P. L. SIBOLE.

ELECTRIC SWITCH.

APPLICATION FILED SEPT. 20, 1909.

977,140. Patented Nov. 29, 1910.

6 SHEETS—SHEET 1.

Fig. 1.

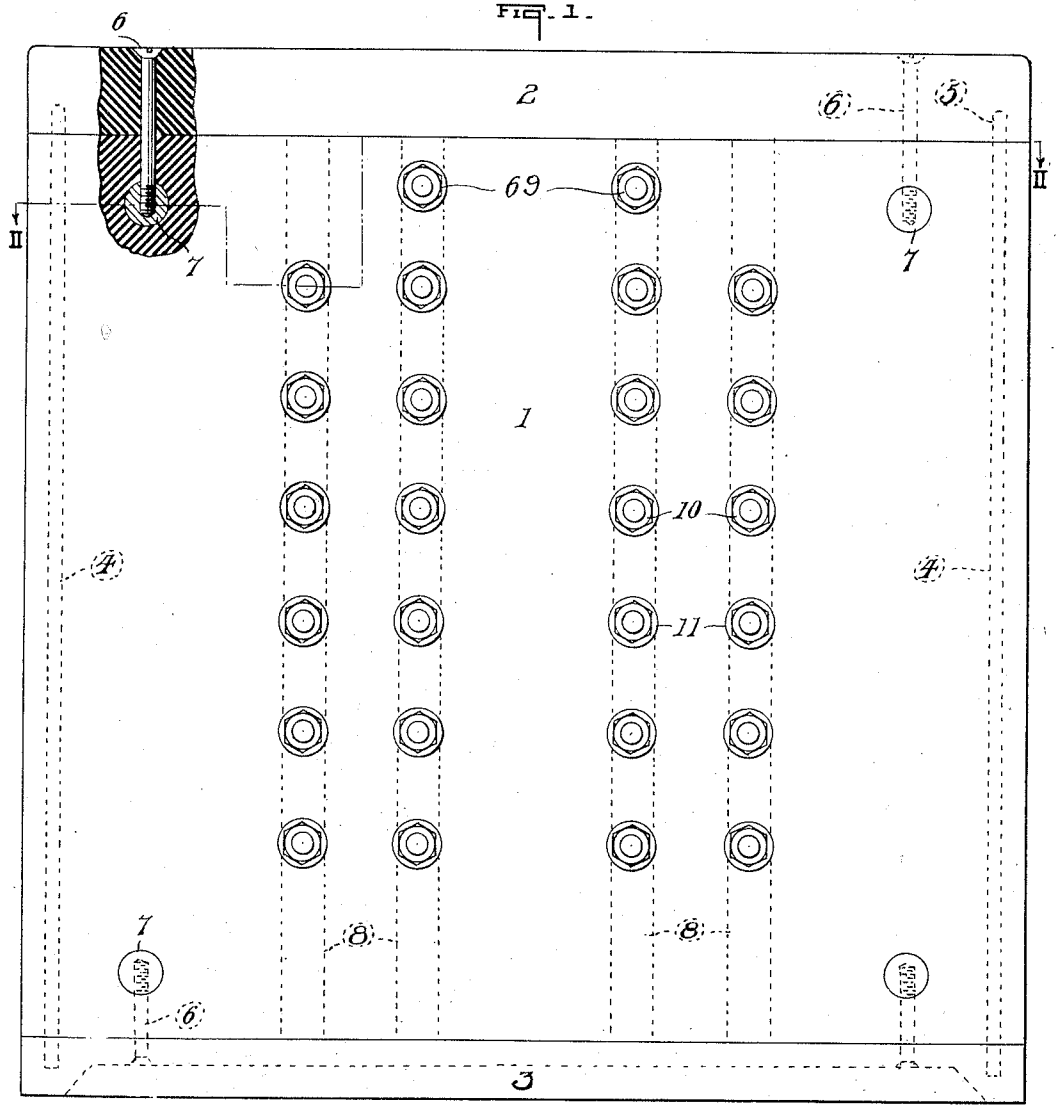


Fig. 2.

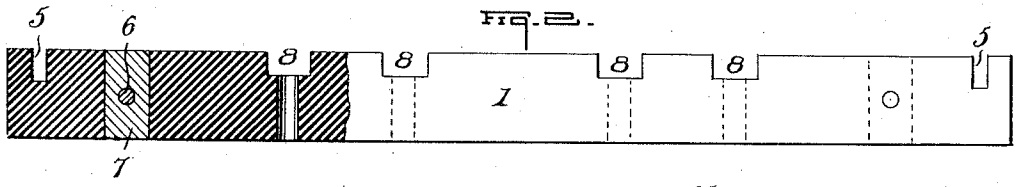
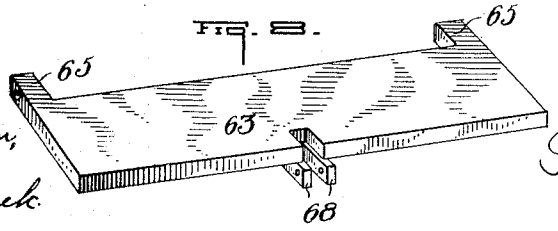


Fig. 3.



WITNESSES:

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6 SHEETS—SHEET 2.

Fig. 11.

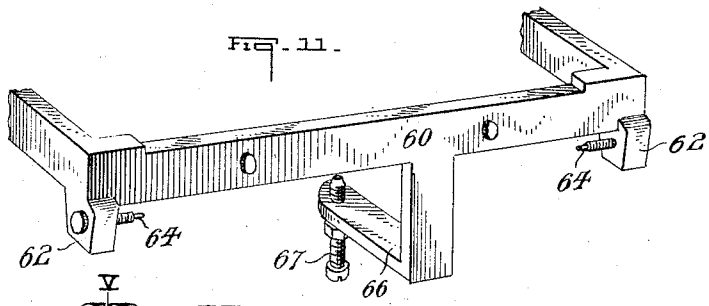
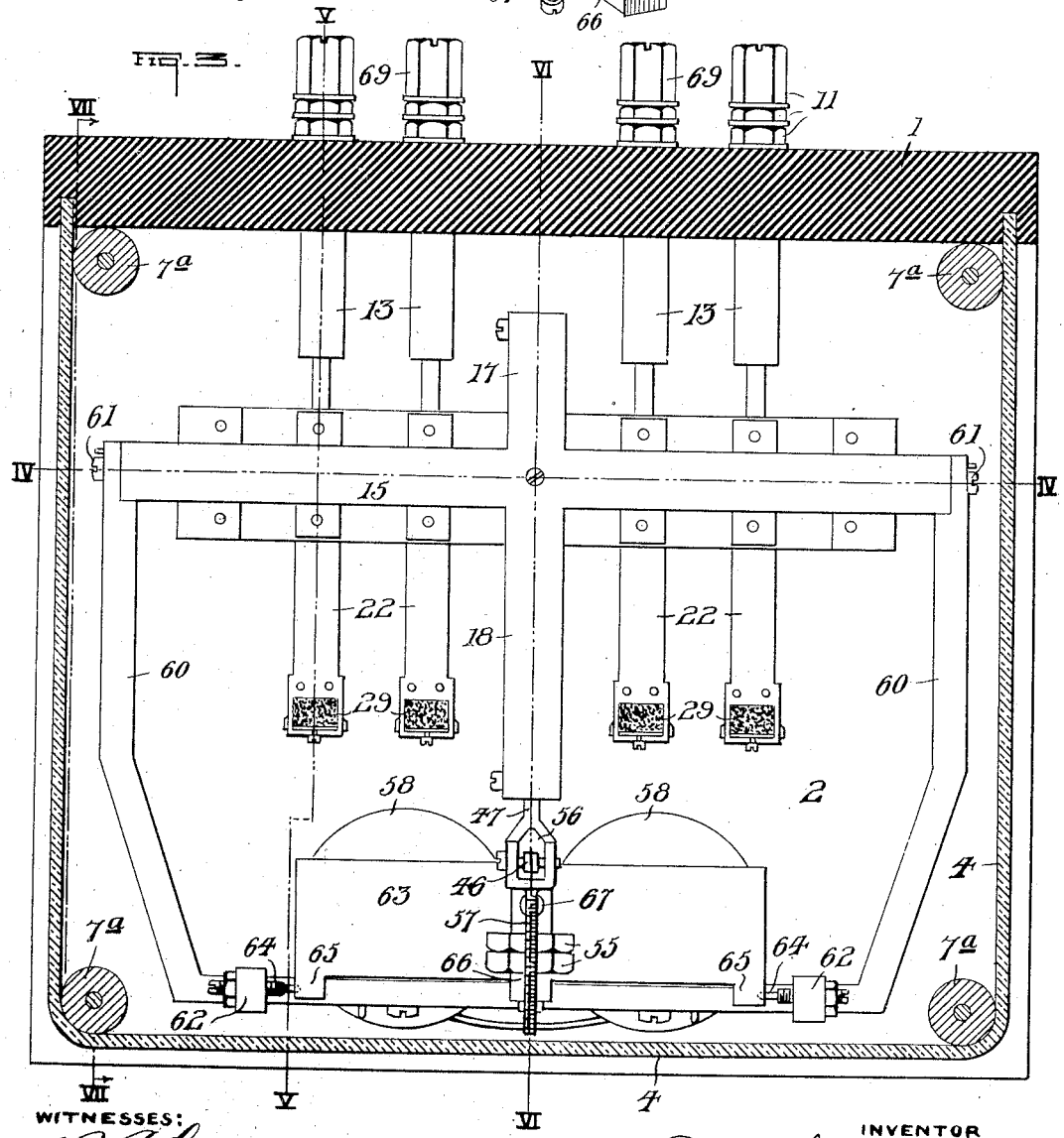


Fig. 3.



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6 SHEETS—SHEET 3.

FIG. 4.

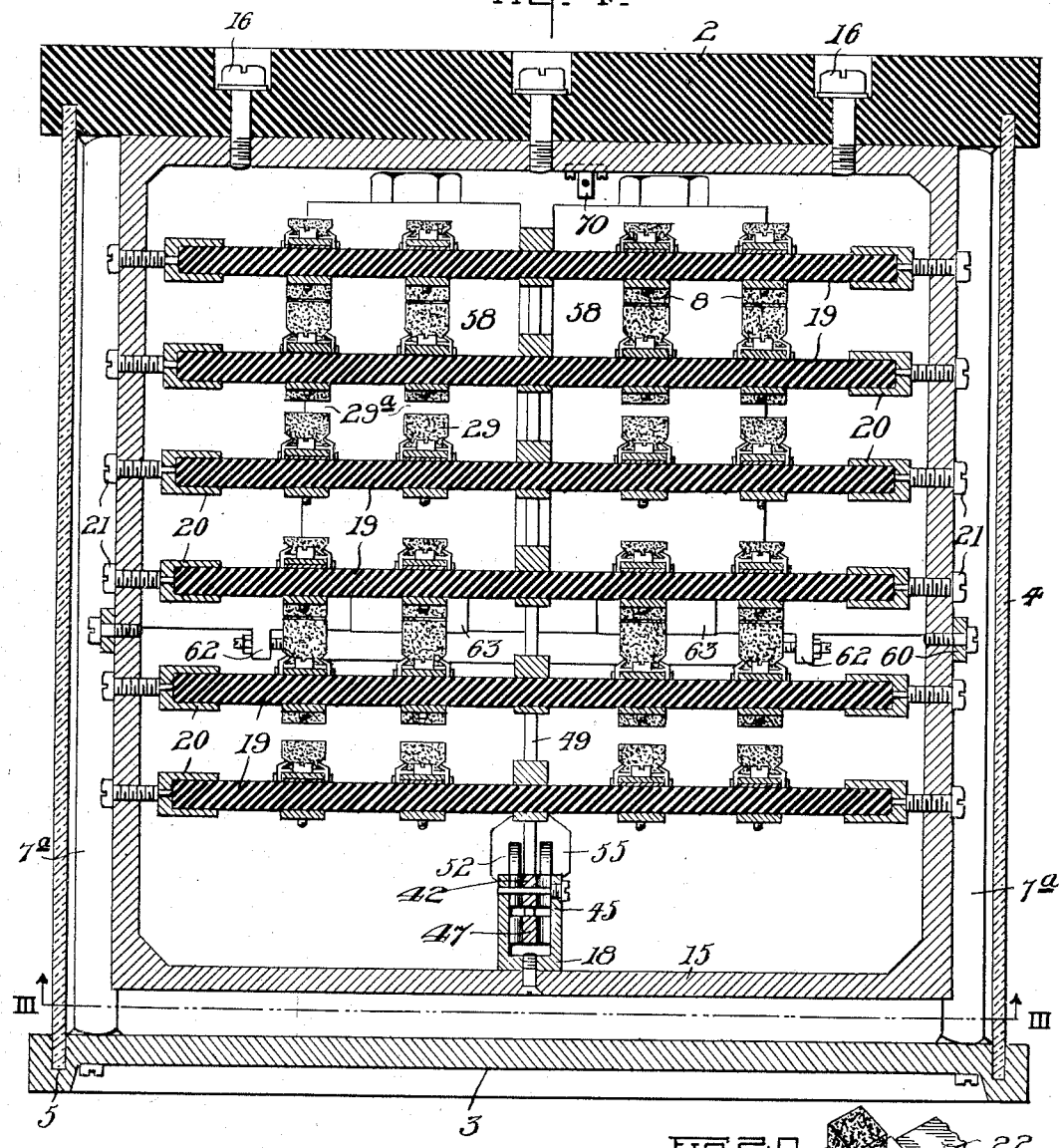


FIG. 15.

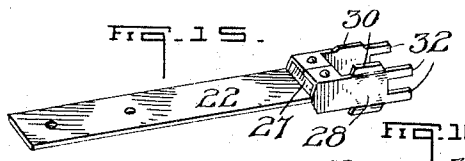


FIG. 16.

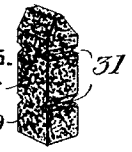


FIG. 20.

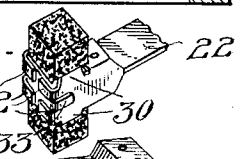
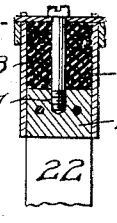


FIG. 19.

FIG. 18.

FIG. 21.



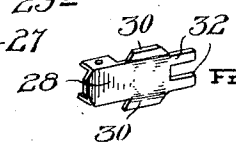


FIG. 17.

WITNESSES:

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6 SHEETS—SHEET 4.

Fig. 5.

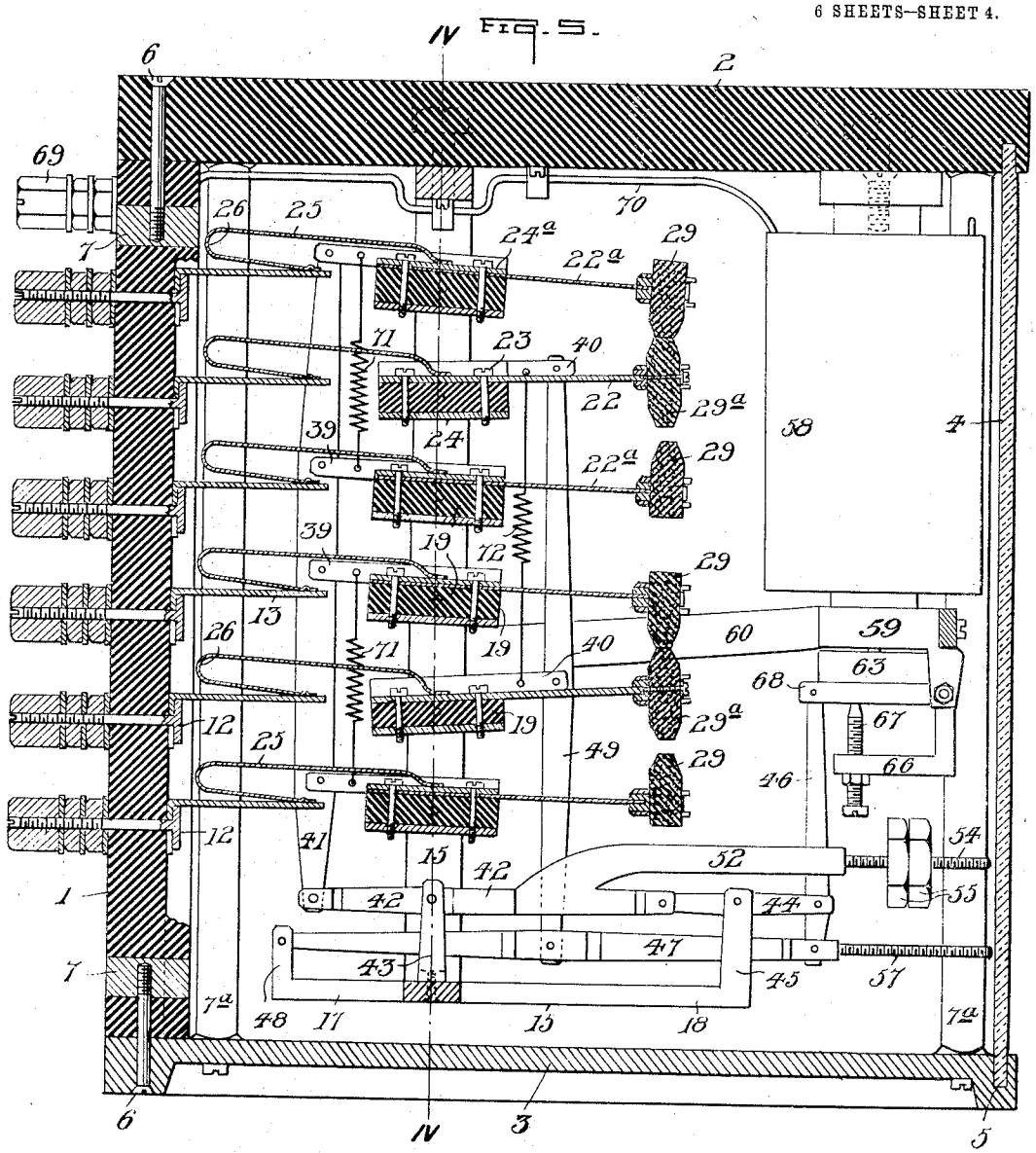


Fig. 9.

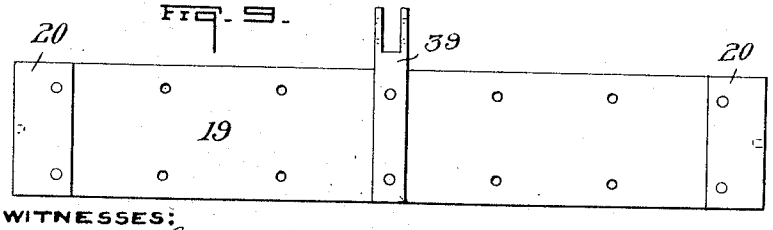
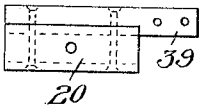


Fig. 10.



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977,140. Patented Nov. 29, 1910.

6 SHEETS—SHEET 5.

FIG. 5.

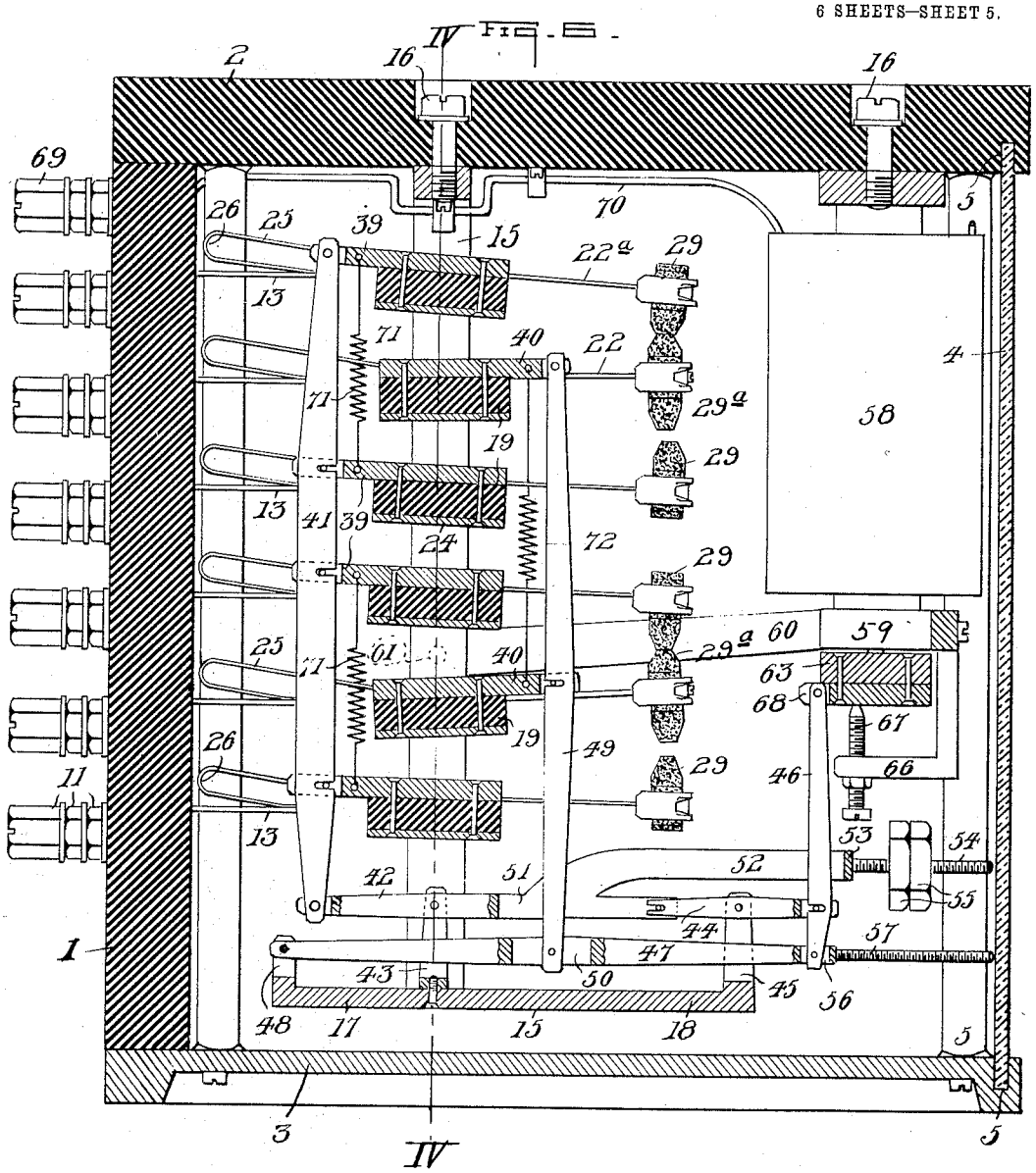


FIG. 13.

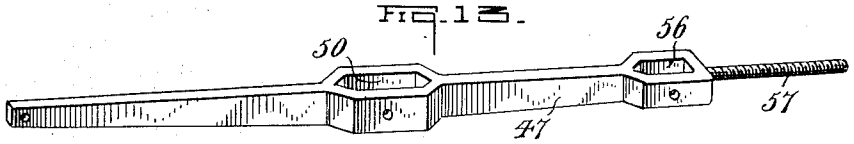
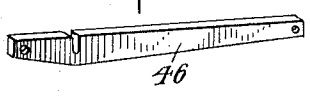


FIG. 14.



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APPLICATION FILED SEPT. 20, 1909.

977,140. Patented Nov. 29, 1910.

6 SHEETS—SHEET 6.

FIG. 7.

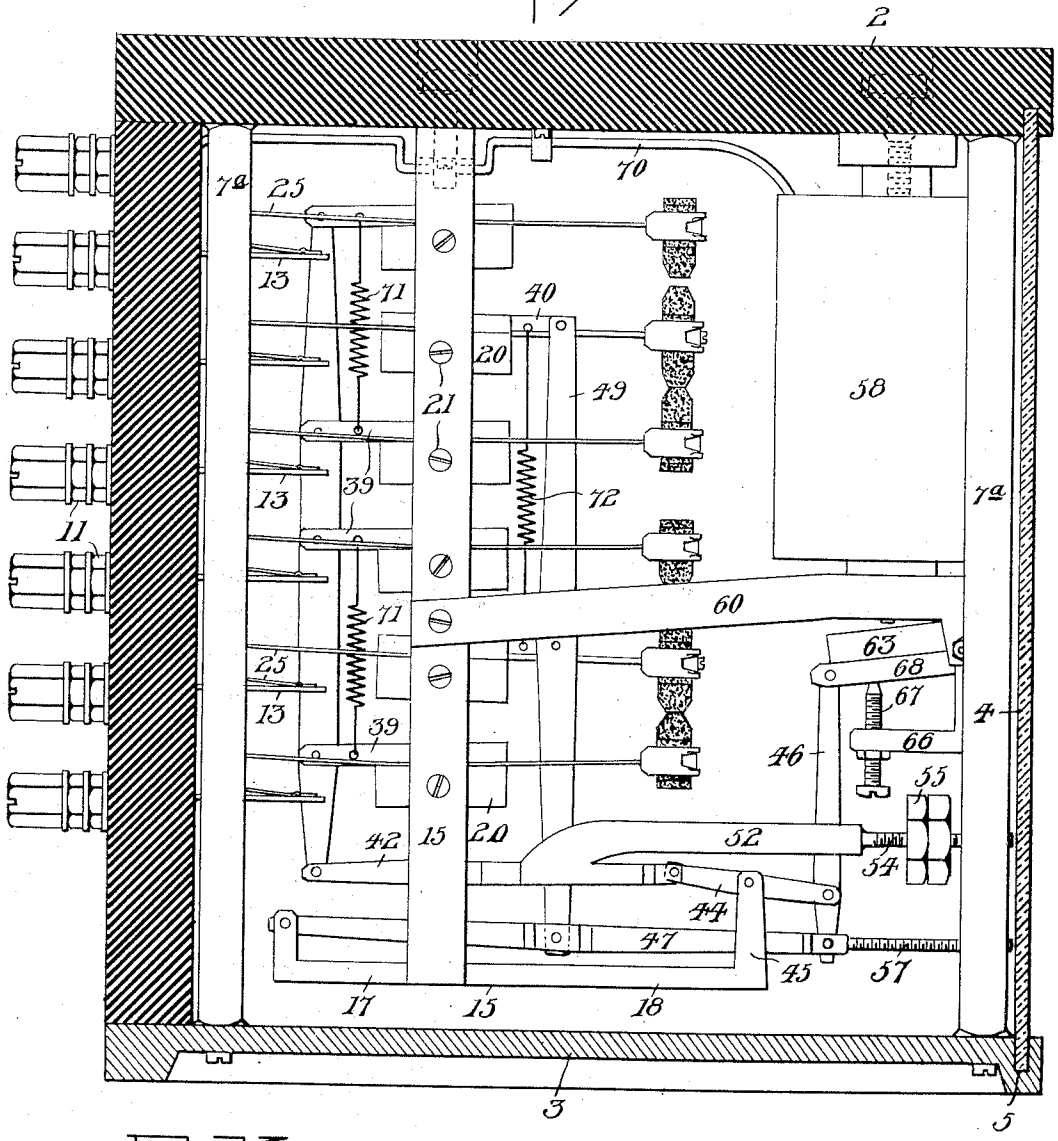

FIG. 23.

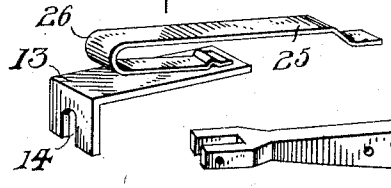

FIG. 12.

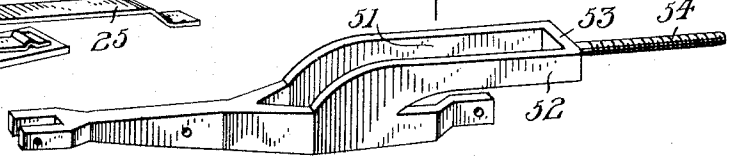

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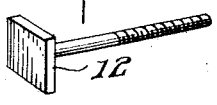
FIG. 22.



INVENTOR

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UNITED STATES PATENT OFFICE.

PERCY L. SIBOLE, OF WILKINSBURG, PENNSYLVANIA.

ELECTRIC SWITCH.

977,140. Specification of Letters Patent. Patented Nov. 29, 1910.

Application filed September 20, 1909. Serial No. 518,558.

To all whom it may concern:

Be it known that I, PERCY L. SIBOLE, a citizen of the United States, residing at Wilkinsburg, in the county of Allegheny and State of Pennsylvania, have invented or discovered new and useful Improvements in Electric Switches, of which the following is a specification.

My invention relates to electric switches and more particularly to the mechanism designed for increasing the tension or pressure at the contact points, whereby a proportionate increase of area at the points of contact is provided, thereby permitting the use of graphite or carbon without decreasing the resistance and thereby reducing the tendency to burn and the liability of fusing the contact points. I attain these features without any change of proportions in the electro-magnet or armature motion, or the air gap between the contact points, commonly recognized as correct proportion by those familiar with the art.

My invention relates also to various details of construction as hereinafter pointed out in the description and defined in the claims.

Referring to the accompanying drawings, Figure 1 is an elevation showing the exterior face of the terminal board and the edges of the base and bottom of the frame with the means for connecting the same; Fig. 2, a view on the line 2—2, Fig. 1; Fig. 3, a view on the line 3—3, Fig. 1, looking upwardly; Fig. 4, a section on the line 4—4, Fig. 3; Fig. 5, a section on the line 5—5, Fig. 3; Fig. 6, a section on the line 6—6, Fig. 3; Fig. 7, a section on the line 7—7, Fig. 3; Fig. 8, a perspective of the armature for the electro-magnets; Fig. 9, a top plan of one of the switch carrier bars; Fig. 10, an end view of Fig. 9; Fig. 11, a perspective of a part of the frame supporting the armature; Fig. 12, a perspective of one of the upper compounding levers; Fig. 13, a perspective of the lower compounding levers; Fig. 14, a perspective showing one of the vertical links; Fig. 15, a perspective showing a switch arm and the main portion of a carbon-contact holder; Fig. 16, a perspective of the carbon contacts; Fig. 17, a perspective of one of the side members of the contact holder; Fig. 18, a perspective of the end piece for holding the carbon in the holder; Fig. 19, a perspective showing Fig. 15 with the side pieces omitted; Fig. 20, a perspective showing Figs. 15–19 assembled; Fig. 21, a section through the carbon and carbon holder showing the retaining screw; Fig. 22, a perspective of the terminal bolt; and Fig. 23, a perspective of the terminal connector and ribbon.

On the drawings, 1 represents the terminal board composed of any suitable insulating material, to the top of which is secured the base or top 2 also composed of suitable insulating material. To the bottom of the board 1 is secured the bottom 3 which may be composed of metal or other material. The top or base 2 and bottom 3 lie in parallel planes on the same side of the terminal board 1, the parts 1, 2, and 3 forming three sides of the casing for the apparatus presently to be described, the three remaining sides being composed of the glass 4 set in grooves in the parts 1, 2, and 3 as shown at 5.

The top and bottom are secured to the terminal board 1 by the screws 6 which extend transversely through the top and bottom and longitudinally into the terminal board, in which I provide holes for the preferably cylindrical nuts 7. This construction is valuable in case the terminal board is made of porcelain or other material not readily provided with integral screw-threads. The top and bottom are spaced apart and further secured together by the metal posts 7^a.

The inner face of the terminal board is provided with any desired number of vertical rectangular grooves 8, provided with a number of openings leading through to the outer face of the board. In these openings or such number of them as may be required, I place the terminal screws or bolts 10 having the necessary binding nuts and washers 11 at the outer face of the board and the rectangular heads 12 fitting the grooves 8. These terminal connectors 13 are thin strips of metal having one end forked or notched as shown at 14 in Fig. 23 and bent so as to be seated and clamped between the heads 12 and the rear walls of the grooves 8 with the bodies of the terminal screws 10 in the forks or notches 14.

The metal frame 15 is secured to the base or top 2 by the screws 16. This frame is rectangular as shown on Fig. 4 and stands parallel to the terminal board 1. It has at the bottom the horizontal arms 17 and 18. Between the sides of the frame 15, I pivot-

ally mount any required number of switch carrier bars 19 made preferably of insulating material and provided at the ends with the metal U-shaped caps or clips 20, which lie close to the sides of the frame. Pivot screws 21 pass through the sides of the frame and into the said caps 20 to form pivots on which the said bars 19 can rock. I have shown the bars 19 arranged in sets of three but the number in each set will vary according to the required grouping of the switch contacts. A description of the upper three bars 19 and their connections on Figs. 5–7 will suffice for all as the other groups are constructed in the same manner. The middle bar 19 carries the switch arm 22 which is preferably made of stiff unyielding material. It is secured to the bar 19 by the screws 23 whose lower ends are secured in the metal strap 24 resting against the bottom of the bar 19. The screws clamp in each case the bar 19, the arm 22, and the strap firmly together, which furnishes a reinforcement to the material of the bar 19. The upper and lower bars 19 carry the spring or yielding switch arms 22^a, which are secured to the bars 19 the same way that the arm 22 is secured to its respective bar 19 except that straps 24^a are placed on the ends of the springs 22^a.

The inner ends of the terminal strips 13 are connected to the arm 22 and the straps 24 by the springs or ribbons 25 bent to U-shape at an intermediate portion 26. In case the upper member of the ribbon 25 breaks or burns off, the end will drop down on the strip 13 and thereby be prevented from engaging a lower current carrying member. The outer ends of the arms 22 and 22^a are provided with carbon holders, each made as follows (Figs. 15 to 21): A metal block 27 is provided, having at one end a slot to receive the end of the arm 22 or 22^a. Two side pieces 28 arranged at right angles to the arm 22 are secured at the sides of the block, the space between the pieces 28 forming a place for the carbon contact 29. The edges of the pieces 28 are bent over upon the block 27 and riveted thereto. The side pieces 22 may be brazed or soldered to the block, if desired. The edges of the pieces 28 are provided with inwardly bent lugs 30, which extend into the grooves 31 in the carbon contact 29 to prevent the movement of the latter lengthwise. The pieces 28 are each provided with a pair of end projections 32 to receive the reduced ends 33 of the clamping plate 34 which rests on the outer face of the carbon contact 29. The ends 33 are bent down on the outer faces of the pieces 28 and the projections 32 are bent down on the outer face of the plate 34 to securely hold the carbon contact in place on the holder. I provide the plate 34 with the hole 35, the carbon contact with the hole 36, and the block 27 with the hole 37 to receive the screw 38 to aid in holding the carbon and the holder together, but the ends 32 may be made short as shown in Fig. 21, if preferred, in case the screw 38 is used. The carbon 29^a is double ended for contact with opposite carbons 29.

The upper and lower bars 19 of each set are provided above with arms 39 which project toward the board 1 and the middle bar 19 of each set is provided above with an arm 40 projecting in the same direction as the arms 22 and 22^a. The arms 39 and 40 are secured to the bars 19, straps 24 being used at the lower side of the upper and lower bars 19 just as the straps 24 are used with the middle bar 19. The ends of the arms 39 are pivotally connected to the vertical link 41, whose lower end is pivoted to one end of the lever 42 pivoted between its ends on the post 43 secured by a screw or the like to the junction of the arms 17 and 18 with the main frame 15. The other end of the lever is pivoted to one end of the lever 44 having its middle portion pivotally connected to the posts 45, preferably integral with the arm 18. The other end of the lever 44 is connected to an intermediate part of the vertical link 46, whose lower end is pivoted to one end of the lever 47, the other end being pivotally connected to the posts 48, preferably integral with the arm 17. The post 43 is between the posts 45 and 48. The arms 40 are pivotally connected to the vertical link 49, whose lower end is secured in the slot 50 in the lever 47 between the posts 48 and the link 46, the link 49 passing through the slot 51 in the lever 42. Two arms 52 rise from the walls of the slot 51 in the lever 42 and extend away from the post 43. The outer ends of the arms 52 are united at 53, from which extends the screw extension 54 to receive the adjustable screw weights 55. The link 46 is in the slot 56 in the lever 47, which carries the screw extension 57 to which the weights 55 may be applied. The weights serve the purpose of almost balancing the mechanism in order to put on the armature, or equivalent actuating element, as little work as possible, and to give the mechanism such tendency to move in one direction or the other as correct operation may require.

A pair of electro-magnets 58 are mounted on the lower side of the top 2 and have their pole pieces 59 connected to the auxiliary frame 60 (Fig. 11) which is connected to the sides of the frame 15 by the screws 61^a. The frame 60 has the hangers 62 to which the ends of the armature 63 are pivotally connected by the pivot screws 64 in the arms 65 of the armature (Fig. 8). The frame 60 carries the bracket 66 having an arm beneath the armature, in which arm is the adjusting screw 67 to adjust the distance which the

armature can drop when the magnets are demagnetized. At an intermediate portion of the armature opposite the pivots there is a forked arm 68 which is secured to the lower side of the armature. To this forked arm the upper end of the link 46 is pivotally connected.

69 represents on the board, the binding screws, to which the conductors 70 from the magnets 58 are connected.

Preferably the arms 39 in each set will be connected by a tension spring 71, and the arms 40, by a tension spring 72 to take up lost motion at the various pivots.

It is seen readily that, when the armature 63 is attracted by the magnets 58, the arm 22 and the upper arm 22^a of each set are both moved one toward the other, and that by the arrangement and construction of the compound levers employed, the entire energy developed by the electro-magnets less slight frictional losses is concentrated at the points of contact between the upper carbon 29 and the middle carbon 29^a. If the armature motion be 1/16 of an inch, the compounding of the armature motion through the various levers and links together with the movement of two switch arms of each set toward each other creates an air-gap of 1/8 of an inch at the contacts and at the same time the full energy of the armature is transmitted to the contact points. Thus, the motion of the armature is compounded so that there is no loss of energy at the contacts except that of friction. By changing the position of the pivots in the levers or by reducing the length of the switch arms, an armature movement of 1/16 of an inch may create an air-gap of 1/16 of an inch, while the energy of the armature is transmitted to the contacts and increased without loss of energy except friction. If the normal air-gap at the contacts is 1/16 of an inch instead of 1/8 of an inch, as above assumed, the motion of the armature 1/32 of an inch would close the air gap, and the remaining 1/32 of an inch motion of the armature would place the yielding arm under tension.

While I have shown and described my invention in detail, I do not desire to be limited to the details and combinations shown except where the claims are susceptible of no other construction.

I claim:—

1. The combination of a frame, a pair of bars pivotally connected to the sides of the frame, switch-arms connected to the bars, contacts on the switch-arms, links connected to the switch-arms, levers connected to the links, and an actuating element connected through the links and levers, to move said contacts simultaneously toward and from each other into mutual engagement and disengagement.

2. The combination of a frame, a pair of bars pivotally connected to the sides of the frame, switch-arms attached to the bars, contacts on the switch-arms, links attached to the switch-arms, lever mechanism connected to the links, and an actuating element connected to the links and lever mechanism, the parts being so proportioned that the full energy of the actuating element may be transmitted to the contacts substantially undiminished.

3. The combination of a frame, a pair of bars pivotally connected to the sides of the frame, switch-arms attached to the bars, contacts on the switch-arms, links attached to the switch-arms, lever mechanism connected to the links, and an actuating element connected to the links and lever mechanism, the parts being so proportioned that a portion of the motion developed at the element may close the said contacts and the remainder of said motion may apply pressure to the contacts.

4. The combination of an electric circuit, two movable switch elements therein adapted to mutually engage, an actuating element, and connections between the said switch elements and the said actuating element, to move the switch elements toward each other into mutual engagement.

5. The combination of an electric circuit, two movable switch elements therein adapted to mutually engage, an actuating element, and connections between the switch elements and the actuating element to move the switch elements simultaneously toward each other into mutual engagement.

6. The combination of three movable switch elements, one of the switch elements being between the other two and arranged to engage either of the same, an actuating element, and connections between the switch elements and the actuating element arranged to simultaneously move either of the said two switch elements and the intermediate switch element toward each other and into mutual engagement and the other one of the said two switch elements away from said intermediate switch element.

7. The combination of three switch arms carrying contacts and arranged so that one may engage either of the other two, and an actuating element, mechanical connections between the said element and the three arms so arranged as to move the said two arms simultaneously in the same direction and the said one arm toward either one of the said two arms.

8. The combination of three switch arms carrying contacts and arranged so that one may engage either of the other two, and an actuating element. mechanical connections between the said element and the three arms so arranged as to move the said two arms

simultaneously in the same direction and the said one arm toward either one of the said two arms, and to cause a portion of the movement of said element to close the contact on said one arm on the contact on either of the other two arms and the remainder of the said movement to increase the pressure of the contacts, one with the other.

9. The combination of three switch arms carrying contacts and arranged so that one may engage either of the other two, and an actuating element, mechanical connections between the said element and the three arms so arranged as to cause a portion of the movement of said element to close the contact on said one arm on the contact on either of the other two arms and the remainder of the said movement to increase the pressure of the contacts, one with the other.

10. A terminal board having a groove therein, terminal devices having heads fitting said groove, and terminal strips clamped in said groove between said head and terminal board.

11. A terminal board having a groove therein, terminal devices having heads fitting said groove, and terminal strips clamped in said groove between said head and terminal board, said strips having open slots fitting over the body of said devices, whereby they may be readily removed when unclamped.

12. A vertical series of terminal strips, a series of corresponding electrical connections at a distance therefrom, and conducting ribbons having opposite ends connected to corresponding strips and connections, said ribbons having a reverse bend above their respective strips and having the ends connected to the said connections extending over and beyond the ends of said strips, whereby said strips constitute supports to arrest the descent of severed ribbons.

13. The combination of two switch-arms carrying contacts, an actuating element, connections between the said arms and element to move the contacts simultaneously toward and from each other, said parts upon release of said element operating under gravity to move said contacts simultaneously away from each other, the said contacts being arranged to directly engage each other to close a circuit.

14. The combination of three switch-arms, two of said arms carrying each one contact and the remaining arm, two contacts, the latter contacts being between the contacts on the said two arms, an actuating element, connections between the arms and the element arranged to move simultaneously two of said contacts toward each other and into mutual engagement, and the other two of said contacts away from each other, and on release of the actuating element to move simultaneously the engaged contacts apart and the separated contacts toward each other.

15. A horizontal base, an open rectangular vertical frame suspended from said base, a pair of bars pivotally connected by their ends to the sides of the frame, switch-arms attached to the bars, an actuating element, a system of links and levers connected between the said arms and element, a terminal board arranged parallel to the vertical frame and at right angles to the base, terminal devices attached to the terminal board, and connections between the switch-arms and the terminal devices, the switch-arms being insulated from each other, the terminal devices being insulated from each other, and the said frame being insulated from said terminal board.

16. The combination of three pivotal bars, switch-arms connected to the bars, having contacts at one end and terminal connections at the other, and insulated from each other, one arm having two contacts arranged to engage either of the other two contacts, an actuating element, levers and links connecting the switch-arms and the actuating element, the said links connecting the arms so that the middle contact and one of the other two arms move simultaneously toward each other and that the middle contact and the remaining one of the two arms move simultaneously away from each other, the middle and said two contacts directly engaging each other.

17. The combination of two switch elements, movable toward and from each other, one containing yielding material, an electro-magnet, an armature operatively related to the same, links and levers connecting the switch elements to the armature, the levers being so proportioned that, when the switch elements engage each other, the air gap between the armature and the pole-piece is greater than a predetermined amount and that, when the said air gap is at said predetermined amount the yielding material of said switch element has permitted the application to the contact element the full pressure applied by the electro-magnet to the said armature.

18. A vertical frame, switch-arms pivoted thereto, an electro-magnet, a frame for the electro-magnet, located at one side of the first frame, an armature, means for operatively connecting the armature and the switch arms, and substantially horizontal braces connecting the two frames.

19. A vertical frame, bars pivotally supported by the sides of the frame, switch-arms attached to the bars, an actuating device, links and levers connecting the bars and the actuating device, some of the pivotal connections of the links consisting of a pin at each end thereof and an open-ended slot between the pins, some of the levers

having a pin at one end and an open-ended slot at the other end and a pin at an intermediate point.

20. The combination of a pair of movable switch arms, a link connected to one arm on the same side of the fulcrum as the contact on said arm is located, a second link connected to the other arm on the opposite side of the fulcrum from the contact on the same, an actuating element, a link connected to the same, and levers connecting said links so as to cause motion of the actuating element to actuate the contact elements in opposite directions.

21. The combination of a pair of movable switch arms, a link connected to one arm on the same side of the fulcrum as the contact on said arm is located, a second link connected to the other arm on the opposite side of the fulcrum from the contact on the same, an actuating element, a link connected to the same, levers connecting said links so as to cause motion of the actuating element to actuate the contact elements in opposite directions, and means for balancing the mechanism.

22. A vertical frame, switch arms pivoted between the sides thereof, links connected to said arms, a support connected to the base of the frame between the sides thereof, an actuating element, a link connected thereto, an arm on said frame, a lever connected to said arm and to the armature link, a second lever connected to said support, said first lever and one of said first links.

23. A vertical frame, switch arms pivoted between the sides thereof, links connected to said arms, a support connected to the base of the frame between the sides thereof, an actuating element, a link connected thereto, an arm on said frame, a lever connected to said arm and to the armature link, a second lever connected to said support, said first lever and one of said first links, a second arm on said frame, and a lever pivoted thereto and to said armature-link and to the remaining one of said first links.

24. A horizontal base, a vertical open rectangular frame secured to the base, horizontal switch-carrying bars, pivots extending through the vertical sides of the frame and into the ends of the bars, switch-arms carried by said bars, oppositely extending horizontal arms extending at right angles from the lower horizontal end of the frame, vertical brackets at the ends of the arms, an intermediate vertical bracket connected to the lower end of the frame at the junction of the arms therewith, levers having bearings in said brackets, links connecting the switch-arms and the levers, and means for actuating the levers and links.

25. A pair of pivoted switch-arms, contacts on one end of each arm, a link connected to one arm between its fulcrum and contact, a link connected to the other arm at the opposite side of its fulcrum from its contact, an actuating element, a link connected thereto, levers connecting the second and third links, a second lever connecting the first and third links, and means providing a minimum of adjustable overbalance to said mechanism, whereby the actuating element may close the contacts with a minimum of force, and gravity be able to open the said contacts.

Signed at Pittsburg, Pa., this 11th day of September, A. D. 1909.

PERCY L. SIBOLE.

Witnesses:

ALICE E. DUFF,

F. N. BARBER.