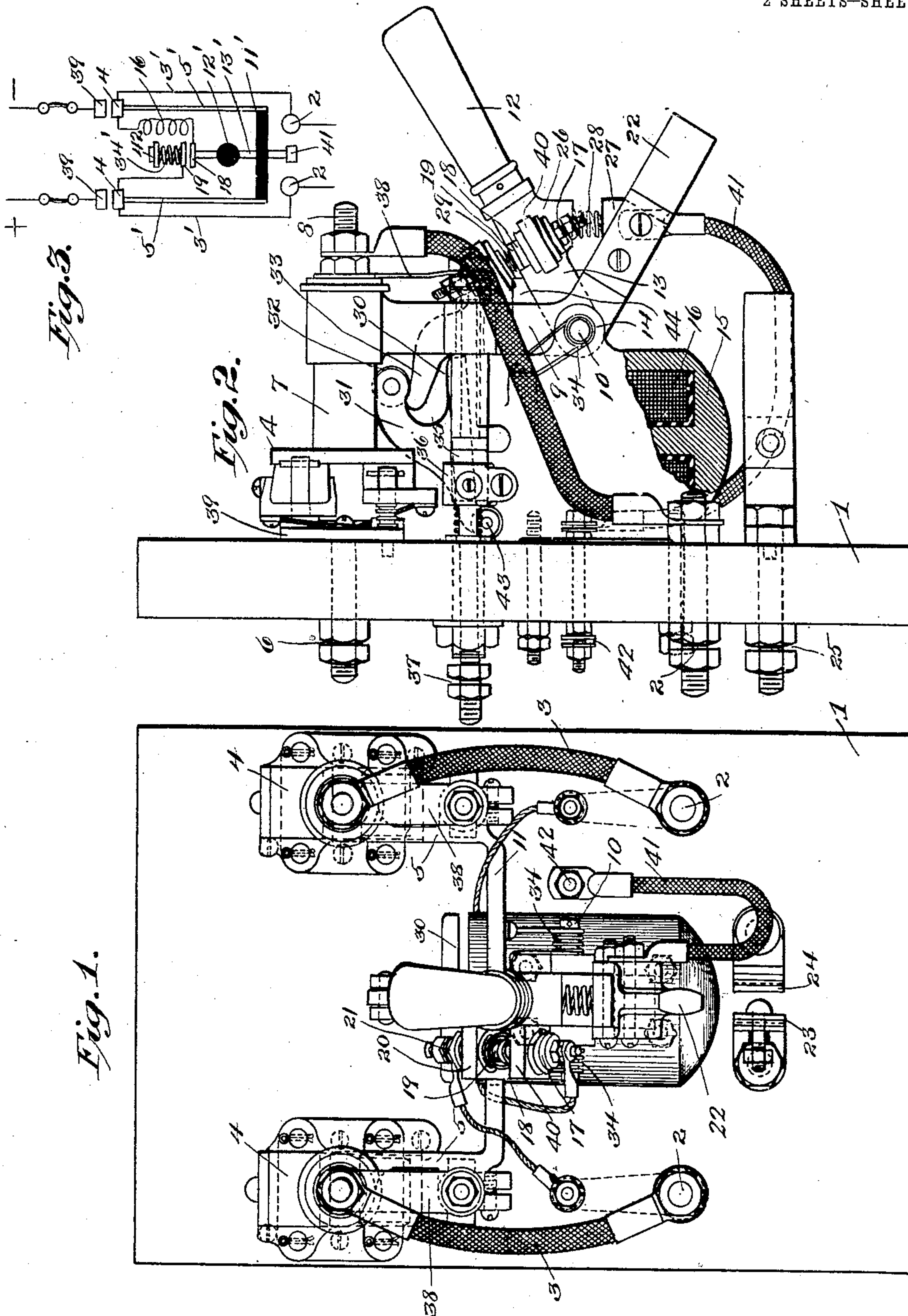


J. D. IHLDER.  
POTENTIAL SWITCH.  
APPLICATION FILED APR. 9, 1906.

973,508.

Patented Oct. 25, 1910.

2 SHEETS—SHEET 1.



Attest:  
*Walter C. Strang*  
Walter C. Strang

by

Inventor:  
*John D. Ihlder*  
Chas. M. Nissen  
Atty

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2 SHEETS—SHEET 2.

Fig. 5.

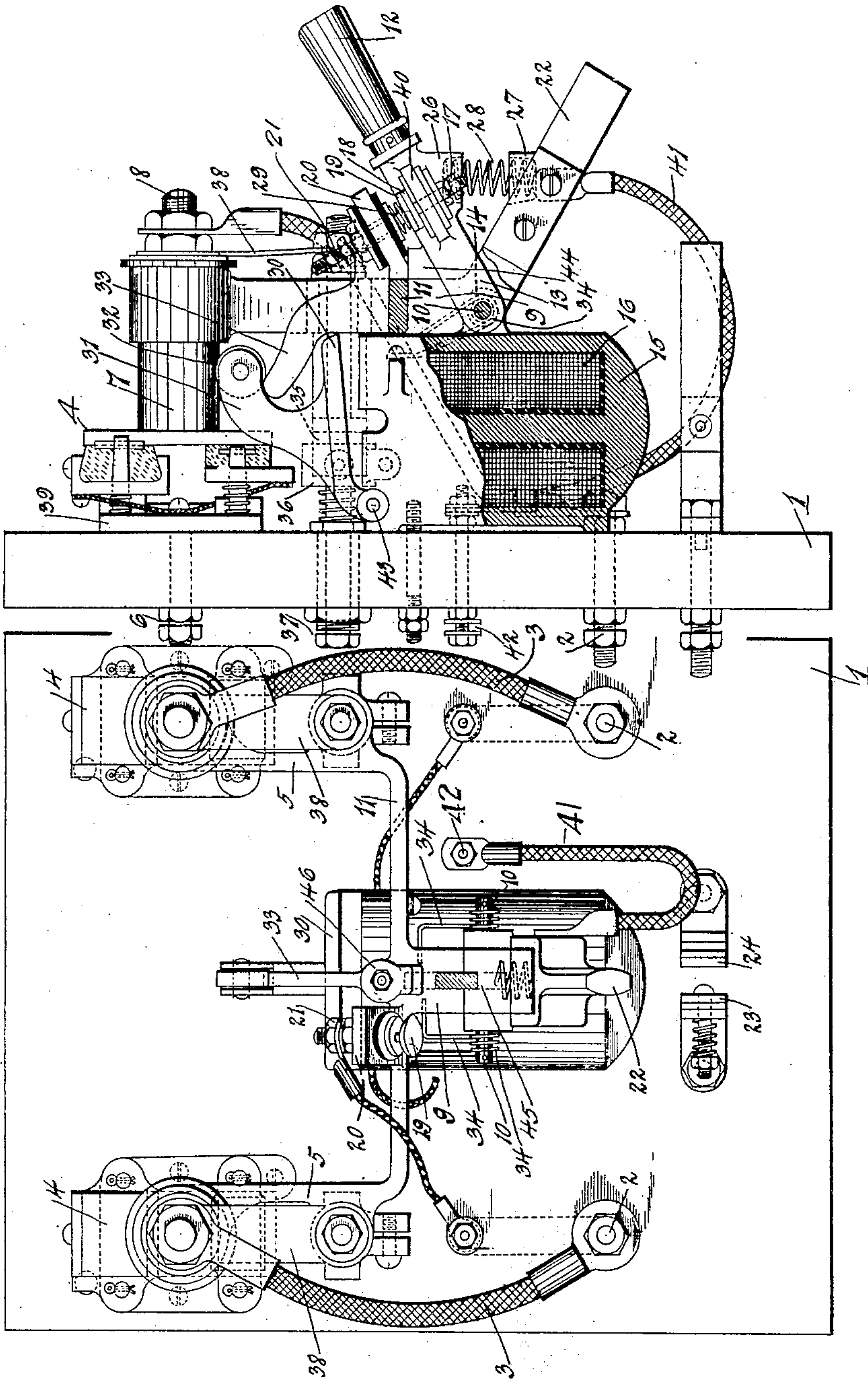


Fig. 4.

Witnesses

Ernest L. Gale, Jr.  
James G. Bethell.

334

Inventor  
John D. Ihlder  
Attorney  
C. M. Wissen



# UNITED STATES PATENT OFFICE.

JOHN D. IHLDER, OF NEW YORK, N. Y., ASSIGNOR TO OTIS ELEVATOR COMPANY, OF JERSEY CITY, NEW JERSEY, A CORPORATION OF NEW JERSEY.

## POTENTIAL SWITCH.

973,508.

Specification of Letters Patent.

Patented Oct. 25, 1910.

Application filed April 9, 1906. Serial No. 310,656.

*To all whom it may concern:*

Be it known that I, JOHN D. IHLDER, a citizen of the United States, residing in New York city, in the county of New York and State of New York, have invented a new and useful Improvement in Potential Switches, of which the following is a specification.

My invention relates to electric switches and more particularly it is what are generally termed "potential switches;" and one of its objects is the provision of an improved and efficient electric switch.

A further object of the present invention is the provision of means for opening said switch by the application of minimum manual force.

More particularly it is the object of the present invention to provide means for breaking a circuit of an electric switch by a movement of the operating element; or for interrupting a circuit of the holding electro-magnet of a potential switch by the actuation of the operating handle thereof to permit the switch to be opened easily.

Other objects of my invention will appear hereinafter, the novel combination of elements being pointed out in the claims.

In the accompanying drawing, Figure 1 represents in elevation, a potential switch embodying my invention; Fig. 2 is a side elevation thereof; Fig. 3 is a diagrammatic view to illustrate the operation of my invention; Fig. 4 is an elevational view omitting certain parts; and Fig. 5 is a view similar to Fig. 2, but omitting a portion of the multiple electric switch.

1 designates a base or support of insulating material for the various operating parts of the switch. 2, 2 are binding posts herein shown at the lower portion of the support 1, and to these binding posts are connected the leads of the apparatus which is to be supplied with electric current. The binding posts 2, 2 are connected by the flexible connectors 3, 3, to the movable contacts 4, 4, carried by the switch arms 5, 5. The movable contacts 4, 4 are adapted to cooperate with the fixed contacts mounted on the support 1 and electrically connected to the binding posts 6, as indicated in Fig. 2. Preferably the fixed contacts are spring-pressed, and comprise a plurality of parts, one of said parts including a carbon block, and the other a metal block such as copper, so

that when the switch is opened the movable contact will leave the copper block before it leaves the carbon block. The carbon block will therefore, take all the arc but when the switch is entirely closed, a good electrical connection will be obtained by reason of the connection of the movable contact with the copper block. It will be noticed that each of the arms 5 comprises a substantially vertical portion when the switch is closed, and a horizontal portion 7. Through the latter 7 passes the connecting rod 8 to which is clamped the upper end of the electric connector 3. The switch is in reality a two-pole switch with the movable contacts insulated from each other. This may be accomplished in any desirable manner, as for instance, by placing an insulated bushing in the horizontal portion 7, through which the rod 8 is passed. Any other desirable means for insulating the movable contacts from each other may be employed if desired. For the sake of durability, however, insulating sections in the structure itself should be avoided.

The lever 9, which is pivoted at 10, extends vertically and is connected rigidly to the horizontal connecting bar 11, to the outer ends of which are secured the switch arms 5, 5, respectively, so that when the lever 9 is moved in one direction or the other, the switch will be closed or opened, as desired, in the well known manner. Ordinarily a handle 12 connected to a lever arm 13 is employed to impart motion to the electric switch to close or open the same, but in such cases such handle moves with the switch arms. In this instance, however, although the manual lever 13 is pivoted at 10, on a bracket 14 extending from the magnet frame 15, it has a movement relative to the switch lever 9.

By referring to Figs. 2 and 5 it will be seen that the lever 13 is limited in its upward movement by the lug 44 which is preferably integral with the switch lever 9. Fig. 5 also shows more plainly the cups 26 and 27 of Fig. 2, in which rest the ends of the spring 28. Normally this spring holds the lever 13 against the stop 44, and at the same time holds the electric switch comprising the contacts 18 and 19 in closed position. The block 20 which carries the contact 19 is mounted on or is integral with the horizontal bar 11. The manual lever



13 is herein shown as pivoted on the same bearing shaft 10 on which the switch lever 9 is pivoted. The springs 34 mounted on the extended ends of this shaft are so arranged that one end of each is fastened to the iron frame of the electro-magnet and the other end of each bears against the back portion of the lever 13, tending to move the same outwardly to automatically open the electric switch when the electro-magnet is deenergized to release the locking device. It will also be seen from an inspection of Figs. 4 and 5 that the lever 13 is movable in a slot 45 of the switch lever 9, so that the manual lever may have a free movement relatively to the switch lever.

The detent 33 is carried by or is integral with the switch lever 9, as indicated in Figs. 4 and 5. 46 designates an adjustable buffer device to cushion the blow of the switch lever 9 against the magnet frame when the electric switch is closed.

When the electric switch is open, the positions of the various contacts are as indicated in Fig. 3. When the handle 12 is grasped and lifted, motion is transmitted through the stop 44, the lever 9, the detent 33, and the contacts carried by the horizontal bar 11. At this time the switch comprising the contacts 18 and 19 is closed, and when the main line switch is closed the electro-magnet 16 is connected directly across the line and pulls down the armature 30 to cause the latch 31 to firmly hold stationary the detent 33, and therefore in turn hold the main line switch closed after the handle 12 is released. Ordinarily it is difficult to open such an electro-magnetic main line switch while the magnet 16 is energized, for the reason that considerable force must be used to pull the detent 33 from under the latch 31 which is being pulled down by the electro-magnet. In the present construction, however, the only force needed to open the main line switch is that required to move the handle 12 against the action of the spring 28 to separate the contacts 18 and 19. When this occurs the circuit of the magnet 16 is interrupted, the latch 31 is released, and the springs 34 automatically throw the switch lever 9 outwardly or about its pivotal bearing 10 to effect the opening of the main line switch. When the switch controlling the electro-magnet is open and the main line switch is open, the handle 12 may be released, whereupon the switch lever 9 will continue its movement until the blade 22 strikes the buffer device comprising the clips 23 and 24. Or, if desired, the switch controlling the electro-magnet may be easily opened by the handle 12, whereupon the main line switch will be immediately opened and the stop 44 will again engage the lever 13, after which the movable parts of the main line switch may be allowed to move

to their outer positions as quickly as desired, depending upon how the handle 12 is held or when it is released.

A spring 19 is placed between the contact 19 and brake 20, but this spring is weaker than the spring 28, so that the latter securely holds the switch lever 13 up against the stop 44 with the spring 29 compressed; a good electrical connection between the contacts 18 and 19 is thus secured.

Extending laterally from the manual lever 13 and rigidly connected thereto, is a lug or projection 40 for carrying a binding post 17, and an electrical contact 18. This electrical contact is adapted to cooperate with an additional contact 19 which is mounted on a bracket 20 rigidly connected with the horizontal connecting bar 11 of the electric switch. The contact 19 is connected with the binding post 21. Preferably the binding post 17 and the contact 18, although securely mounted on the lug 40, are insulated therefrom in any well known manner. So also are the contact 19 and the binding post 21 insulated from the bracket 20.

The switch lever 9 carries a downwardly extending auxiliary switch lever 22 which is adapted to cooperate with the blades 23 and 24 mounted below the magnet frame 15 and in the path of travel of said auxiliary switch lever. One of the blades 23, 24, as that indicated 23 in Fig. 4, may be spring-pressed so that when the lever 22 is moved into engagement with said blades, the latter may act as a buffer device to the electric switch upon being thrown to open position. Furthermore when the switch is thrown to open position and the lever 22 connects the blades 23 and 24, a secondary circuit or local circuit may be closed for securing any desired operation of the apparatus to be controlled. For example, if the switch is connected to an electric motor and the main line potential falls below a pre-determined value, and the potential switch is therefore automatically opened, the secondary switch may control an electro-dynamic brake circuit in the well known manner. In this instance, I have connected the lever 22 by a flexible wire or cable 41 to the binding post 42, on the base or support 1; the other binding post of this auxiliary switch being indicated at 25 (Fig. 3).

The electro-magnet comprising the casing 15, and a winding 16, is securely attached to the supporting board 1, and is provided with an armature 30 pivoted at 43 which may be on the magnet frame 15 or attached to a bracket on the base blade 1. On the upper side of the armature 30 is mounted a latch 31 which is curved outwardly and carries an anti-friction roller 32 at its free end. Cooperating with the roller 32 is a detent 33 extending inwardly from the horizontal support 11, and preferably from the central por-



tion thereof. The detent 33 therefore, moves with the electric switch, and when the latter is closed, the detent 33 will be placed under the anti-friction roller 32. If the electro-magnet is energized at this time, it will firmly draw its latch 31 downwardly to effect a holding of the electric switch in closed position. It is obvious that the electro-magnet may be designed to have a certain strength when a certain potential is applied thereto, and when this potential falls below a predetermined value, the latch 31 will be sufficiently released to allow the switch to be automatically opened. When thus sufficiently deenergized, the springs 34, 34, will throw the switch to open position and cause the auxiliary switch to be closed, and at the same time act as a buffer device.

Additional contacts 35 may be carried by the switch arms 5, 5, and cooperate with the spring-pressed contacts 36, as indicated in Fig. 2, the binding posts for the latter being indicated at 37. In such case the positive and negative mains may be connected to the binding posts 37 so that the current will flow through the spring-pressed contacts 36, the movable contacts 35, and the connectors 38 to the leads 3, 3. Or said connectors 38, 38, may be removed and the secondary switches used to control a dependent circuit. Preferably, however, I connect the positive and negative mains to the binding posts 6, so that the current will flow to the binding posts 2, 2, and thence to the apparatus to be controlled. The secondary switch may then be used, for example, to control the current flowing through the winding 16 of the electro-magnet, by connecting the terminals of said electro-magnet with the binding posts 37. It will then be evident that when the switch as a whole is closed, the electro-magnet will be connected directly across the mains.

When it is desired to use this potential switch as a manual main line switch and such switch is held closed by the electro-magnet, it is evident that it will be difficult in most instances to manually operate the electric switch to open position the same as such switch is ordinarily constructed. It should be particularly noted that the contacts 18 and 19 comprise a switch, which when placed in circuit with the winding 16 of the electro-magnet, will control the energization of said magnet. Assuming therefore, that the switch is closed, as indicated in Fig. 2, and the contacts 18, 19 in engagement with each other, and in circuit with the electro magnet, it will be obvious that when such contacts are separated, the magnet will be deenergized, after which the switch may be allowed to be automatically moved to open position. All the manual effort, therefore, required, is to move the handle 12 against the action of the small

spring 28 to separate the contacts 18 and 19 to effect the deenergization of the electro-magnet and the consequent release of the latch 31 and the detent 33. After the contacts 18, 19 have been thus separated, the springs 34, 34, will begin to act to throw the switch in its entirety to open position, and the auxiliary switch comprising the lever 22 to closed position. When the switch is desired to be closed, the handle 12 will of course be lifted, and when this is done, the contacts 18 and 19 will be immediately moved into engagement with each other. The electro-magnet may be so connected that it will be immediately energized therefrom to draw inwardly its latch 31, so that as the switch is closed, the detent 33 will be snapped into locking position. I prefer, however, to employ the secondary switches for closing the electro-magnet circuit after the detent 33 has been moved under the roller 32, thus obviating the necessity of throwing the switch quickly to closed position so that the detent 33 will be moved into locking engagement with the anti-friction roller 32. Although the spring 29 may be omitted, it is preferable to employ it to insure the contacts 18, 19 being separated when desired, as it may occur in some instances that these contacts will stick together on account of arcing.

Fig. 3 illustrates diagrammatically the operation of one form of my invention. If it is desired to close the main line switch between the positive and negative mains, and the binding posts 2, 2, respectively, the insulating handle 12' is moved upwardly to effect the engagement of the contacts 18, 19 against the action of the spring 34' mounted between the fixed support 42 and the movable contact 19. Now when these contacts 18 and 19 are thus electrically connected, they are connected in circuit with the electro-magnet winding 16 between the movable contacts 4, 4, but the latter are not moved into engagement with the fixed contacts 39, 39, until the abutment 41 strikes against the horizontal insulating support 11'. This abutment 41 being carried with the handle 12' by the rod 13', will move the support 11' together with the vertical rods 5', 5', and movable contacts 4, 4, upwardly to effect the engagement of the latter with the fixed contacts 39, 39. The circuit to the apparatus to be controlled will thus be closed and at the same time the electro-magnet of the potential switch will be energized to hold the main line switch closed in the desired manner.

When it is desired to open the main line switch, this may easily be done by moving downwardly the rod 13' which may be actuated independently of the horizontal support 11', just as the handle 12 in Fig. 2 may be moved downwardly independently of the



horizontal support 11. It is assumed that after the rod 13' has been moved upwardly, it is held in such position by the locking device which is intended not to be unlocked until the electro-magnet is deenergized. It will therefore be seen that the contacts 4, 4 will be held in engagement with the contacts 39, 39, respectively, until the contacts 18, 19 are separated. For when this occurs, the electro-magnet winding 16 will no longer receive current, and consequently the latch 31 will be released to allow the support 11', rods 5', 5', and the contacts 4, 4, to drop so as to open the main line switch.

It is obvious that my improved electric switch may be connected to any electrical apparatus to be controlled in various ways, to secure any desired operation within certain limits.

It is also evident that various changes in the details and arrangement of parts may be made by those skilled in the art without departing from the principles of my invention, as defined in the claims, and I therefore, do not desire to be limited to the precise construction herein disclosed.

Having thus fully described my invention, what I claim and desire to have protected by Letters Patent of the United States is:—

1. The combination with an electric switch, of a device for closing the switch, means for opening the switch, electro-responsive means for holding the switch closed, and means operated by said device for deenergizing said electro-responsive means and thereby rendering said holding means ineffective and permitting the switch to open.

2. The combination with an electric switch, of a device for closing said switch, electro-magnetic means for holding the switch closed, and means operated by the said device when moved in the opposite direction for deenergizing said electro-magnetic means, thereby permitting the switch to move freely to open position.

3. The combination with an electric switch, of manual means for closing said switch, electro-responsive mechanism for holding said switch in closed position, and an appliance operated by the same manual means to render said holding mechanism ineffective by reducing its holding power.

4. The combination with an electro-magnetic switch, of locking apparatus therefor, electro-magnetic means for holding said apparatus in operative position, a manual device for closing said switch, and means operated by the same manual device for effecting the release of said locking apparatus by affecting the magnetic power of said electromagnetic means and thereby permitting the free opening of said switch.

5. The combination with a potential

switch, of a manual device for opening said switch, magnetic means for holding the switch closed, and means co-acting with said manual device for varying the magnetic power of said magnetic means, and thereby effecting the release of said potential switch.

6. The combination with an electromagnetic switch, of a locking apparatus therefor, a magnetic device for operating said apparatus, a manual device for opening said switch, and means co-acting with said manual device for affecting the operation of said magnetic device by changing its magnetic power and thereby unlocking said locking apparatus.

7. The combination with an electric switch, of an electro-magnetic device for locking said switch in closed position, a circuit-closer for controlling the energization of the electro-magnet of said electro-magnetic device, and a manual device for operating said switch and said circuit-closer.

8. The combination with a potential switch, of manual means for operating said switch to open or closed position, additional means for operating the switch to open position, a magnetic device normally preventing such operation of said additional means, and a device operable by said manual means for effecting a variation in the magnetic power of said magnetic device and thereby controlling the opening of said switch.

9. The combination with an electric switch, of means for closing said electric switch, a locking device for holding said switch in closed position, an electro-magnet for operating said locking device, and a circuit-closer operated by said switch-closing means to control the energization of said electro-magnet without moving said switch.

10. The combination with an electric switch, of means for closing or opening said switch, an electro-magnetic locking device for said switch, and a circuit-closer for controlling said electro-magnetic device, said circuit-closer being operable by the switch-closing and opening means without opening the said switch.

11. The combination with an electric switch comprising a pivoted switch lever, of a manual lever for operating said switch, but movable relatively to said lever, an electro-magnetic locking device for controlling said switch, and a circuit-closer operated by said manual lever.

12. The combination with a potential switch, of an actuating lever therefor, having an independent movement and means electrically controlled by said actuating lever for effecting an automatic opening of said potential switch.

13. The combination with a pivoted switch lever, of a plurality of switch arms carried by said lever, one or more contacts



mounted on each of said arms, additional contacts cooperating with said movable contacts, a pivoted lever for actuating said switch lever, a circuit-closer one of the contacts of which is carried by the switch lever and the other contact of which is carried by the actuating lever, an electro-magnet connected in circuit with said circuit-closer contacts, and a locking device controlled by said electro-magnet to hold the switch in closed position.

14. The combination with an electric switch comprising a pivoted lever, of an actuating pivoted lever for said switch, a circuit-closer co-acting with said levers, and operable to open position independently of the switch, means for holding said circuit-closer normally in closed position, an electro-magnet connected to said circuit-closer, and a locking device for said switch and controlled by said electro-magnet.

15. The combination with a multiple switch, of an actuating device therefor movable relatively thereto, a circuit-closer between said switch and said actuating device, a spring for holding said circuit-closer normally in closed position, and an electro-magnetic locking device for said switch controlled by said circuit-closer.

16. The combination with an electric switch, of manual means for closing and opening said switch, a locking device for said switch, an electro-magnet for operating said locking device, a circuit-controller co-acting with said manual means and connected to said electro-magnet, and resilient apparatus for throwing the switch to open position upon the manual means being actuated to operate said circuit-controller and effect the release of said locking device.

17. The combination with an electric switch, of an electro-magnetic locking device therefor, manual means for opening and closing said switch, a circuit-controller operable by said manual means for effecting the release of said locking device, and an auxiliary switch.

18. The combination with an electric switch, of an electro-magnetic locking device therefor, a manual appliance for closing said switch, a circuit-closer operable by said manual appliance while the switch is closed to control said locking device, and a buffer for said switch.

19. The combination with a switch lever, of a pivotal bearing therefor, a manual lever pivoted on the same bearing, a spring tending to move the switch lever in a predetermined direction, a second spring tending to hold said manual lever in a predetermined position, and a circuit-closer controlled by said manual lever.

20. The combination with a movable member, of electro-mechanical mechanism for holding said member in a predetermined position, a device for moving said member to such position, and means operable by said device for electrically controlling said electro-mechanical mechanism while said member is in said predetermined position.

21. The combination with an electric switch comprising a pivoted lever, of a second lever having movement independently of the switch lever but capable of engaging the same positively, electro-mechanical mechanism for holding the switch in closed position, an auxiliary switch for controlling said electro-mechanical mechanism, and a spring acting on said second lever to normally hold said auxiliary switch in a predetermined position.

22. The combination with an electric switch comprising a lever, of a pivotal bearing for said lever, one or more springs tending to move said lever to open the switch, a manual lever pivoted on said bearing, an extension from said switch lever, a spring between such extension and the manual lever, a detent carried by said lever, an electro-magnet, a latch held by said electro-magnet against said detent to hold the switch closed, and an auxiliary switch, one of the contacts of said switch being carried by said switch lever and the other by said manual lever and placed in circuit with said electro-magnet.

23. The combination with a multiple switch comprising a pivoted lever, of one or more springs tending to move said switch to open position, an auxiliary switch acting as a buffer device for said multiple switch, a pivoted lever for opening or closing either of said switches and having a movement relatively to said switch lever, a circuit-closer, one contact of which is carried by the switch lever, and the other contact of which is carried by the actuating lever, a spring for normally holding said contacts in engagement with each other, an electro-magnet having its winding connected in circuit with said contacts, and a locking device operated by said electro-magnet to hold the multiple switch in closed position and permit said contacts to be separated by said actuating lever, and in turn effect the opening of the multiple switch and the closing of the auxiliary switch.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN D. IHLDER.

Witnesses:

C. BLUM,  
W. H. BRADY.