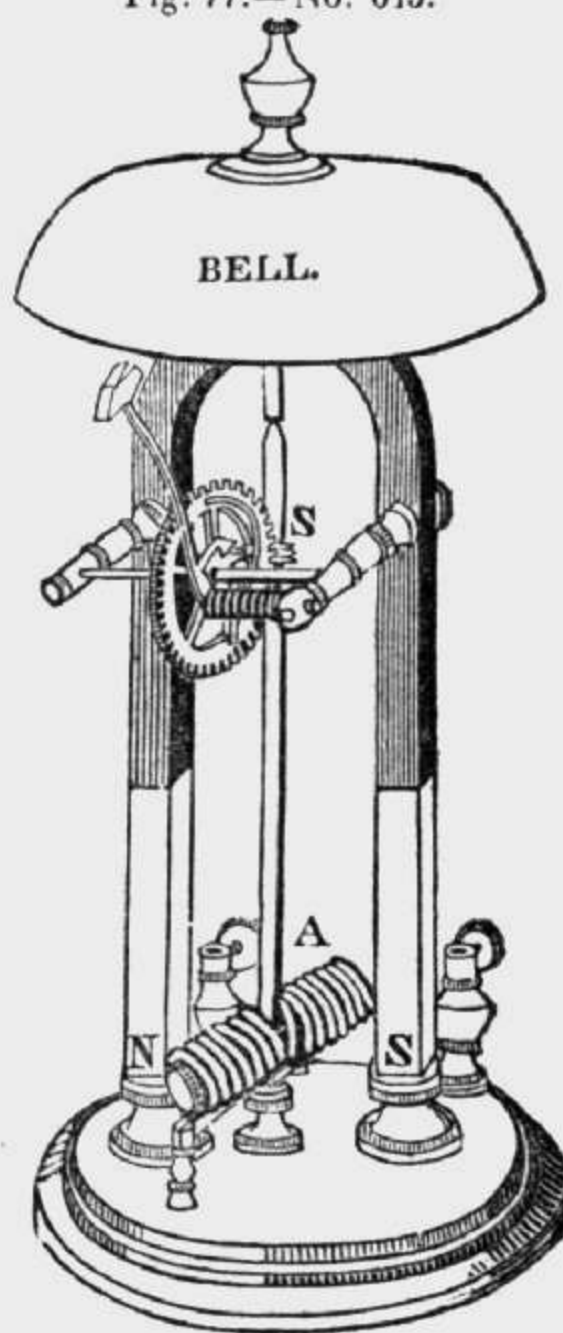


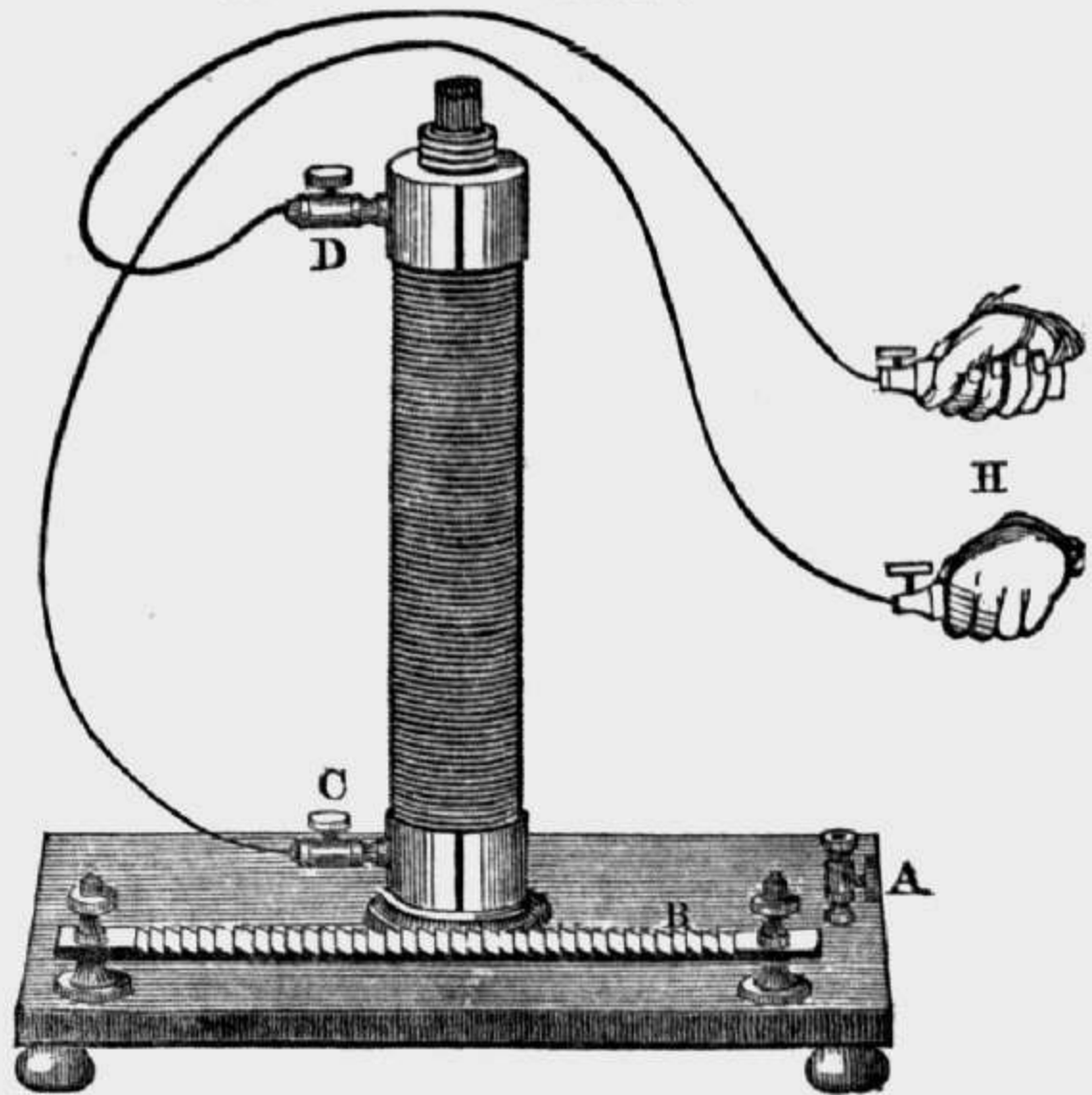
Fig. 77.—No. 615.



ELECTRO-MAGNETISM.

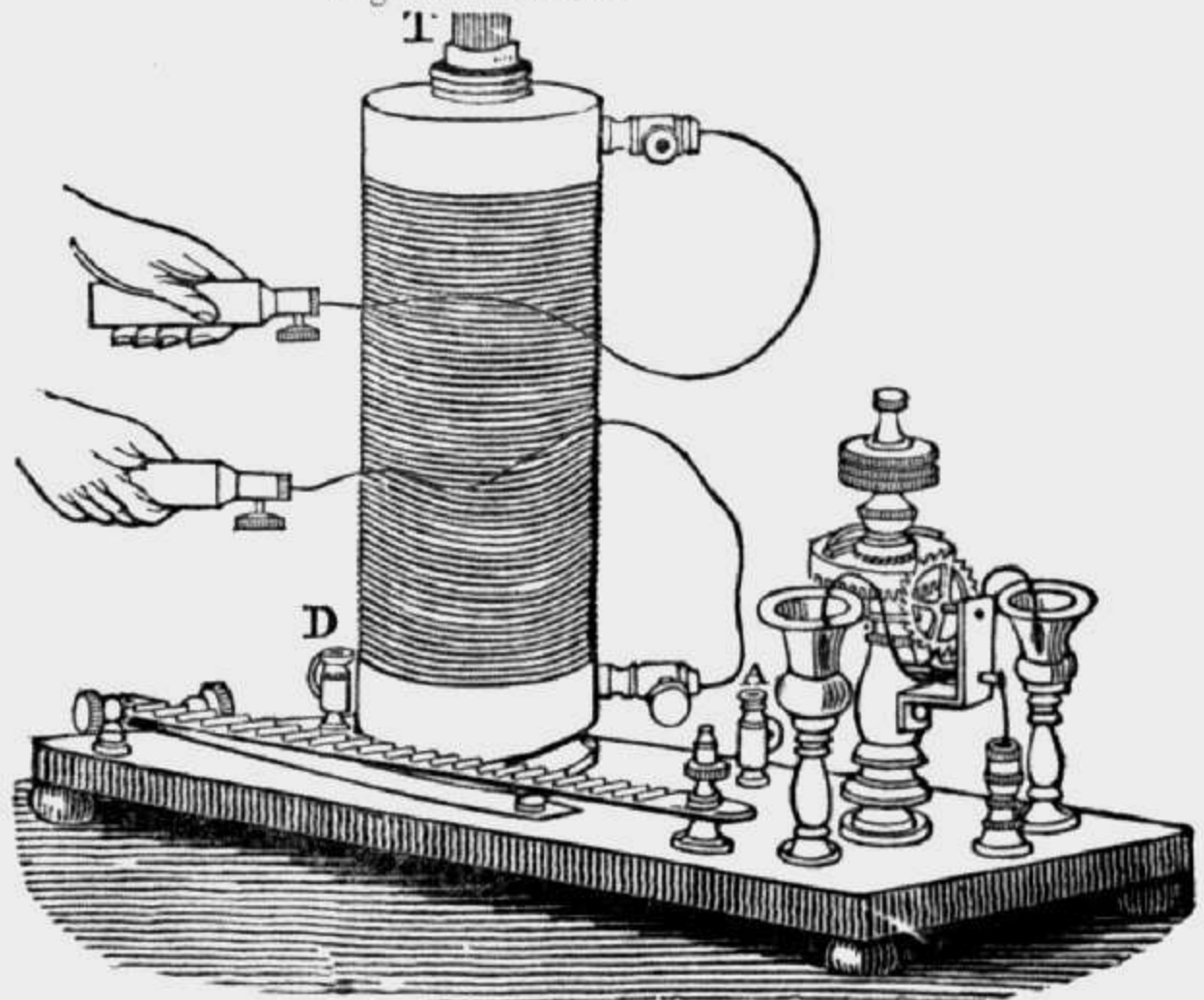
Fig. 78.—No. 606.

ANALYTICAL APPARATUS.



ANALYTICAL APPARATUS AND ELECTROTOME.

Fig. 79.—No. 607.



MAGNETO-ELECTRICITY.

IMPROVED MAGNETO-ELECTRIC MACHINES.

Fig. 80.—No. 621.

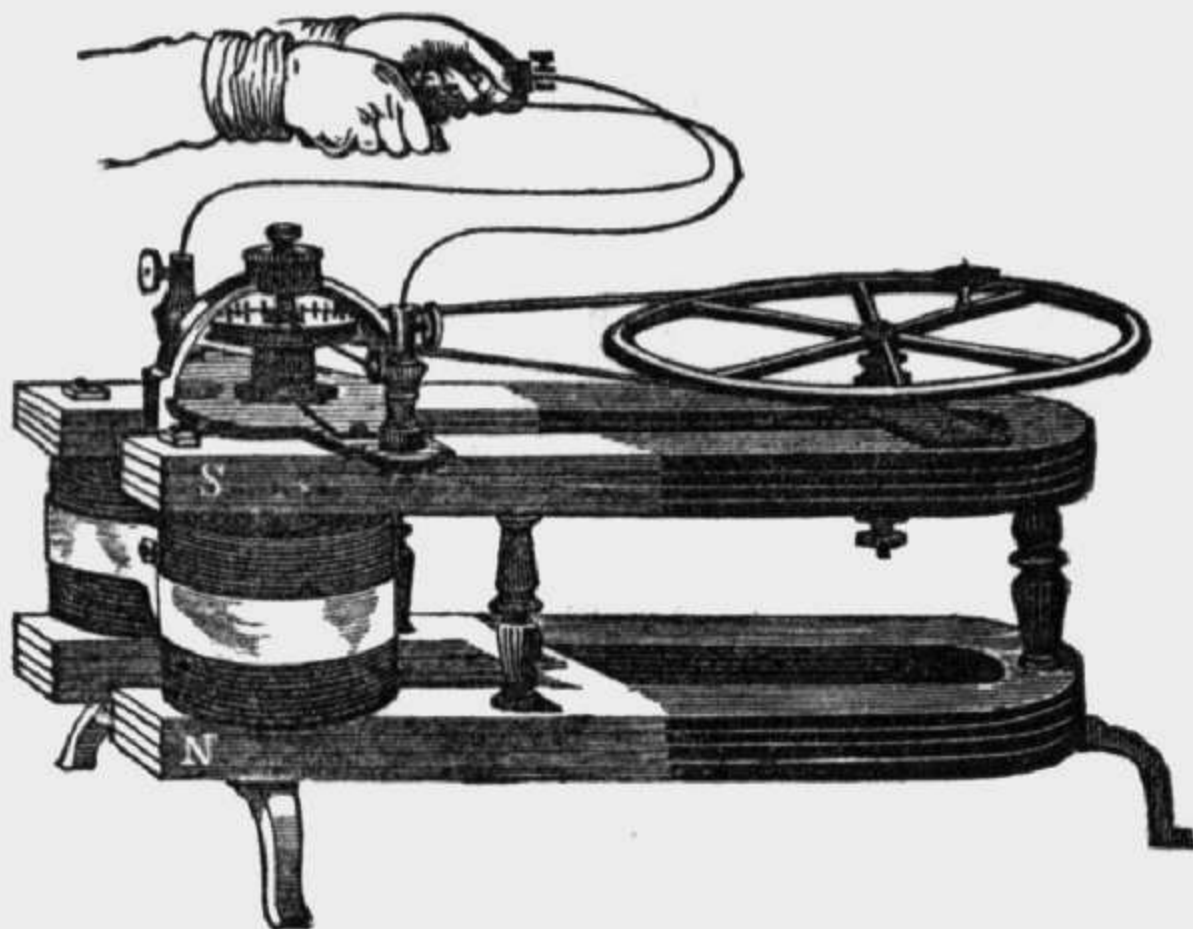
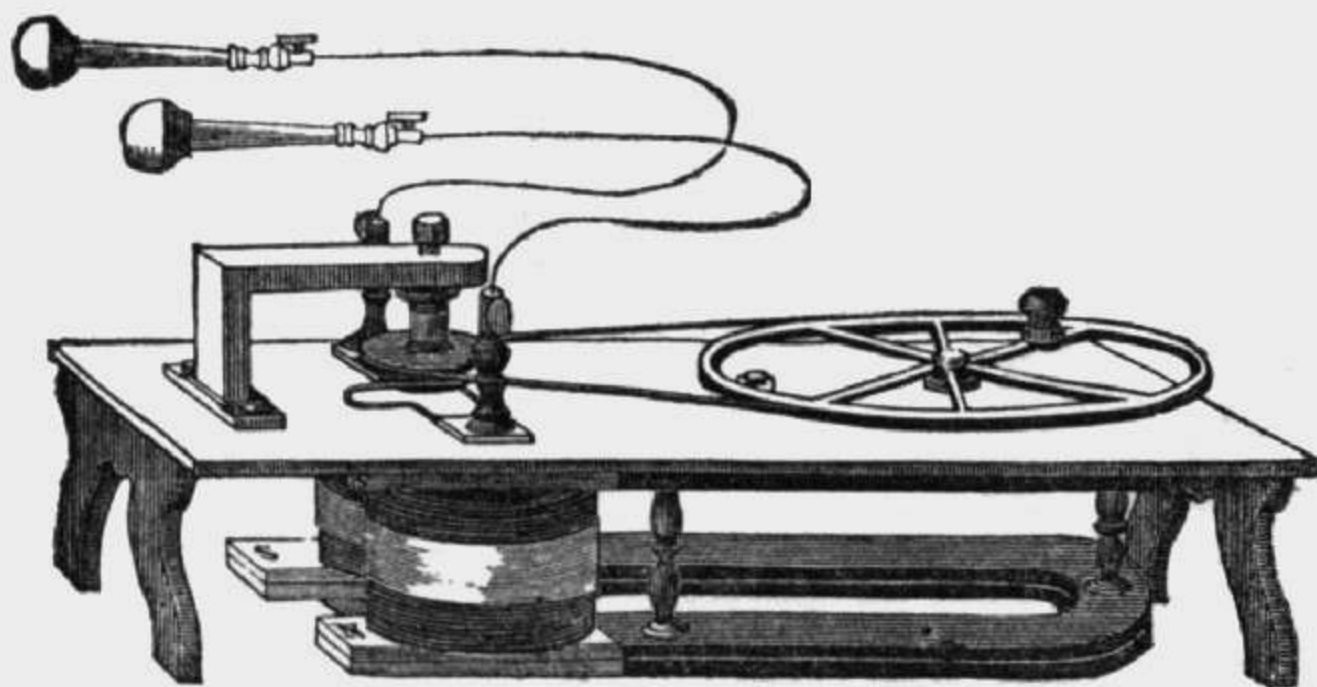
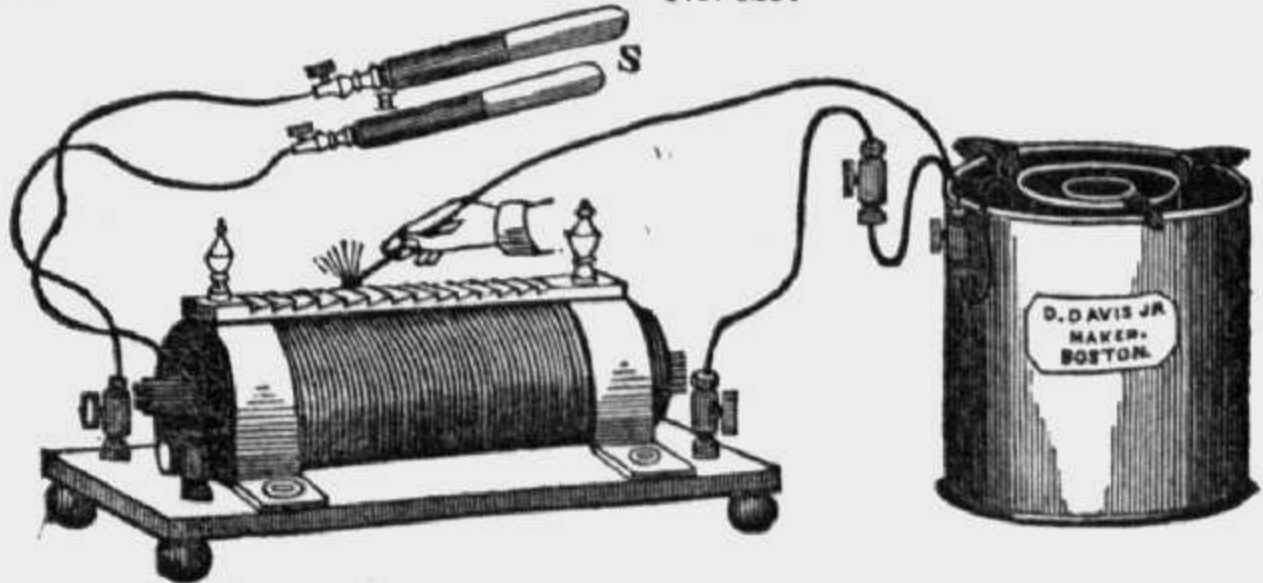
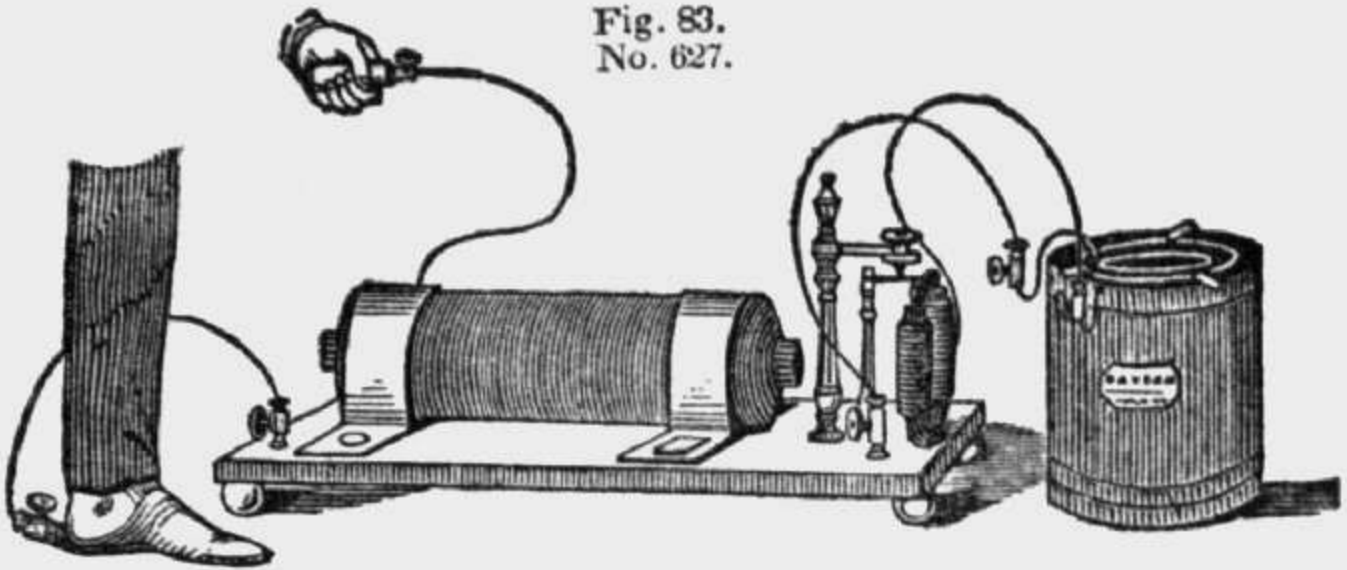


Fig. 81.—No. 622.



ELECTRO-MAGNETISM.

MEDICAL APPARATUS, AND FOR SHOCKS.

Fig. 82.
No. 629.Fig. 83.
No. 627.Fig. 84.
No. 623.

ELECTRO-MAGNETISM.*Set No. 1.*

Cylindrical Battery, small size,	Heliacal Ring and Armatures,
Electro and U. Magnet, Fig. 69,	Powder Cup,
Magnetic Needle on Stand,	Vibrating Apparatus for Shocks.

Price, \$15 00.

Set No. 2.

Battery, medium size,	Analytical Apparatus, Fig. 78,
Electro and U. Magnet,	Heliacal Ring and Armatures,
Oersted's Galvanometer,	Magnetic Needle on Stand.
Helix on Stand,	Pair of Handles for Shocks.

Price, \$30 00.

Set No. 3.

Battery, Medium size,	Heliacal Rings and Armatures,
Oersted's Galvanometer,	Page's Reciprocating Engine,
Electro and U. Magnet,	Analytical Apparatus,
Page's Revolving Magnet,	Electric Telegraph, No. 624,
Pair of Handles for Shocks,	'Manual of Magnetism.'

Price, \$50 00.

Electro Magnetic Set; for Medical Application, Fig 82.

Price, \$10 00.

Self-acting Electro Magnetic Set, for Medical Application.

Price, according to size, \$12 00 to \$15 00.

Fig. 83. *** A Handle may be had instead of the Slipper.

Magneto Electrical Medical Apparatus in Box, Fig. 84.

Price, \$30 00 to \$35 00.

*** Each Set is accompanied with a Treatise and full directions.

ASTRONOMY.

ORRERY.

Fig. 85.—No. 633.

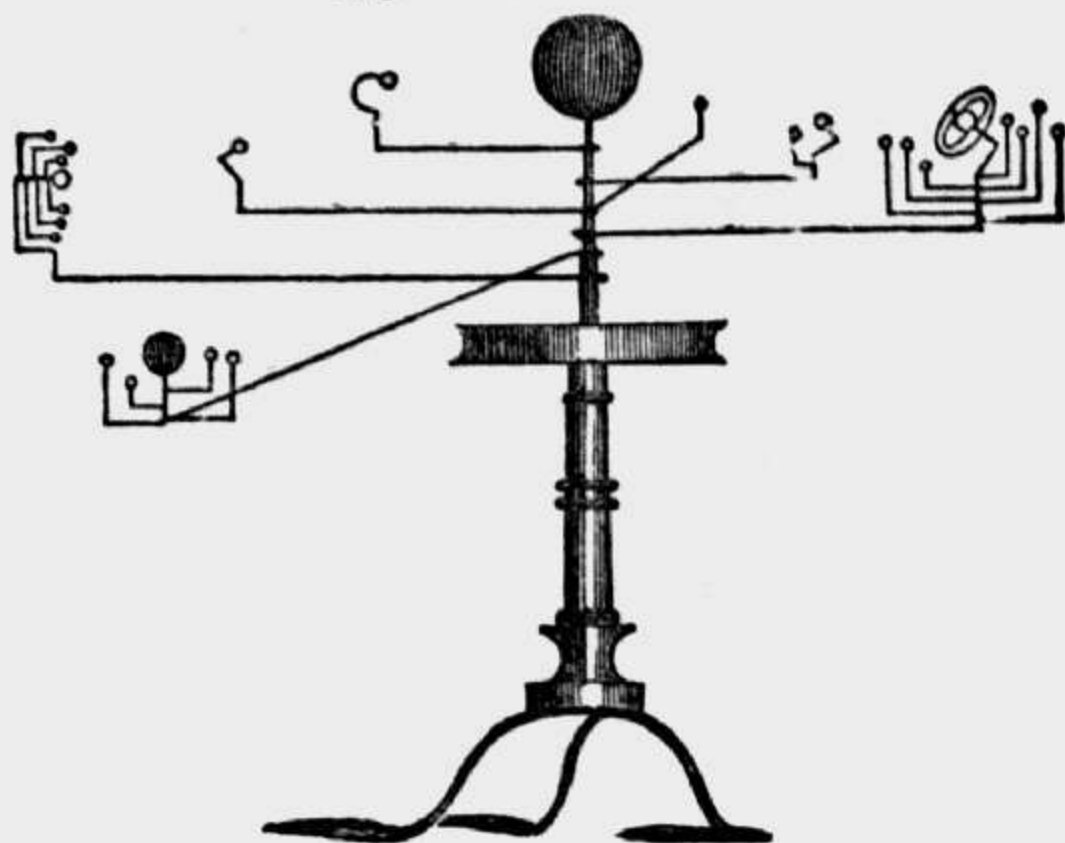
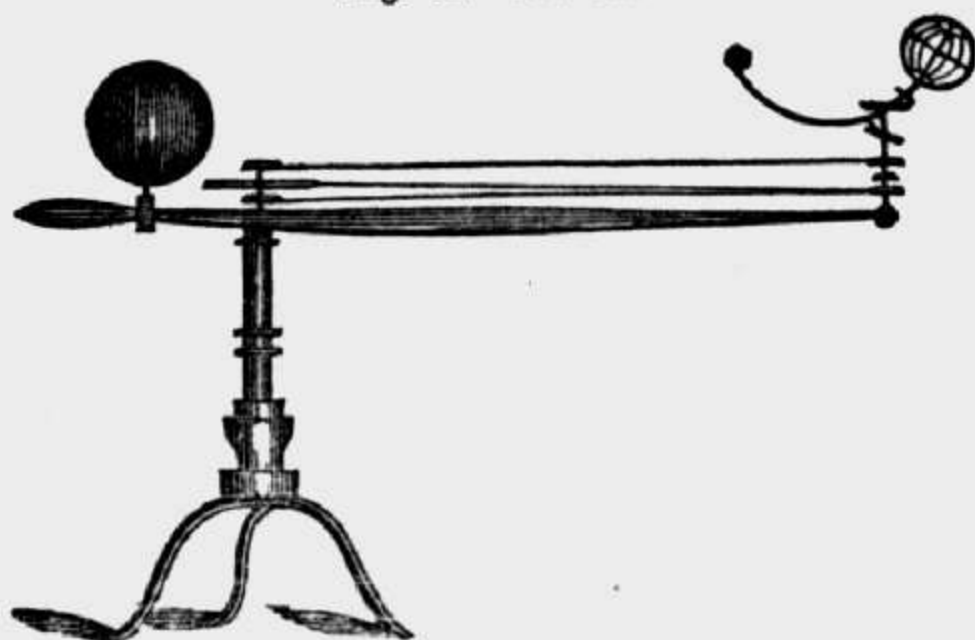


Fig. 85 shows the form and construction of an improved Orrery mounted upon a Brass stand, with gilt Sun. The motions of the primary planets are relatively correct with regard to their times of revolution round the sun. The earth also revolves upon its axis, and the moon around the earth. The gearing is of Brass, and the zodiac is movable, that the wheel-work may be seen. Price, \$25 00.

TELLURIAN.

Fig. 86.—No. 635.



At Fig. 86 is shown a Tellurian, mounted upon a Brass stand, and corresponding in form with the Orrery. It is very neat, and being of Brass, is very durable and efficient. All the phenomena of the Seasons, and cause of Eclipses, are easily illustrated. Price, \$12 00 and \$15 00.

TIDE DIAL.

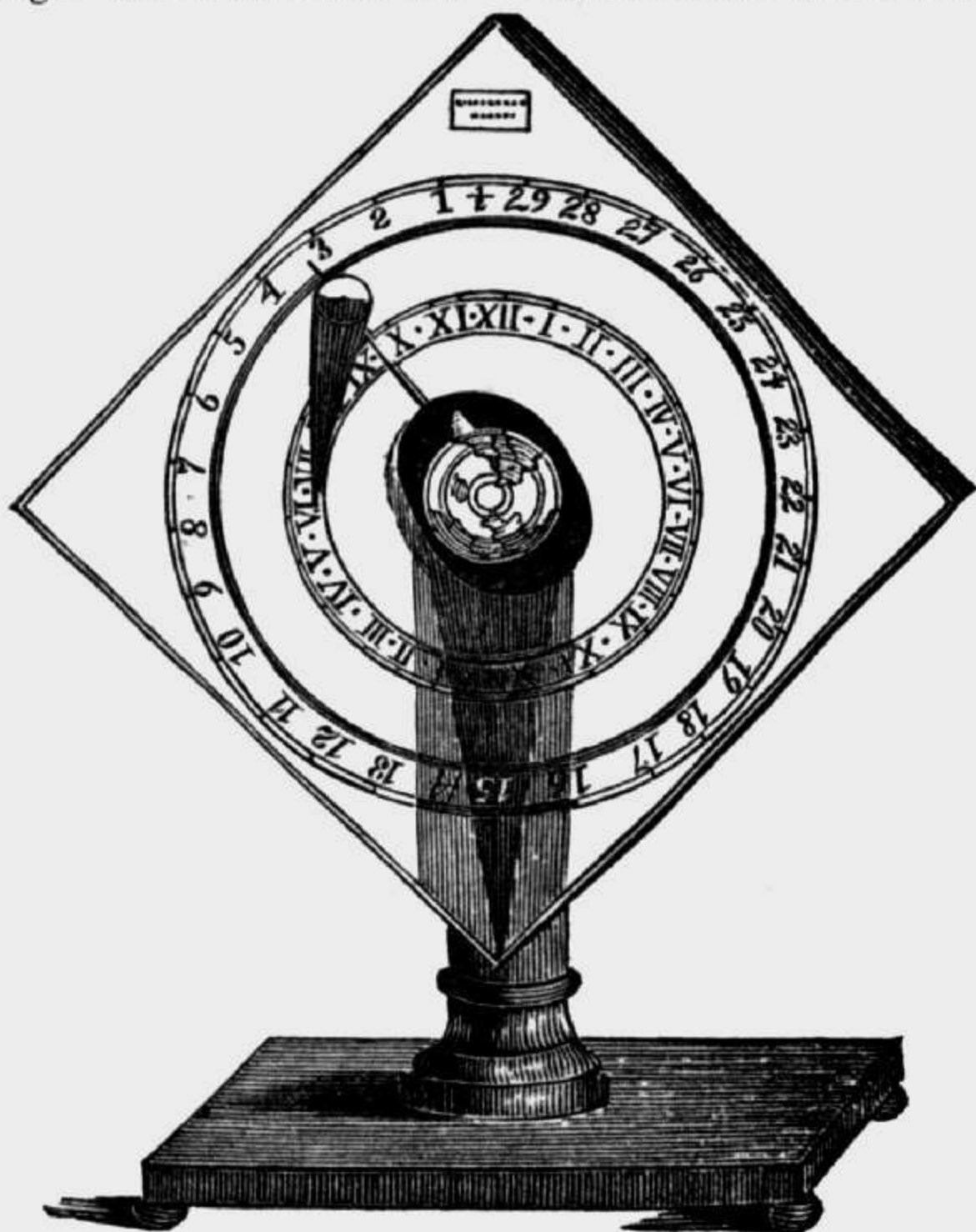
Fig. 87.—No. 637.



This Instrument is 15 inches square, and by turning a crank on the back, illustrates the daily change in the Tides; the diurnal motion of the Earth; the cause of Eclipses; and the *um-bra* and *penumbra* of the Earth. The larger circle indicates the

number of days in the lunar month, and the smaller circle, the 24 hours of the days.

This is the most correct Tide Dial made, and is very neat in construction, being mounted upon a mahogany stand, with a gilt sun, and Brass wheel-work.



Price, \$6 00.

GEOGRAPHY.

JOSLIN'S METAL FRAME GLOBE.

Fig. 88.—No. 643.



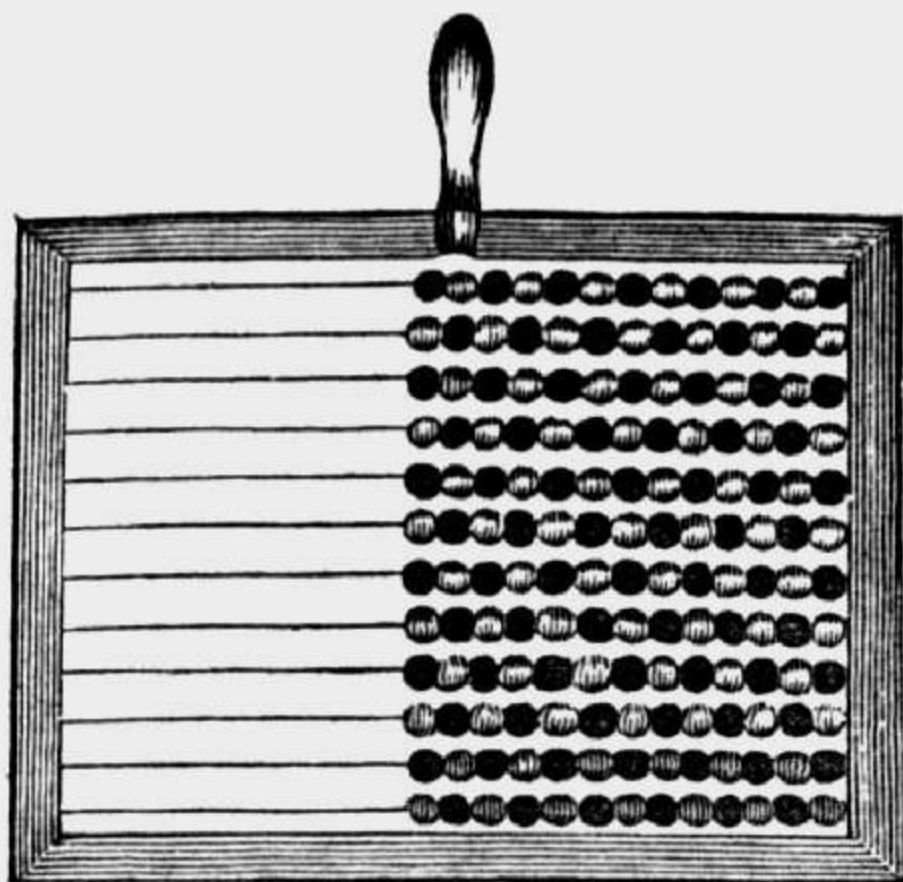
The Globe stand, represented above, adapted to Loring's 12 inch Globes, has been extensively introduced since 1842. Being of Metal, the centre of gravity is very low, and the spread of the tripod is so great that it can only be overturned by design. It has been very desirable to have a Globe stand of sufficient height to be easily examined and moved before the pupils of an entire class; mounted upon wood stands this could not be done without great care; but in the present, it can be pushed about by even the top of the Globe, (however carelessly,) without any possibility of being overturned.

The Stand is Bronzed, and is neat, convenient, and substantial.

GEOMETRY.

NUMERAL FRAME.

Fig. 89.—No. 669.

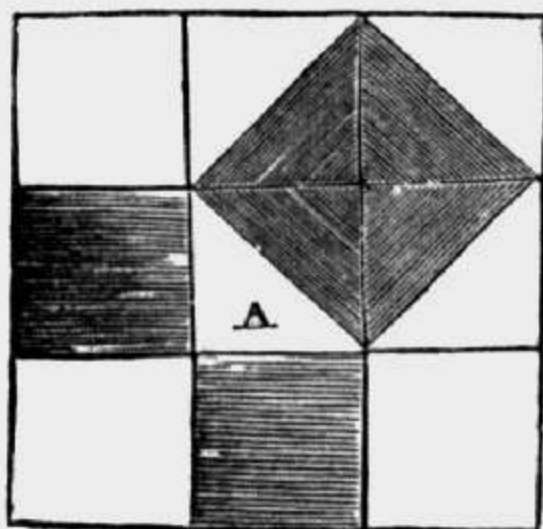


DISSECTED CONE.

Fig. 90.—No. 673

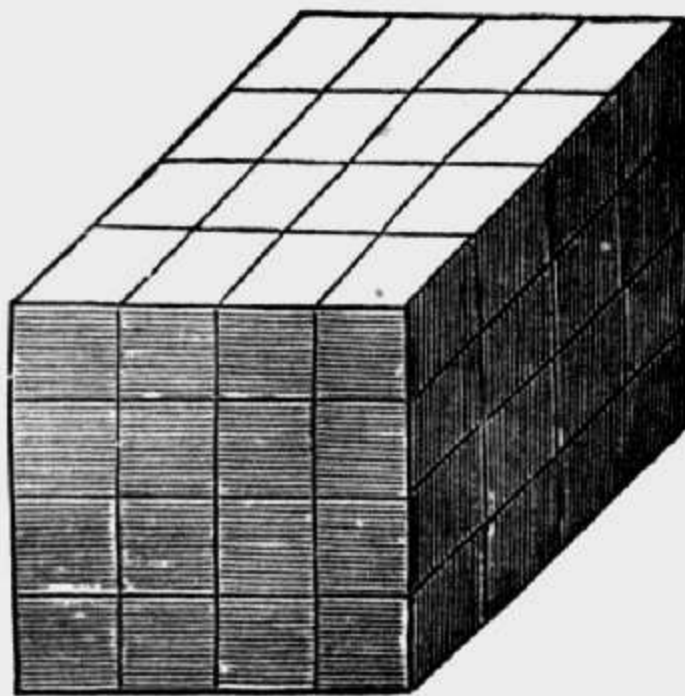
MECHANICAL ILLUSTRATION OF
THE 47th PROB. OF EUCLID.

Fig. 91.—No. 678.



BOX OF 64 CUBES.

Fig. 92.—No. 671.



LIST OF THE
SUPERIOR SET OF ASTRONOMICAL DIAGRAMS.

No. 514.

- | | |
|--------------------------|-------------------------------|
| 1. Sun, Telescopic View, | 4. A Map of the Earth, |
| 2. Mercury, " " | 5. Mars, Northern Hemisphere, |
| 3. Venus, " " | 6. Mars, Southern Hemisphere, |

- | | |
|---|--|
| 7. Jupiter, Telescopic View, | 31. Retrogradations of Venus, |
| 8. Saturn, " " | 32. Retrogradations of Mars, |
| 9. Herschell, " " | 33. Orbit of a Comet, |
| 10. New Moon, Telescopic View, | 34. Comet of 1680, |
| 11. Gibbous Moon, " " | 35. Comet of 1811, |
| 12. Full Moon, " " | 36. Comet of 1843. |
| 13. System of Ptolemy, | 37. Rotundity of the Earth; <i>movable</i> , |
| 14. System of Copernicus, | 38. Signs of the Zodiac, |
| 15. System of Tycho Brahe, | 39. The Seasons, |
| 16. Comparative size of the Sun,
as seen from the different
planets, | 40. Phases of the Moon, |
| 17. Comparative sizes of the plan-
ets, | 41. Phases of Venus, |
| 18. Comparative distances of the
Planets, | 42. Earth's Shadow, |
| 19. Comparative distances of the
Satellites of the different Plan-
ets. | 43. Superior and Inferior Conjun-
tion, |
| 20. Geocentric and Heliocentric
Longitude, | 44. Theory of the Sun's Eclipses, |
| 21. Parallax, | 45. Theory of the Moon's Eclipses, |
| 22. Refraction of the Earth's At-
mosphere, | 46. Moon's Nodes, |
| 23. Summer and Winter Rays, | 47. Sun's Eclipses; <i>movable</i> . |
| 24. Equation of Time, | 48. Moon's Eclipses; <i>movable</i> . |
| 25. Sidereal Time, | 49. Figure of Constellation Orion, |
| 26. Evening Sky in Saturn, | 50. Stars in the " " |
| 27. Transit of Venus, | 51. Figure of Constellation Ursa
Major, |
| 28. Morning and Evening Star, | 52. Stars in Ursa Major, |
| 29. Earth and Moon's Light, | 53. Milky Way, |
| 30. Eclipses of Jupiter's Moons, | 54. Great Nebula in Orion, |
| | 55, 56 and 57, Clusters of Stars, |
| | 58. Nebulous Stars, |
| | 59. Various Nebula, |
| | 60. Nebulous Phenomena. |

* * All the subjects of this Set of Sliders have been carefully revised to correspond with the recent discoveries of Herschell, Baer, Madler and others. The views of Mars are now first painted from Madler's drawings.