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AUTOMATIC SWITCH.

APPLICATION FILED AUG. 29, 1907.

920,667.

Patented May 4, 1909.

Fig. 1.

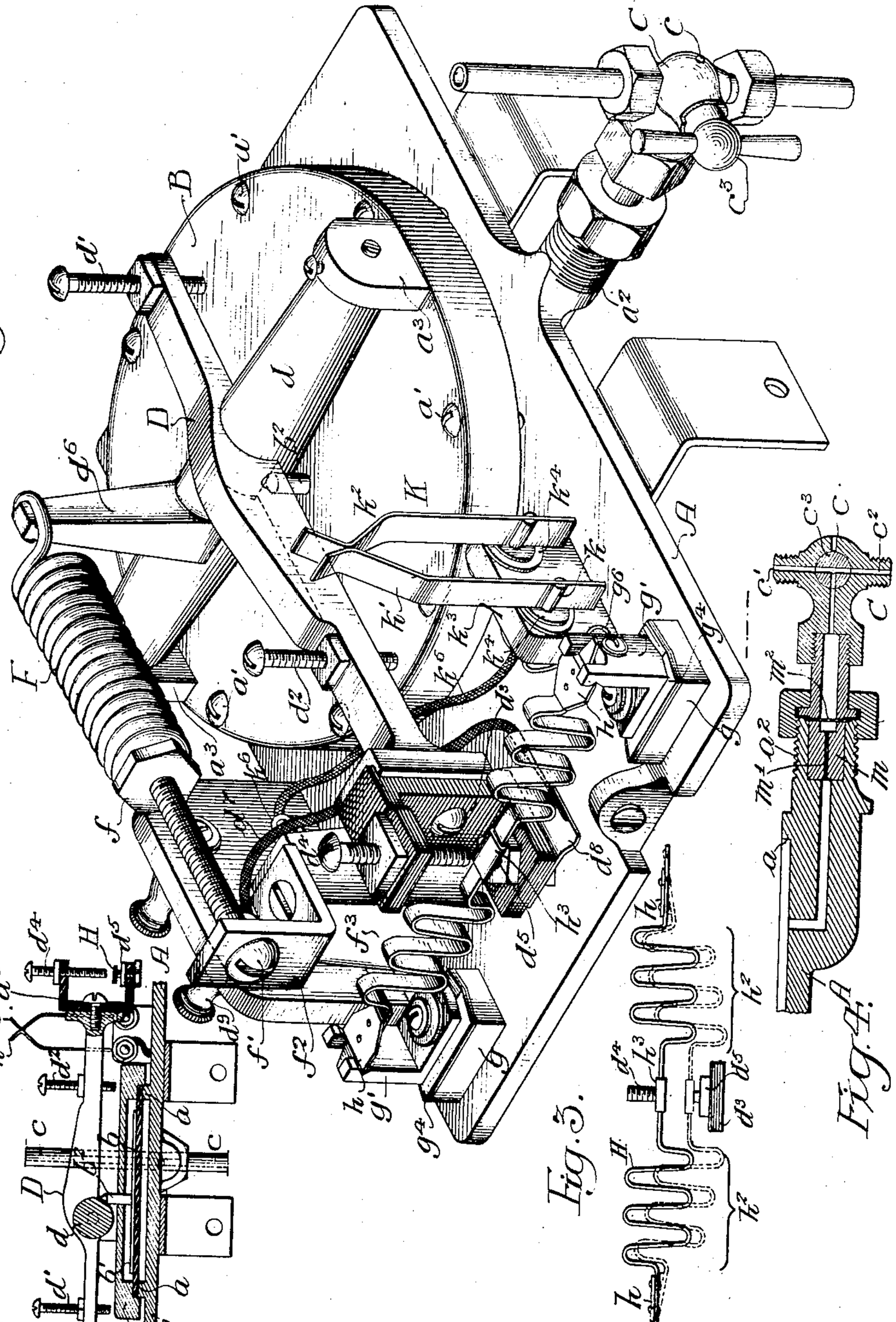

Fig. 2.

Fig. 3.

Fig. 4.

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UNITED STATES PATENT OFFICE.

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AUTOMATIC SWITCH.

No. 920,667. Specification of Letters Patent. Patented May 4, 1909.

Application filed August 29, 1907. Serial No. 390,677.

To all whom it may concern:

Be it known that we, ADOLPH W. SCHRAMM and ALFRED E. OSWALD, citizens of the United States, residing in Riverton, New Jersey, and Philadelphia, Pennsylvania, respectively, have invented certain Improvements in Automatic Switches, of which the following is a specification.

One object of our invention is to provide a fluid controlled device for making and breaking an electric circuit, which shall not only be relatively simple in construction and certain in action, but shall have its parts so arranged as to constitute a quick break switch.

A further object of our invention is to provide a fluid actuated electric switch of such a nature that the limits of fluid pressure between which it works may be readily adjusted both relatively to each other and to the point of zero pressure. It is further desired that the parts of the switch shall be so arranged as to not only be freely accessible but also of such a nature that the likelihood of their getting out of order or requiring repairs shall be reduced to a minimum.

These objects and other advantageous ends we attain as hereinafter set forth, reference being had to the accompanying drawings, in which:

Figure 1, is a perspective view illustrating the preferred arrangement and construction of the apparatus comprising our invention; Fig. 2, is a vertical section illustrating the detail construction of the diaphragm chamber and its associated parts; Fig. 3, is a side elevation of one of the switch members, showing in dotted lines the position occupied when the electric circuit is closed, and Fig. 4, is a vertical section of one side of the switch-supporting structure, showing in detail the connection between the air pipe and the diaphragm chamber.

In the above drawings A represents a base plate or other suitable supporting structure, which in the present instance is provided with an annular flange or rib a, forming with a cylindrical cap or cover B, a diaphragm chamber. This cover is secured to the baseplate by screws a' and has confined between it and the flange a a circular diaphragm b of rubber, rubber fabric or other flexible, airtight material. The base portion has a tubular lug a^2 whose passage communicates with the interior of the diaphragm chamber under the diaphragm b' and which has coupled to it a three way valve C. The valve casing has in it four passages, one communicating with the passage of the lug a^2 and a second passage c in line with the first and opening into the atmosphere. Of the two remaining passages in the valve casing the upper one c' connects to an air pump while the other c^2 leads to an air reservoir. The valve plug c^3 has a T-shaped passage capable of being made to simultaneously connect any three of the passages in the valve casing while shutting off the fourth. While the greater portion of the passage a^2 may be of a relatively larger caliber we preferably place in it a plug m having a relatively reduced passage m' and provide a fine mesh screen m^2 over the entrance to the plug opening to prevent the admission of foreign bodies thereto. By this means we throttle the flow of fluid under pressure to and from the diaphragm chamber and thereby secure greater steadiness of action of the apparatus hereafter described.

A circular plate b' rests upon the upper surface of the diaphragm b and is designed to act upon a lever D through a compression member b^2. This lever is carried by and in the present instance is integral with, a transverse bar d journaled in lugs a^3 carried by the cover B of the diaphragm chamber and extends in both directions from the bar d, having at its rear end a vertically adjustable screw d' and at an equal distance on the opposite side of the bar d a second vertically adjustable screw d^2, by means of which it is possible to vary the arc of oscillation of said lever. The front end of the lever D is extended beyond the edge of the cover B and has fastened to it an E-shaped structure d^3 of insulating material, in the upper part of which is mounted a vertical screw d^4, while opposite said screw and in line therewith is a contact piece d^5, in electrical connection with a metallic plate d^8 forming a terminal.

Extending upwardly from the transverse bar or member d is an arm d^6 and to the upper end of this is connected one end of a spring F which has fixed to its opposite end a nut f. A screw f' enters a threaded opening in this piece f and is in turn held in posi-

tion by an L-shaped piece f^2 mounted upon a supporting bracket or standard f^3 attached to or integral with the main supporting structure A; the various parts being so designed that any desired degree of tension may be placed upon the spring F by properly adjusting the screw f'.

On opposite sides of one end of the base structure A are mounted two blocks g each carrying an angular piece g' preferably forked at its upper end and forming abutments in which are bearings for the reception of horizontal knife edges. A flexible metal ribbon H is, preferably though not necessarily, bent or corrugated, as illustrated in Fig. 3, so as to be capable of varying its overall length under longitudinal compression, and at each end has fastened to it a thin hard piece h forming a knife edge constructed to fit into the bearings formed in the abutments g'. The body of the spring ribbon H projects beyond the knife edges between the forks of said abutments g' so as to prevent sidewise motion of the knife edges in their bearings.

From Fig. 3, it will be seen that there are two sets of corrugations h^2 formed in the spring member H, one set on each side of a straight middle section, which has soldered or otherwise suitably fixed to it a platinum or silver contact piece h^3, the whole being so arranged that when the said spring member H is mounted with its knife edges in their bearings, the contact piece h^3 is intersected by a straight line between the screw d^4 and the contact piece d^5. Plates of insulating material g^4 are interposed between the blocks g and the abutments g'. There is connected to one of the said abutments g' a wire or other conductor g^6 whereby it is placed in electrical connection with the terminal k of the switch K, but inasmuch as this latter switch forms no part of the present invention, it has not been illustrated in full, as it is fully described and claimed in an application for United States Patent No. 389,068, filed August 17, 1907. It may, however, be noted that said switch is of the normally closed type, and has two spring members k' and k^2 so mounted upon a supporting structure k^3 carried by the base plate A, as to always tend to engage each other. They are insulated from said structure and from each other by insulating bushings k^4 and are designed to be separated under predetermined conditions, by a piece of insulating material not shown. From the terminal of the member k^2 of this switch a connection k^5 leads to a binding post mounted upon but insulated from a terminal plate carried by the base plate A, the rear end of this binding post being shown in Fig. 1, at k^6. The metallic plate d^8 is connected to the lower contact piece d^5 carried by the lever D and is in turn connected through a wire or small cable d^7 with a second binding post d^9 also mounted on the terminal plate which carries the binding post k^6.

It may be noted that the corrugated spring member H, forming one of the movable members of our improved switch, is so designed that when its knife edges are mounted so as to support it between the two abutments g', it is as a whole in a condition of compression and assumes the general bowed position indicated in dotted lines in Fig. 3, with its contact piece h^3 some distance below a straight line joining the two knife edge bearings. In addition, the various parts of the device associated with the lever D are so adjusted that when there is no fluid pressure exerted against the diaphragm b, the spring F causes the contact h^3 of the spring member H to rest against and be in electrical connection with the contact d^5 carried by said lever D. As a consequence there is a closed electrical circuit through the apparatus from the binding post d^9 through the cable d^7, plate d^8, contact d^5, contact piece h^3, through one half of the spring member H to one of the abutments g, wire g^6 to the member k' of switch K, through the member k^2 of said switch and cable k^5 to the second binding post k^6. The spring F being adjusted to exert a certain pull upon the arm d^6, the admission of air or other fluid under pressure through the pipe c and conduit a^2 to the under side of the diaphragm b, will force the latter upwardly so as to turn the cross bar b of the lever D in the bearings a^3, thus in effect turning the lever on its fulcrum. The spring F, however, resists this turning tendency, so that as the pressure increases on the diaphragm, the lever D is gradually moved so as to raise its end with the contact d^5, and since the middle part of the spring member H is engaged by this contact piece d^5, it also is moved upwardly by said lever D until the middle part of the said member with the contact h^3 passes to the upper side of the line joining the knife edge bearings of the pieces g'. When this occurs the corrugations h^2, which have hitherto been under compression as the contact piece h^3 was raised by the contact d^5, are at liberty to expand, and the spring member H, as a whole, suddenly moves to an upwardly bowed position, the curvature being limited by the stop screw d^4. It will be noted that the movement of the contact piece h^3 into this upper position is a sudden one, so that the electrical connection between it and the contact piece d^5 is quickly broken, thereby opening the circuit through the apparatus without causing or permitting any injurious arcing. If now, from any cause, there is a fall in the pressure of the fluid in the diaphragm chamber, the lever D is gradually permitted to turn on its fulcrum so as to move downwardly its long arm with the screw d^4. Such downward movement at first

merely reduces the amount of upward curvature in the spring member H, since the stop screw d^4 presses down the piece h^3 and in so doing compresses the corrugations h^2. As soon, however, as the lever has moved sufficiently to again bring said contact piece h^3 to the lower side of the straight line joining the knife edge bearings, the spring member H will again suddenly assume its downwardly bowed position, which is limited by the engagement of the contact piece h^3 with the contact piece d^5, so that the electrical circuit through the apparatus is thereby again completed.

From the above description it will be noted that if the apparatus be employed in connection with an air compressing plant such as that described and claimed in the application filed by Russell and Schramm, No. 389,068, dated August 17, 1907, the air pressure in the tank may be maintained between any desired limits by reason of the fact that the pump will be started whenever the pressure falls to the predetermined point, and stopped when, upon operation of the pump, the pressure has been caused to rise to another predetermined point. These two points at which the electrical circuit is completed and broken are determined by the adjustment of the two screws d^4 and d^5, for it is obvious that by slacking off or unscrewing the latter of these, a much greater upward movement of the lever D is necessary before the spring member H is caused to break the electrical circuit. Similarly by backing off the screw d^4, the distance through which it is necessary to move the lever downward before the spring member H completes the circuit, may be increased as desired. The actual pressures at which the device operates may be regulated by the adjustment of the screw f', which, as is obvious, varies the amount of tension on the spring F.

Any rapidly varying pressure in the pipe c is prevented from causing vibration of the diaphragm and consequently of the lever D, by the small orifice plug m, which as before noted, serves to throttle the flow of air to and from the diaphragm chamber. It is to be noted that by mounting the lever D upon the cover B we are enabled to expeditiously replace or examine the diaphragm b, for it is obvious that these parts may be removed as one piece and that without disturbing any other part of the mechanism with the exception of the spring F, which is preferably detached from the arm d^6. Again, it will be seen that the corrugated metal ribbon H may be quickly removed from its bearings should it by any means become injured or require adjustment.

By providing the valve C it is possible to greatly extend the field of usefulness of our invention when it is used in connection with an air compressing plant such as that described and claimed in the application of Russell and Schramm above referred to. For example, under ordinary working conditions it would be impossible to use the pump-driving motor, which is ordinarily connected in circuit with the switch above referred to, as long as the air pressure, admitted through the passage c^2 of the valve C to the under side of the diaphragm, is above that at which the switch was designed to close. In other words, the switch being moved to its open position by the rise in air pressure, would remain in such open position until this air pressure had fallen to some predetermined point, so that the motor could not be started and used for any other purpose. By providing the valve C, however, it is possible to cut off the passage c^2 leading to the reservoir and to permit the high pressure air from under the diaphragm to exhaust through the passage c of the valve C. This, by permitting the switch to close, will permit it to complete the circuit of the motor, which may thereafter be employed for any desired purpose independently of the air pump. By again turning the plug c^3 of the valve C into the position shown in Fig. 4, the apparatus as a whole is restored to its normal automatically operative condition.

We claim:

1. A switch consisting of two members of which one has means for maintaining it in one of two bowed positions and the other is capable of moving said first member from one to the other of said positions.

2. A switch consisting of two members of which one consists of a piece of flexible material, and two fixed abutments placed to maintain said flexible member in one of two bowed positions, the second switch member being capable of moving said first member from one to the other of said positions.

3. A switch consisting of two members of which one has means for normally maintaining it in one of two bowed positions, and the other member is capable of moving said first member from one to the other of said positions, with means for actuating said second member.

4. A switch consisting of two members of which one is mounted so as to be movable from one to the other of two positions, and the second member is placed to be operative upon said first member to cause such movement, with an adjustable spring or springs for varying the conditions under which the second member operates the first.

5. A switch consisting of two members of which one is mounted so as to be normally in one of two bowed positions, and the second member is placed to be operative upon said first member to move it from one to the other of said positions, with means for adjusting the amount of bowing of the first member.

6. A switch consisting of a flexible metal

piece, two abutments engaged by the ends of said piece and placed to normally maintain the piece in one of two bowed positions, a second movable member, and means for operating the second member to move the said metallic piece from one bowed position to the other, substantially as described.

7. A switch consisting of a supporting structure, abutments mounted thereon, a corrugated metallic piece mounted between said abutments so as to be maintained in one of two positions, a terminal connected to said metallic piece, and a second switch member for moving said corrugated piece from one position to the other, substantially as described.

8. A switch consisting of a corrugated metal piece provided at its ends with knife edges, a supporting structure having bearings for said knife edges and provided with a terminal electrically connected to said metal piece, with a second switch member having a contact placed to engage said corrugated piece to move the same from one to the other of its two positions, substantially as described.

9. The combination of a supporting structure, a lever mounted thereon, an actuating device and operative on the lever, a spring also operative on the lever so as to oppose said device, a contact piece carried by the lever and forming one member of the switch, with a second switch member consisting of a piece normally maintained in one of two bowed positions and capable of engaging the contact on the lever when in one position, substantially as described.

10. A switch consisting of a lever, means for moving the lever, two stops carried by the lever of which one consists of a contact piece, with a member having means maintaining it in one of two bowed positions, the amount of its displacement being limited by the stops of the lever, substantially as described.

11. A switch consisting of a lever, means for moving the lever, two stops carried by the lever of which one consists of a contact piece forming one of the switch members, with a second switch member having means maintaining it in one of two bowed positions, and constructed so that the amount of its displacement is limited by the stops of the lever, with means for adjusting the throw of the lever, substantially as described.

12. A switch consisting of a lever, means for moving the lever, a spring tending to oppose movement of the lever in one direction, a switch contact carried by the lever, a stop also carried by the lever opposite said contact, with a corrugated piece extending between the contact and the stop of the lever, and an abutment for maintaining said corrugated piece in one of two bowed positions, substantially as described.

13. An electric switch consisting of a supporting structure, two forked abutments thereon each provided with a knife edge bearing, a piece mounted between said abutments and having knife edges operative in said bearings, said piece being of such a length as to be normally maintained in a bowed position and having projections extending between the forks of the abutments, and a second switch member having actuating means and capable of moving said bowed piece from one to the other of its two positions, substantially as described.

14. The combination in a switch of a supporting structure, two abutments mounted thereon and provided with knife edge bearings, a corrugated piece forming one member of the switch and extending between said abutments, said piece being provided with knife edges engaging said bearings, means for preventing transverse movement of the knife edges out of their bearings, with a second switch member operative on said piece and capable of moving it from one to the other of its two positions to open or close the switch, substantially as described.

15. The combination in a switch of a lever, a spring operative on one arm of said lever, a device operative on the lever to move it in opposition to said spring, a body of insulating material carried by the lever, a contact piece mounted on said insulating material, a terminal connected to said contact, a stop also carried by the insulating material opposite said contact, a pair of abutments, a metallic piece mounted between said abutments in a bowed position and extending between the contact and the stop, with a second terminal connected to said piece, substantially as described.

16. The combination of a casing having a diaphragm, a switch operatively connected to the diaphragm, a conduit for connecting the casing with a source of fluid under pressure, with a plug removably mounted within said conduit and having a passage whose bore is reduced sufficiently to materially throttle the flow of fluid into and out of the casing.

17. A switch consisting of two movable members, and means for actuating one of the members to cause movement of the other member, with consequent operation of the switch.

18. The combination of a supporting structure, an oscillatory arm mounted on said structure, and a switch having two members of which one is carried by said arm and the other is capable of being moved by said first member from one to the other of two positions.

19. The combination of a supporting structure, an oscillatory bar mounted thereon, two arms on the bar, a spring operative on

one arm, switch operating means connected to the second arm, and two switch members of which one is carried by the second arm and the other is capable of being moved by the first member from one to the other of two positions.

In testimony whereof, we have signed our names to this specification, in the presence of two subscribing witnesses.

ADOLPH W. SCHRAMM.
ALFRED E. OSWALD.

Witnesses:
WILLIAM E. BRADLEY,
JOS. H. KLEIN.