

Jan. 22, 1929.

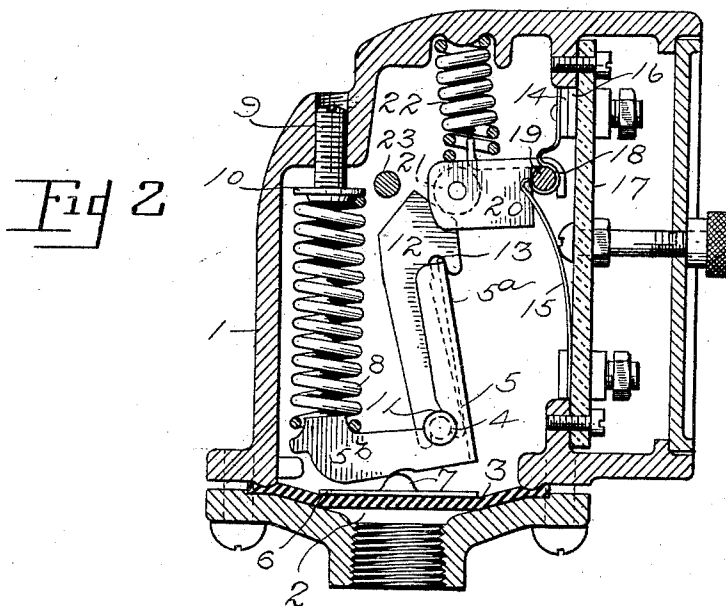
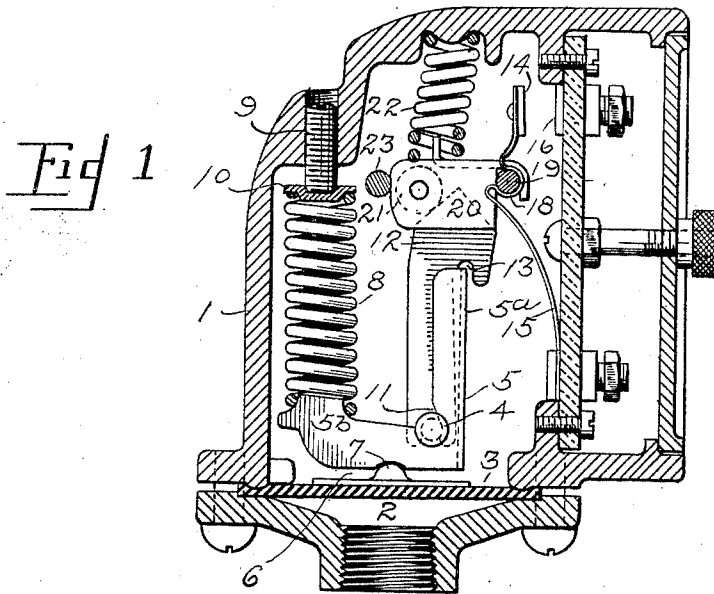
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QUICK ACTING SWITCH

Filed Oct. 19, 1925

2 Sheets-Sheet 1



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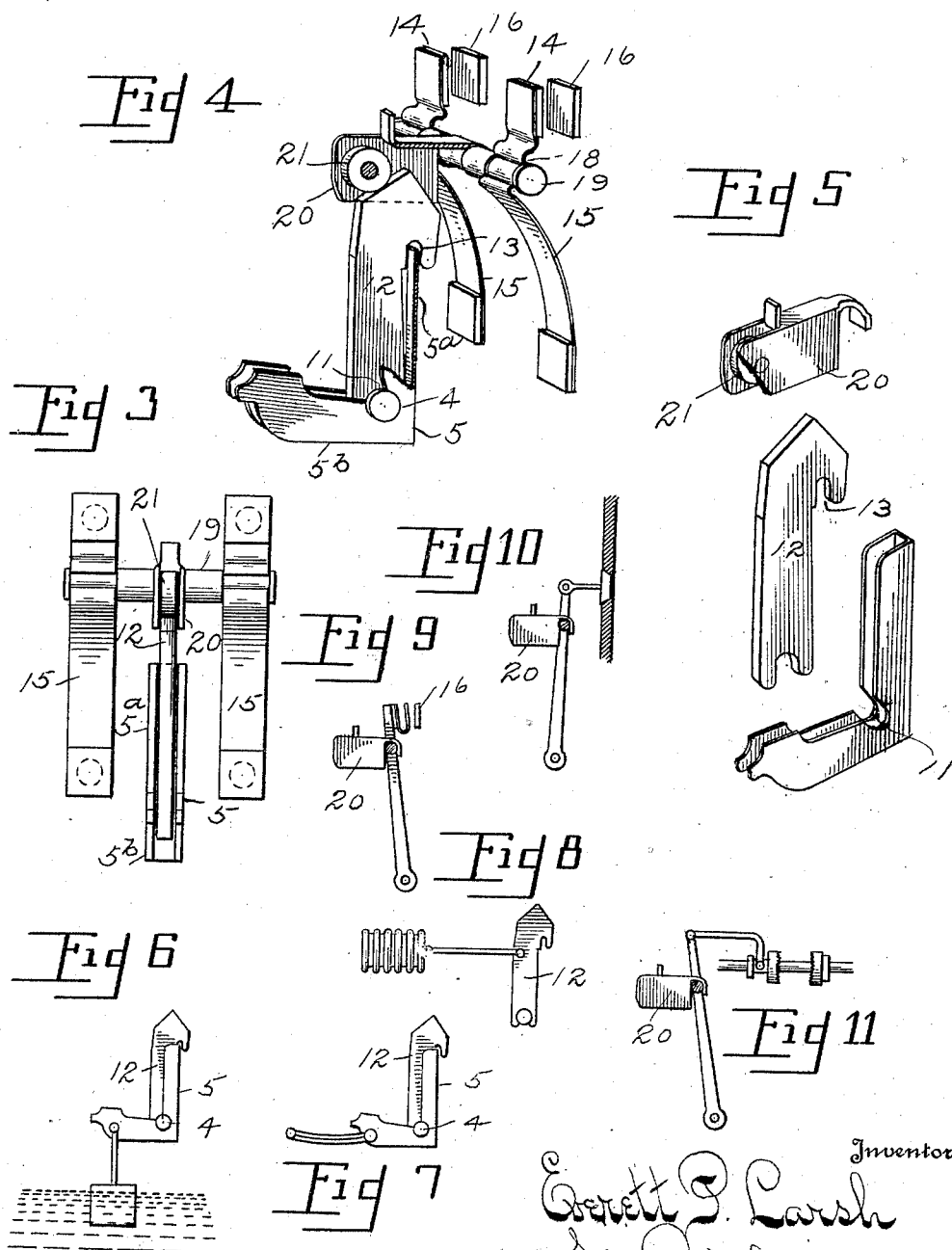
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2 Sheets-Sheet 2



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Patented Jan. 22, 1929.

1,699,792

UNITED STATES PATENT OFFICE.

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QUICK-ACTING SWITCH.

Application filed October 19, 1925. Serial No. 63,393.

My invention relates to electric switches and more particularly to an automatic quick acting cut-out for alternately opening and closing electric circuits under influence of variations of pressure, temperature or intensity of an actuating medium. While invention is herein shown and described more particularly in its application to electric switches, it will be understood that the same actuating mechanism may be utilized for opening and closing a valve, shifting a clutch into or out of operative position, or to perform other analogous operations.

A very usual application of the present type of automatic cut-out is in the control of motor driven pumping systems for water distribution. In such installations, it is customary to store water and air in a suitable tank or reservoir, by means of a motor driven supply pump, discharging under sufficient pressure that the water may be carried through the pipe lines of the distribution system by the influence of air pressure within the tank or reservoir. Control or cut-out devices are utilized in such systems to maintain the pressure within prescribed limits by setting the supply pump in operation when the pressure within the tank and distribution system falls below a predetermined range and to arrest the supply pump when the pressure has been restored, to a predetermined maximum degree. In many instances these control devices have been of a slow acting type, having a tendency to dwell or lag in a partially operated condition. The present construction is designed to not only overcome this objection by providing a construction which will maintain a full or even increased pressure upon the contact until the instant of breakage, whereupon the disconnection or breaking movement will be effected with a quick snap-over action, eliminating any tendency to spark or arc between the contact points.

The object of the invention is to simplify the structure as well as the means and mode of operation of such quick acting cut-out mechanisms, whereby they will not only be cheapened in construction, but will be more efficient in use, positive in operation, uniform in action, automatically controlled, and unlikely to get out of repair.

A further and important object of the invention is to provide such a mechanism having a minimum number of parts so shaped

and designed that they may be economically manufactured by stamping or punch press operations and so arranged as to facilitate assembly. Simplicity of construction and economy of manufacture are of prime importance.

With the above primary and other incidental objects in view, as will more fully appear in the specification, the invention consists of the features of construction, the parts and combinations thereof, and the mode of operation or their equivalents as hereinafter described and set forth in the claims.

Referring to the accompanying drawings, wherein is shown the preferred, although obviously not necessarily the only form of embodiment of the invention, Fig. 1 is a side elevation of the assembled mechanism, showing the switch in its open or retracted position. Fig. 2 is a similar view illustrating the relative relation of the parts upon reversal of the movement, the switch being shown in its operated or closed position. Fig. 3 is a detail elevation of the operating members, viewed at right angles from the left in Figs. 1 and 2. Fig. 4 is a detail perspective view of the actuating parts in their assembled relation. Fig. 5 is a detail perspective view of the several operating parts disassembled. Figs. 6, 7 and 8 illustrate different modes of operation, to wit: float actuated, thermostatic operated and by use of a "siphon" or expansion chamber, respectively. Fig. 9 illustrates the use of rigid contact carrying arms in lieu of the spring arms of the primary construction. Figs. 10 and 11 illustrate the application of the apparatus to the operation of a valve and a clutch respectively.

Like parts are indicated by similar characters of reference throughout the several views.

The operating mechanism of the present cut-out is enclosed within a housing or case 1, in the base of which, there is provided an expansible chamber 2, formed by the transverse diaphragm 3, the margin of which is clamped between the housing 1, and base thereof. Pivotally mounted upon a transverse shaft or stud 4 carried by the housing 1 is a right angle or bell crank lever 5, the upstanding arm 5^a of which is longitudinally grooved or channel shaped on its inner margin. The lateral arm 5^b of this rock lever, rests upon the diaphragm 3, which is

provided with a bearing plate 6, provided with a central boss 7, engaged by the arm of the rock lever. The arm 5^b of the rock lever is thus subjected to upward pressure of the diaphragm, and is also subject to yielding resistance of a helical spring 8, bearing upon the outer end of the lever in opposition to the influence of the diaphragm. The tension or resistance of the spring 8 may be regulated by a screw stud 9, engaged in the upper portion of the housing 1, and bearing upon a disc or head 10, against which the upper end of the spring reacts. For convenience of assembly the bell crank lever 5 is provided with a notch 11, at its inner angle for engagement upon the trunnion stud or shaft 4. Pivoted upon the same trunnion stud 4 and positioned within the channel of the upstanding arm 5^a of the bell crank lever, is a cam arm 12, having oppositely inclined or divergent cam faces at its upper end. The cam arm 12 is provided with a notch or recess 13, into which the upper end of the arm 5^a of the bell crank lever extends. This notch 13 is of sufficient dimension to permit a limited play or relative movement of the cam arm and bell crank lever relative one to the other, but beyond which limited range of movement, the cam arm and bell crank lever move in unison in either direction.

The movable switch contacts 14 are carried upon spring arms 15, which are flexed to and fro to carry the contacts into and out of electrical engagement with stationary contacts 16, mounted upon a wall or plate 17 of fiber or other insulating material, secured within the housing 1. The spring arms 15 are formed at mid-length point with bights 18, in which is engaged a transverse tie-rod 19. This tie-rod 19 is preferably provided adjacent its ends with shallow grooves, within which the bights of the respective springs 15 are contracted, to locate the springs upon the tie rod and secure them in relation therewith. Engaged upon the tie rod 19 intermediate the spring arms 15 is a plunger member 20, capable of to and fro movement in unison with the flexing of the spring arms 15, necessary to make and break the electrical contact between the contact heads 14 and 16, and also capable of oscillatory or rocking movement about the tie rod 19. The plunger 20 carries a roller 21, which is engageable first with one inclined side and then with the other of the upper end of the cam bar 12. The plunger member 20 is depressed and the roller 21 held in contact with the engaged inclined face of the cam bar and is forced downward thereon by the pressure of the helical spring 22, bearing at its lower end upon the plunger member 20 and reacting at its upper end against the interior of the top of the housing 1. The camming action of the inclined face

of the cam bar 12 as the roller 20 is forced downwardly thereon under influence of the spring 22 tends to move the plunger 20 to and fro to open or close the switch contact. In the opening movement or retraction of the plunger 20 as shown in Fig. 1, its movement is limited by the stop stud 23, projecting from the housing 1. In its opposite or closing movement, as illustrated in Fig. 2, the movement of the plunger is limited only by the contact pressure of the switch contact heads 14 and 16. The differential mechanism is actuated by variations of pressure within the diaphragm chamber 2, which is connected with any suitable body of fluid under fluctuating pressure. This diaphragm chamber 2 may be connected with the storage reservoir of a water distribution system, or it may be in communication with a body of expansible and contractible fluid subject to variations of temperature as for instance, in a refrigerator, whereby the switch will be operated to stop and start the refrigerating apparatus. In lieu of such pressure variations, the apparatus may be actuated by a rise and fall of a float, or by the tension of a thermostatic bar or the like.

Assuming the parts to be in the position shown in Fig. 2, any upward pressure upon the arm 5^b of the bell crank lever 5 tends to oscillate the bell crank lever toward the right against the yielding resistance of the spring 8. The upper end of the arm 5^a of the rock lever being engaged in the notch 13 of the cam arm 12, carries with it the cam arm, the inclined upper end of which bears against the roller 21 of the plunger 20. This camming pressure of the inclined head of the arm 12, upon the roller 21, not only tends to move the plunger 20 toward the right and thereby increase the contact pressure between the switch contacts 14 and 16, but it exerts an upward or rocking influence upon the plunger 20, against the yielding resistance of the spring 22. It will be noted that the downward pressure of the spring 22 is in a somewhat inclined direction, in which it adds its influence to that of the cam in holding the switch elements in engaged relation. The contact elements are thus held in tight engagement with gradually increasing pressure until in the movement of the rock lever and cam arm, the roller 21 reaches the apex of the oppositely inclined head of the arm. To prevent any dwell or lag of the parts at this stage, and to afford a quick snap-over action, by which the contact is definitely broken without hesitation, the cam arm 12 is permitted a slight movement independent of the rocker arm, within the limits afforded by the clearance of the notch 14. The apex of the cam arm is thus passed entirely past the roller 21, and the roller 21 is forced down the opposite incline of the head of the cam arm, by the reaction of the spring 22, which

has been placed under increased tension by movement of the rocker lever and cam arm, whereas during the initial movement of the parts, the resistance of the spring 22, augmented that of the spring 8 in resisting the fluid pressure beneath the diaphragm, the moment the roller 21 passes the apex of the cam arm, this balance of power is reversed and the stored energy of the spring 22 supplements that of the diaphragm pressure in overcoming the resistance of the main spring 8, and completing the retractive movement of the plunger 20 and the spring switch arms 15. The parts at their final movement assume the position shown in Fig. 1. Upon decrease of pressure beneath the diaphragm, the expansive influence of the spring 8 is exerted to rock the bell crank lever 5 in the opposite direction against the yielding resistance of the spring 22, which is compressed by the camming action of the inclined head of the cam arm 12 upon the roller 21, as the roller and plunger 20 are elevated until the apex of the cam head passes beneath the roller. Thereupon the cam arm is again permitted a slight independent movement sufficient to obviate any tendency to lag and presents the opposite inclined face of the cam head to the roller. In its movement to and fro, the plunger 20 passes a dead center relation relative to the spring 22, so that the spring 22 exerts its influence diagonally, first in one direction and then in the other, to hold the switch contact open or closed. In this manner, the cam action and spring tension are complementary of each other, and operate in unison to effect instantaneous engagement and disengagement and to hold the parts securely in their operated positions. While the several operating parts may be produced by any suitable method as for instance by casting, for economy of manufacture, they are preferably formed by sheet metal stamping as illustrated in the drawings. Likewise, for economy of manufacture, the movable arms 15, are made spring arms, and are included in the electrical circuit to be opened and closed, it will be obvious that these arms may be made rigid and pivoted at their lower extremity, and be made to carry either yielding contact heads, a valve or a clutch operating means as shown in the several detail views, Figs. 9, 10 and 11. Likewise, there has been shown in Figs. 6 and 7, means for operating the bell crank lever by the rise and fall of a float or by the distortion of a thermostatic bar, in lieu of the fluctuations of the diaphragm 3.

From the above description it will be apparent that there is thus provided a device of the character described possessing the particular features of advantage before enumerated as desirable, but which obviously is susceptible of modification in its form, proportions, detail construction and arrange-

ment of parts without departing from the principle involved or sacrificing any of its advantages.

While in order to comply with the statute the invention has been described in language more or less specific as to structural features, it is to be understood that the invention is not limited to the specific details shown, but that the means and construction herein disclosed comprises the preferred form of several modes of putting the invention into effect and the invention is, therefore, claimed in any of its forms or modifications within the legitimate and valid scope of the appended claims.

Having thus described my invention, I claim:

1. In a device of the character described, a pressure operated prime mover, a cam member carried thereby having converging cam faces and capable of limited to and fro movement independent of the movement of the prime mover, an alternator member riding upon the cam member, a spring inclined to the path of travel of said alternator in different directions when the alternator is at opposite limits of its stroke and further pressing an alternator member into engagement with first one, and then the other of said converging faces of the cam member, said converging faces being alternately presented in engagement with an alternator member by the movement of the prime mover, the independent movement of the cam member serving to shift said member past dead center position, a member to be moved to alternate positions connected with said alternator member and pressure means controlling the movement of the prime mover.
2. In a device of the character described, a member to be moved to alternate positions, a pressure actuated main operating lever, a cam lever pivoted concentric with the main lever, a loose coupling between the main lever and the cam lever by which said levers are caused to move in unison in either direction throughout the major portions of their strokes, but permitting a limited independent movement of said levers relative to each other, a reciprocatory actuating member spring pressed into engagement with the cam lever and operatively connected with the member to be moved, the convergent cam faces of the cam lever being alternately presented in operative engagement with the actuating member by the to and fro movement of the main lever and cam lever.
3. In a device of the character described, a member to be moved to alternate positions, a pressure operated prime mover, a cam member carried thereby having convergent cam faces, said prime mover and cam member being movable to and fro in unison throughout the major range of their strokes

but capable of limited independent movement relative to each other, an alternating actuating member for the member to be moved, a spring pressing said alternating member into operative engagement with one of the converging cam faces of said cam member said alternating actuating member being movable to and fro past dead center relation with said spring whereby said spring is caused to act first in one direction and then in the other upon said alternating member, said cam faces being alternately presented in operative relation with the actuating member by the to and fro movement of the cam member to effect alternating shifting of the actuating member and with it the member to be moved.

4. In a device of the character described, the combination with a member to be moved to alternate positions, of an alternating actuating member therefor, a double faced cam over which the actuating member rides in its alternating movement, a spring for effecting operative engagement of said alternating member with first one face and then the other of said cam said alternating member being movable to and fro past dead center relation with said spring whereby the spring tends to hold said alternating member at either limit of its stroke and pressure operated means for relatively adjusting the cam and alternating member to effect reversal of the member.

5. In a device of the character described, a member to be moved to alternate positions, an actuating member therefor, a cam member having converging faces alternately in engagement with the actuating member, a spring tending to move the actuating member along the engaged face of the cam the actuating member being movable to and fro past dead center relation with said spring, and means for shifting the cam member to present the converging faces thereof alternately in engagement with the actuating member whereby the actuating member will be moved alternately in reverse directions under influence of the spring the dead center position of said cam member and said spring being passed substantially simultaneously by said actuating member.

6. In a device of the character described,

a member to be moved to alternate positions, a bell crank lever, one arm of which is channeled, a cam lever concentrically pivoted with the bell crank lever and seating within the channeled arm of the bell crank lever, means for limiting the relative oscillation of the cam lever and the bell crank lever beyond the range of which independent movement said levers move in unison, an actuating member for the member to be moved having operative engagement with the cam lever, in different positions of adjustment of the latter to effect shifting movement of the actuating member in different directions, and means for oscillating the bell crank lever in alternate directions.

7. In a device of the character described, a member to be moved to alternate positions, a main operating lever, a cam lever pivoted concentrically with the main operating lever, means for limiting the relative oscillation of the main lever and the cam lever beyond the range of which independent movement, the levers move in unison, an actuating member for the member to be moved having operative engagement with the cam lever in different positions of adjustment of the latter, to effect shifting movement of the actuating member in different directions, and means for oscillating the main operating lever.

8. In a device of the character described, a member to be moved to alternate positions, a main operating lever, a cam lever pivoted concentrically with the main operating lever, and having therein a recess and an extension upon the main lever projecting into said recess which is of sufficient extent to permit a limited degree of lost motion therein, beyond the range of which lost motion the levers move in unison, an actuating member for the member to be moved having operative engagement with the cam lever in different positions of adjustment of the latter, to effect shifting movement of the actuating member in different directions, and means for oscillating the main lever.

In testimony whereof, I have hereunto set my hand this 28th day of September A. D. 1925.

EVERETT P. LARSH.