(No Model.)

5 Sheets—Sheet 1.

M. E. CROWELL.

ELECTRICAL APPARATUS FOR SCHOOLS.

No. 603,875. Patented May 10, 1898.

FIG 1

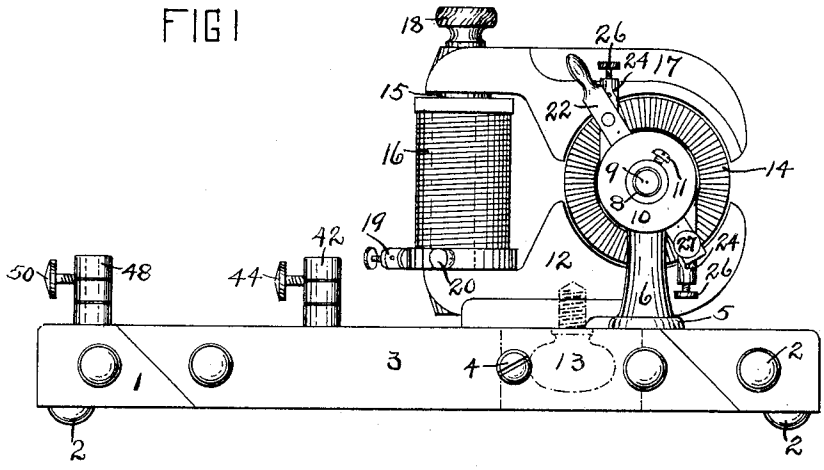
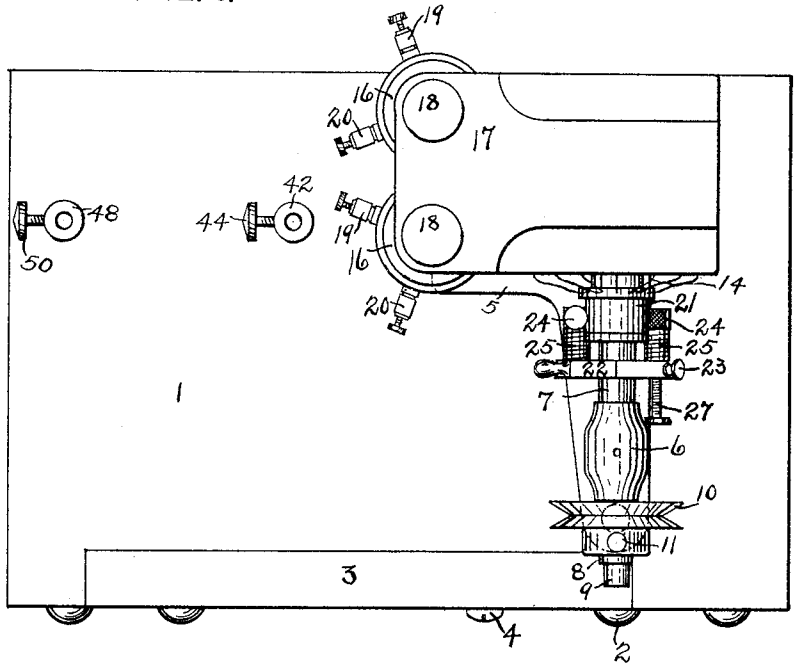


FIG. 2.



WITNESSES:

Horace B. Jones

Zula Green

INVENTOR

Melvin E. Crowell

BY

V. H. Lockwood

His ATTORNEY.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 5 Sheets—Sheet 2.

M. E. CROWELL.

ELECTRICAL APPARATUS FOR SCHOOLS.

No. 603,875. Patented May 10, 1898.

FIG. 3.

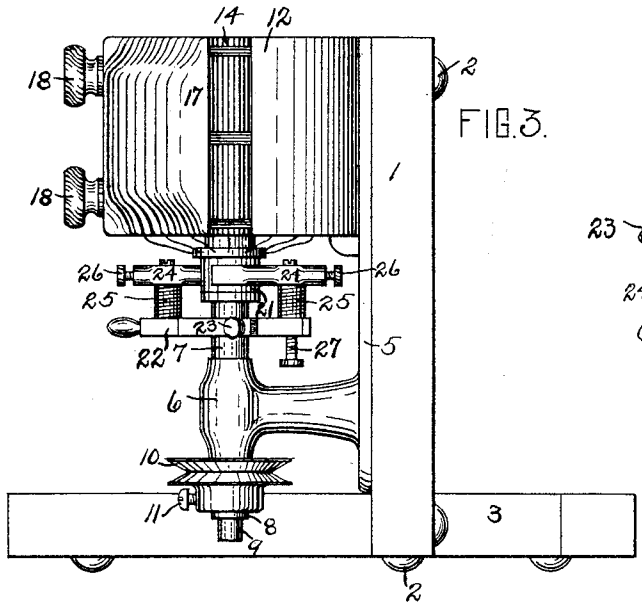


FIG. 5.

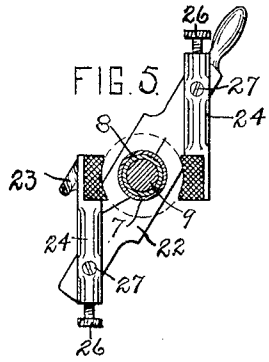


FIG. 4.

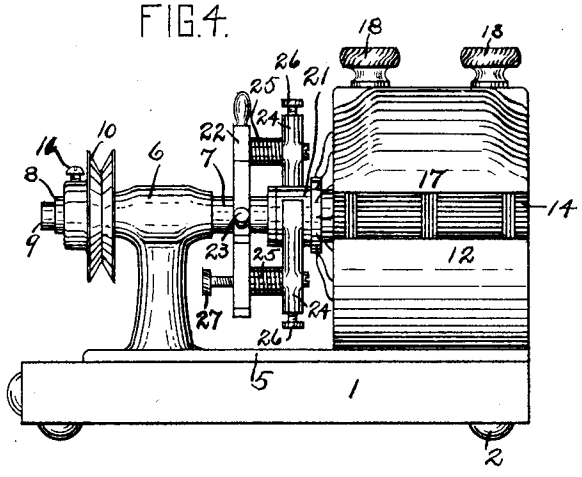
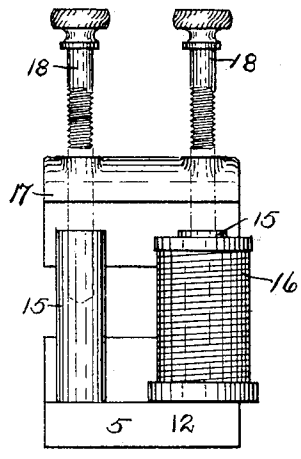


FIG. 6.



WITNESSES:

Horace B. Jones

Zula Green

INVENTOR

Melvin E. Crowell

BY

V. H. Lockwood

His ATTORNEY.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.)

5 Sheets—Sheet 3.

M. E. CROWELL.

ELECTRICAL APPARATUS FOR SCHOOLS.

No. 603,875. Patented May 10, 1898.

FIG. 7.

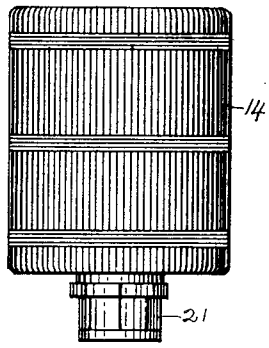


FIG. 9.

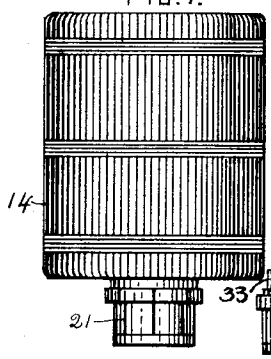


FIG. 11.

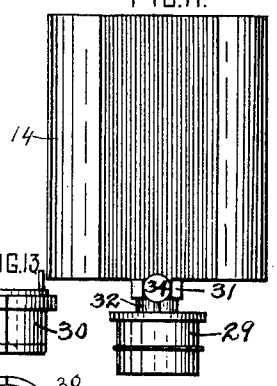


FIG. 8.

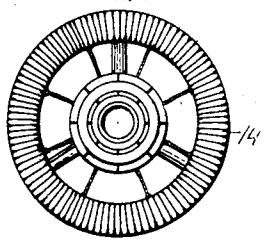
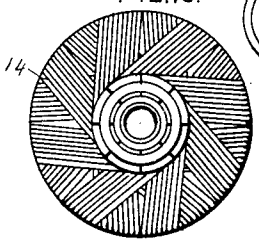


FIG. 10.



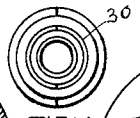


FIG. 12.

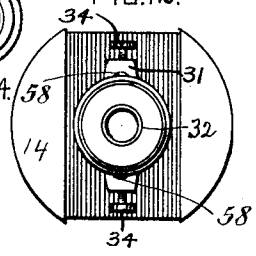
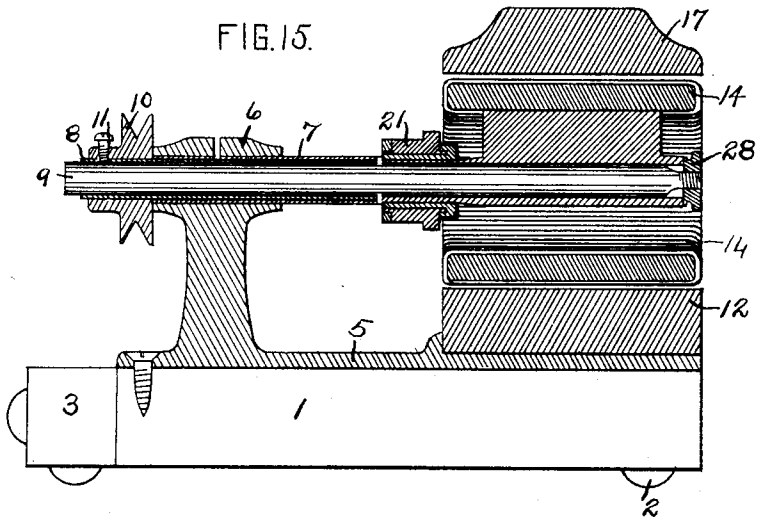


FIG. 15.



WITNESSES:

Horace B. Jones.

Zula Green

INVENTOR

Melvin E. Crowell

BY

V. H. Lockwood

His ATTORNEY.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 5 Sheets—Sheet 4.

M. E. CROWELL.

ELECTRICAL APPARATUS FOR SCHOOLS.

No. 603,875. Patented May 10, 1898.

FIG. 16.

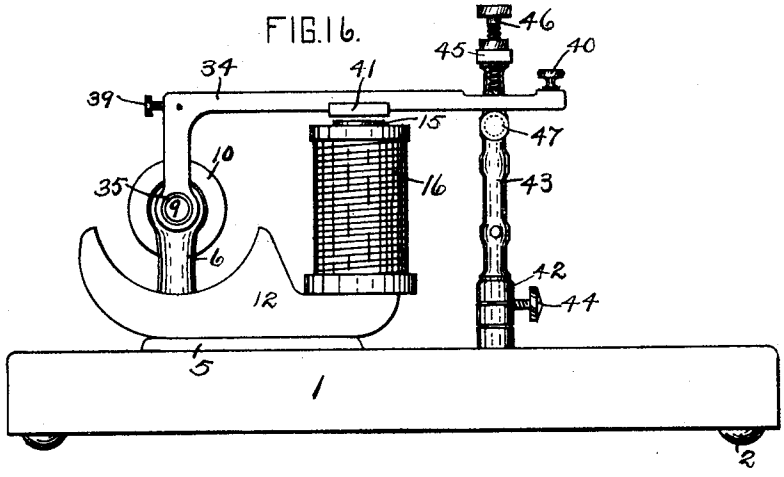


FIG. 17.

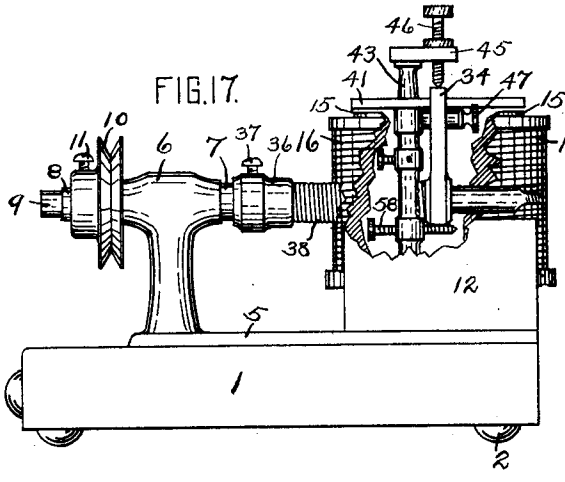
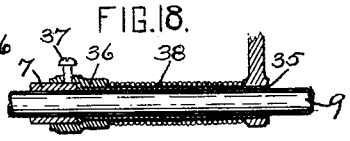


FIG. 18.



WITNESSES:

Horace B. Jones

Zula Green

INVENTOR

Melvin E. Crowell

BY

V. H. Lockwood

His ATTORNEY.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 5 Sheets—Sheet 5.

M. E. CROWELL.

ELECTRICAL APPARATUS FOR SCHOOLS.

No. 603,875. Patented May 10, 1898.

FIG. 19.

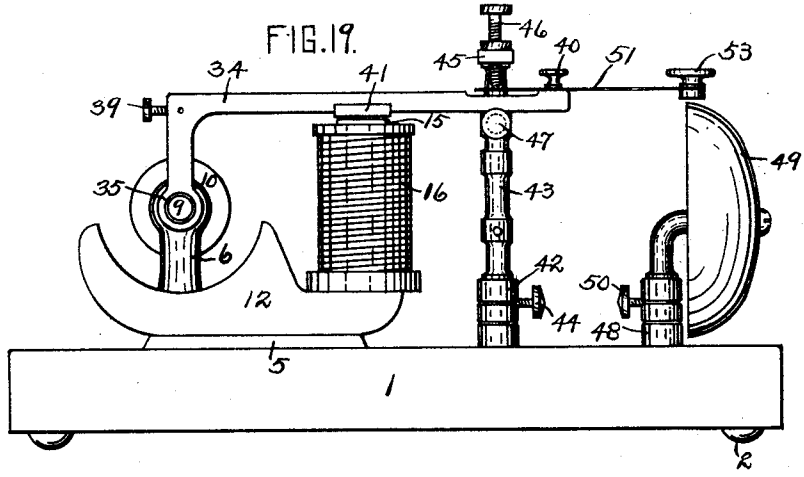


FIG. 21.

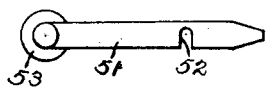
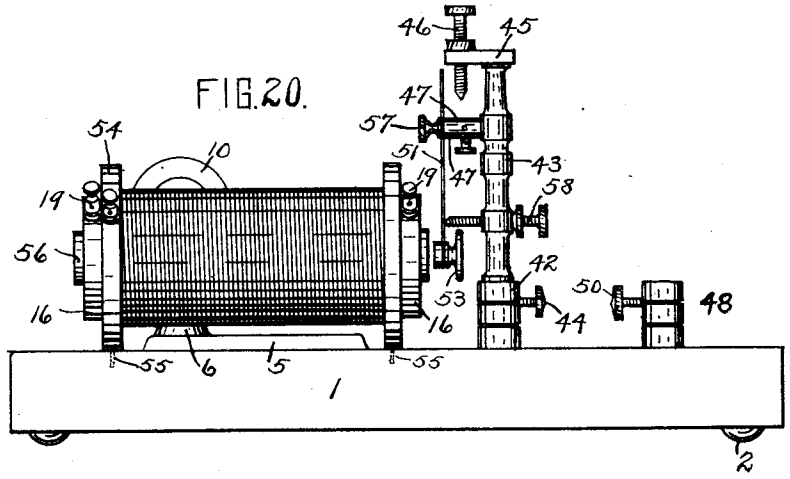


FIG. 20.



WITNESSES:

Horace B. Jones

Zula Green

INVENTOR

Melvin E. Crowell

BY

W. H. Lockwood

ATTORNEY.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

MELVIN E. CROWELL, OF INDIANAPOLIS, INDIANA, ASSIGNOR TO THE CROWELL APPARATUS COMPANY, OF SAME PLACE.

ELECTRICAL APPARATUS FOR SCHOOLS.

SPECIFICATION forming part of Letters Patent No. 603,875, dated May 10, 1898.

Application filed November 23, 1896. Serial No. 613,054. (No model.)

To all whom it may concern:

Be it known that I, MELVIN E. CROWELL, of Indianapolis, county of Marion, and State of Indiana, have invented a certain new and useful Electrical Apparatus for Schools; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, in which like figures refer to like parts.

My invention relates to apparatus for demonstrating the nature and means for generating and utilizing electricity.

It consists of a combination of pieces or parts so formed and adapted with relation to each other as to enable an instructor or pupil to quickly arrange them into various electrical devices as he may desire, several being used in each of such devices.

The object of my invention is to provide means for illustrating a number of machines or devices out of a very small number of simple parts. It not only renders such apparatus cheap, but brings the whole within a small compass and renders it a very simple and quick process to form the various devices when desired. Any desired device may be made by attaching or detaching a few of the pieces or parts in the apparatus. The absolute identity of many of the parts that enter into every kind of device is also of great assistance to the pupil by way of simplifying and making plainer the nature of such devices. This apparatus also has an advantage over ordinary apparatus which is already put together, because the pupil in changing from one device to another must to some extent take apart and put together the parts thereof.

The full nature of my invention will appear from the accompanying drawings and the description and claims following.

In the drawings, Figure 1 is a side elevation of my apparatus arranged to show a dynamo or motor. Fig. 2 is a plan view of the same. Fig. 3 is a front elevation of the same turned up into a vertical position. Fig. 4 is a front elevation of the same, as shown in Fig. 1. Fig. 5 is a side elevation of the commutator-brushes. Fig. 6 is a detail view of the means for connecting the pole-pieces, the upper pole-piece being elevated and also the screws, one coil being removed from its core. Fig. 7 is a plan view of an armature of the Gramme-ring type. Fig. 8 is an end view of the same. Fig. 9 is an armature of the drum type. Fig. 10 is an end view of the same. Fig. 11 is an armature of the shuttle type and a detachable collecting-ring. Fig. 12 is an end view thereof. Fig. 13 is a plan view of a split-ring commutator. Fig. 14 is an end view thereof. Fig. 15 is a longitudinal vertical central section of the dynamo with the brushes removed. Fig. 16 is a side elevation of the parts arranged to form a telegraph-sounder. Fig. 17 is a front view of the same with portions cut away for the sake of illustration. Fig. 18 is a longitudinal section of the means for mounting the arm of the sounder. Fig. 19 is a side view of the parts arranged to form an electric bell. Fig. 20 is a side view of the parts arranged to form an induction-coil. Fig. 21 is a plan view of the circuit-breaker.

In detail, 1 is a base-plate made, preferably, of wood, with rubber tips 2 secured thereto at various places to prevent it slipping on the table on which it may be laid. A section of this plate is cut out, as shown in Figs. 1 and 2, along a portion of one side to form a bar 3, as shown in Fig. 2. This is secured to the body of the base-plate by a screw 4, on which it may turn, and when turned at a right angle to the base-plate it enables the base-plate and whatever may be mounted thereon to be supported in a vertical position on a table or stand, as seen in Fig. 3. This is useful when it is desired to change the position of any device mounted thereon from a horizontal position (shown in Fig. 2) to a vertical position. (Shown in Fig. 3.) For example, by using a sheet of paper with filings thereon just over the armature in Fig. 3 the magnetic field will be shown clearly to the eye.

To the base-plate I secure the metallic plate 5, having preferably integral with it the pillow-block 6. A short sleeve 7 is secured to the pillow-block within its aperture. These are stationary, and within them I provide a loosely-fitting sleeve 8. In this sleeve I place a shaft 9, which is of use in making dynamos, motors, telegraph-sounders, and electric bells and their modifications. To drive the shaft 9, when desired, in motors and dynamos, I

mount on the sleeve 8 a driving-pulley 10, that is held in place by a set-screw 11, which not only passes through the hub of the pulley, but also the sleeve 8, thus coming into engagement with the shaft 9 and binding these parts together. When using devices requiring the rotation of the shaft 9, power from any suitable source may be applied to the driving-pulley 10.

There is only one pillow-block to support the shaft 9, leaving the other end free, whereby the brush, rocker, armatures, and other parts of the apparatus may be slipped on it or on the pillow-block sleeve 7. For use in dynamo and motor machines, &c., I provide a lower pole-piece 12, which is secured to the base-plate by the screw 13, that passes through a hole in the metallic plate 5. For the operation of the head of the screw the base-plate is cut out about the screw, as shown in dotted lines in Fig. 1. This lower pole-piece has two upward extensions with a curved surface connecting them that brings it into close proximity with the armature 14. The pole-piece thus curves nearly half-way about the armature. This pole-piece is provided with a horizontal extension, to be seen at the left hand in Figs. 1 and 2, and the front appears in Fig. 6. On this extension and integral therewith I provide two posts 15. (Seen in Fig. 6.) In arranging the apparatus for dynamos, motors, &c., I place over each of these posts 15 a spool or coil 16. The spools are cored out, so as to slip over the posts loosely, and they constitute the field-magnets when used in the dynamos and motors.

17 is an upper pole-piece which is provided with a pair of downward extensions with a curved surface between them corresponding to the lower pole-piece and adapted to envelop nearly half the armature. It is secured to the lower pole-piece through the two posts 15. These posts are centrally apertured, as shown in dotted lines in Fig. 6, at their upper ends, and the surface of such apertures is threaded. The upper pole-piece is provided with two holes corresponding with the apertures in the posts 15. The screws 18 are then passed through the apertures in the pole-piece into the apertures in the posts, whereby a close connection is made. The posts 15 are slightly longer than the coils 16. These coils 16 have at their lower ends the binding-posts 19 and 20, as seen in Figs. 1 and 2.

The armature 14 has a tube extending through it centrally, of such dimensions as to permit its being readily slipped on the shaft 9.

21 is a commutator which is mounted on the tube extending through the armature, so as to rotate therewith.

The commutator-brush mechanism may be formed in any suitable way; but that which I here show appears in Fig. 5. It consists of the rocker 22, with a centrally-located opening adapted to slip over the pillow-block sleeve 7. To enable it to be slipped on easily, the rocker is split out from the central opening to one side, and a set-screw 23 passes through the free portion of such rocker and screws into the body thereof, so that when the set-screw is turned down the engagement of its head with the free portion of the rocker draws it down, thus decreasing the central opening and clamping the rocker tightly on the pillow-block sleeve 7. When the set-screw 23 is released, the free portion of the rocker springs slightly away from the body thereof, thus enlarging the opening and permitting the easy removal of the rocker. At either end of the rocker a brush 24 is pivoted and is actuated by the springs 25, so that the brushes will be kept in engagement with the commutator. Suitable binding-posts 26 are provided on the commutator-brushes, and a screw 27 adjusts the position of one brush so that it will be in or out of line with the other brush. After the commutator-brushes and the armature have been slipped into place a nut 28 is screwed onto the free end of the shaft, which is turned down and threaded to receive it, whereby the parts are held on the shaft.

When the parts are arranged as I have so far described, they will illustrate a dynamo or motor. Armatures of various windings and commutators of various kinds may be used interchangeably in the construction for illustrating various kinds of dynamos and motors. In Figs. 7 and 8 I have shown a Gramme-ring armature and in Figs. 9 and 10 a drum-armature, with a direct-current commutator integral with each. In Figs. 11 and 12 I show a shuttle-armature for use with either a collecting-ring 29 or a split ring 30. I also show there means for the ready attachment and detachment of such commutators, the split-ring commutator 30 being shown in Figs. 13 and 14. This means of attachment is shown in Figs. 11 and 12 and consists of a bracket 31, secured to the tube 32 through the armature. Near each end of such bracket I place a hole 58 to receive the small pins 33 on the commutators, and at each end of it I place a set-screw 34, which when screwed down binds the pins 33 in the bracket. By this I can exchange these commutators very quickly, the commutator being slipped over the pipe or sleeve 32. The brushes of the mechanism I have heretofore described are adjusted to engage the collecting-rings 29 by means of the screw 27, which when screwed in pushes the brush on the end of it farther away from the rocker in which it is mounted than the other brush.

When it is desired to make by means of this apparatus a telegraph-sounder after the dynamo or motor is already set up, I remove the upper pole-piece and the screws that hold it and also remove the armature, commutator, and brushes, leaving the rest of such mechanism in place, as seen in Fig. 16. I provide then an arm 34, preferably L-shaped, as shown in Fig. 16, with its short arm downward and rigidly secured to the sleeve 35, which slips

loosely over the shaft 9. On the pillow-block sleeve 7 I secure the collar 36 by the set-screw 37. About the sleeve I place a spiral spring 38, secured at one end to the collar 36 and at the other end to the lower part of the arm 34, as seen in Figs. 17 and 18. The tendency of this spring is to keep the free end of the arm 34 in an upward position.

At the bend in the arm 34 I provide a binding-post 39 and at the free end thereof a key 40. This arm 34 passes over the coils 16 on the posts 15. These constitute the magnet when arranged for a telegraph-sounder, and the armature 41 is provided to engage the two poles of said magnet. In the base-plate I secure a supporting-sleeve 42, that receives a post 43, holding the same in place by the set-screw 44. At the upper end of such post I provide a horizontal arm 45, through which a set-screw 46 extends downward. A short distance below this I place another arm 47. The free end of the bar 34 extends between the arm 47 and the lower end of the set-screw 46. With this construction last described when the circuits are completed with the addition of suitable wires, which I have thought it needless to show here, as the same are well understood, the telegraph-sounder is well illustrated. I need not specify the mode of operation, as that is well known.

The wiring for each machine capable of being made by this apparatus is to be left to the pupil or teacher, as it gives a practical knowledge not obtainable with machines already wired.

When I desire to make an electric bell of my apparatus, I add to the construction which I have just described and which makes a telegraph-sounder the following parts: In the threaded sleeve 48, secured to the base-plate, I mount the bell 49, holding it in place by the set-screw 50, as seen in Fig. 19. In the arm 34 of the telegraph-sounder the key 40 consists of a screw which screws into the bar. I then take a thin metallic plate or flat spring 51, cutting in its side a notch 52, as seen in Fig. 21. I partially release the key 40 and slip this spring or plate at the notch under such key and clamp the key down. At the end of the plate 51 I provide a hammer or button 53, close enough to the bell to engage the same whenever it is vibrated. The other end of the plate 51 is sufficiently long to extend beneath the screw 46, whereby its movement is limited.

When it is desired to show an induction-coil, parts of the dynamo, telegraph-sounder, and electric bell are retained, as seen in Fig. 20. I remove the lower pole-piece and the two coils on it, as well as the shaft 9 and bar 34, on the sounder and the bell. I provide a large spool 54 (shown in Fig. 20) with a secondary winding thereon, the ends of said spool being provided with short pins 55, that fit in little holes in the base-plate to hold the spool in place. This spool is hollow, the hollow being of sufficient diameter to admit both of the coils 16, one at each end. Through the hollow portion of these coils or spools 16 I extend an iron core 56, as shown in Fig. 20. The arm 47 is provided at its end with a screw 57. Between these two I clamp the plate or circuit-breaker 51, which is used in connection with the bell; but instead of placing it horizontally I place it in a vertical position, as seen in Fig. 20, so that the button or contact-piece will be in close proximity to the core 56. Through the post 43 I extend the screw 58 for regulating the position of the circuit-breaker.

It will be seen from the foregoing description that with a few simple pieces I am enabled to make several devices for the illustration of electrical force and appliances. The parts are all designed with reference to each other and adapted to be readily united or disconnected by a teacher or pupil during the recitation. Furthermore, the apparatus, by reason of the features just stated and its simplicity, can be furnished cheap, and thus be brought within the reach of all schools and experimenters.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. As an article of manufacture, apparatus for teaching electricity comprising a base-plate, a pillow-block with a sleeve extending therefrom, an armature-shaft mounted in such pillow-block and sleeve, a driving-pulley mounted on such shaft, an armature adapted to be removably mounted on such shaft, a lower pole-piece with a pair of posts extending therefrom, a pair of coils that fit over such posts and have suitable binding-screws, an upper pole-piece detachably secured to the said posts on the lower pole-piece, a commutator, commutator-brushes removably mounted on the pillow-block sleeve, an L-shaped bar with one end secured to a sleeve adapted to be carried loosely on the armature-shaft and having a key at its free end and a binding-screw at its other end, a clamping-collar adapted to be mounted on the pillow-block sleeve, a spiral spring surrounding the sleeve to which the L-shaped bar is attached and secured at one end to such collar and at the other end to the bar, an armature secured to the bar over the posts on the lower pole-piece, and a post mounted in the base-plate having two parallel arms one above and one below such L-shaped bar with a set-screw in the upper one, whereby a dynamo or telegraph-sounder may be made as desired.

2. As an article of manufacture, apparatus for teaching electricity comprising a base-plate, a pillow-block with a sleeve extending therefrom, an armature-shaft mounted in such pillow-block sleeve, a driving-pulley mounted on such shaft, an armature adapted to be removably mounted on such shaft, a lower pole-piece with a pair of posts extending therefrom, a pair of coils that fit over such posts and have suitable binding-screws, an upper pole-piece detachably secured to the

said posts on the lower pole-piece, a commutator, commutator-brushes removably mounted on the pillow-block sleeve, an L-shaped bar with one end secured to a sleeve adapted to be carried loosely on the armature-shaft and having a key at its free end and a binding-screw at its other end, a clamping-collar adapted to be mounted on the pillow-block sleeve, a spiral spring surrounding the sleeve to which the L-shaped bar is attached and secured at one end to such collar and at the other end to the bar, an armature secured to the bar over the posts on the lower pole-piece, a post mounted in the base-plate having two parallel arms one above and one below such L-shaped bar with a set-screw in the upper one, a bell mounted in the base-plate, and a hammer detachably secured to the free end of such L-shaped bar and extending in close proximity with the bell, whereby a dynamo, telegraph-sounder or electric bell may be made as desired.

3. As an article of manufacture, apparatus for teaching electricity comprising a base-plate, a pillow-block with a sleeve extending therefrom, a shaft mounted in such block and sleeve, an electric magnet mounted on the base-plate and having suitable binding-screws, a post mounted in the base-plate having two parallel arms with a set-screw in the upper one and the lower one insulated, a bar secured at one end to a sleeve that is loosely carried on the shaft having a key at its free end and a binding-screw at the other end, a clamp-collar mounted on the pillow-block sleeve, a spiral spring surrounding the sleeve to which the bar is secured with one end attached to such collar and the other end to the bar, an armature secured to the bar over the poles of the magnet, a bell mounted on the base-plate, and a hammer removably secured to the free end of the bar and extending into close proximity with the bell, whereby a telegraph-sounder or an electric bell may be made as desired.

4. As an article of manufacture, apparatus for teaching electricity comprising a base-plate, a pillow-block with a sleeve extending therefrom, an armature-shaft removably mounted on such pillow-block, an armature adapted to be mounted on such shaft, a lower pole-piece with a pair of posts extending therefrom, a pair of coils removably mounted on such posts and having suitable binding-screws, an upper pole-piece detachably secured to the posts on the lower pole-piece, a commutator, commutator-brushes removably mounted on the pillow-block sleeve, a spool adapted to be secured to the base-plate having a secondary coil wound thereon and with an opening longitudinally through it large enough to admit the coils 16, a core adapted to extend through such coils, a post secured to the base-plate having an arm extending therefrom and provided with a regulating set-screw, and a circuit-breaker connected to such arm and extending into close proximity with the end of the core, whereby a dynamo or induction-coil may be made as desired.

5. As an article of manufacture, apparatus for teaching electricity comprising a base-plate, a pillow-block with a sleeve extending therefrom, a shaft removably mounted in such block and sleeve, an electric magnet mounted on the base-plate with removable coils and having suitable binding-screws thereon, a bar secured at one end to a sleeve that is loosely carried on the shaft having a key at the free end and a binding-screw at the other end, a clamp-collar mounted on the pillow-block sleeve, a spiral spring surrounding the sleeve to which the bar is secured with one end attached to the collar and the other end to the bar, an armature secured to the bar over the poles of the magnet, a post mounted in the base-plate having two parallel arms with a set-screw in the upper one and the lower one insulated, a spool adapted to be secured to the base-plate having a secondary coil wound thereon and with an opening longitudinally through it large enough to admit the coils of an electromagnet, a core adapted to extend through such coils, a circuit-breaker connected to the insulated arm of such post and extending into close proximity with the end of the core, and a screw extending through such post to regulate the circuit-breaker, whereby a telegraph-sounder or induction-coil may be made.

6. As an article of manufacture, apparatus for teaching electricity comprising a base-plate, a pillow-block with a sleeve extending therefrom, a shaft removably mounted in such pillow-block and sleeve, an electromagnet mounted on the base-plate with removable coils and having suitable binding-screws thereon, a bar secured at one end to a sleeve that is loosely carried on the shaft having a key at the free end and a binding-screw at the other end, a clamp-collar mounted on the pillow-block sleeve, a spiral spring surrounding the sleeve to which the bar is secured with one end secured to such collar and the other end to the bar, an armature secured to the bar over the poles of the magnet, a post mounted in the base-plate having two parallel arms with a set-screw in the upper one and the lower one insulated, a spool adapted to be secured to the base-plate having a secondary coil wound thereon and with an opening longitudinally through it large enough to admit the coils of the electromagnet, a core adapted to extend through such coils, a circuit-breaker connected to the arm on such post and extending into close proximity with the end of the core, a screw extending through such post to regulate the circuit-breaker, and a bell mounted on the base-plate where the circuit-breaker when mounted on the free end of the telegraph-sounder bar will engage such bell, whereby the telegraph-sounder, electric bell or induction-coil may be made as desired.

7. As an article of manufacture, apparatus for teaching electricity comprising a base-

plate, a pillow-block with a sleeve extending therefrom, an armature-shaft removably mounted in such pillow-block and sleeve, a driving-pulley mounted on such shaft, a lower pole-piece removably secured to the base-plate with a pair of posts extending therefrom, a pair of coils mounted on such posts and having suitable binding-screws, an upper pole-piece detachably secured to the said posts on the lower pole-piece, a commutator, commutator-brushes removably mounted on the pillow-block sleeve, an L-shaped bar with one end secured to a sleeve adapted to be carried loosely on the armature-shaft and having a key on its free end and a binding-screw at its other end, a clamping-collar adapted to be mounted on the pillow-block sleeve, a spiral spring surrounding the sleeve to which the L-shaped bar is attached and secured at one end to said collar and at the other end to the bar, an armature secured to the bar over the posts on the lower pole-piece, a post mounted in the base-plate, a spring-plate detachably secured to the free end of such L-shaped bar and extending in close proximity with the bell, a spool adapted to be secured to the base-plate having a secondary coil wound thereon and with an opening through it large enough to admit the coils 16, a core adapted to extend through such coils to a point next said post, and a set-screw extending through said post for regulating the circuit-breaker, whereby a dynamo, telegraph-sounder, electric bell or induction-coil may be made as desired.

8. In a dynamo, the combination of an armature provided with a central tubular extension, a bracket secured on such extension with a hole and binding-screw near its free end for each coil in the armature, and a commutator that slips on said tube and is provided with pins to connect it up with said bracket by means of the binding-screws.

9. In apparatus for teaching electricity, a base-plate, a bar pivoted between its ends to the base-plate at one side thereof, legs or extensions extending from said side of the base-plate of the same thickness as said bar, whereby when the bar is turned at right angles to the base-plate, it together with the legs or extensions on the base-plate will support the base-plate in a vertical position.

In witness whereof I have hereunto set my hand this 9th day of November, 1896.

MELVIN E. CROWELL.

Witnesses:
V. H. LOCKWOOD,
ZULA GREEN.