July 14, 1942. H. A. SCHLOSSER 2,289,463

CIRCUIT MAKER AND BREAKER

Filed March 31, 1941

Fig. 1.

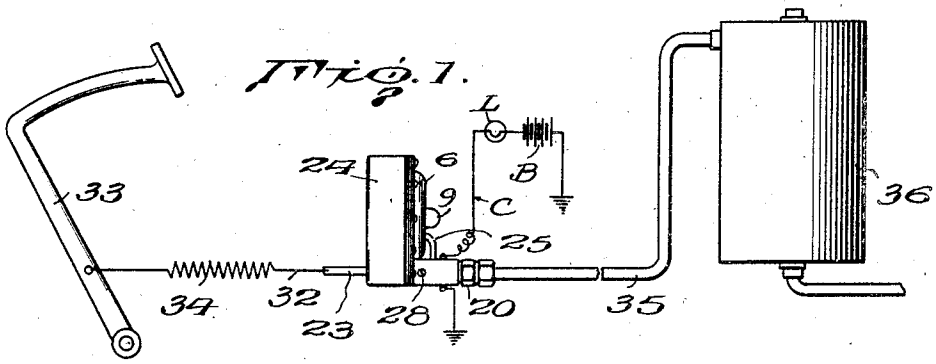


Fig. 2.

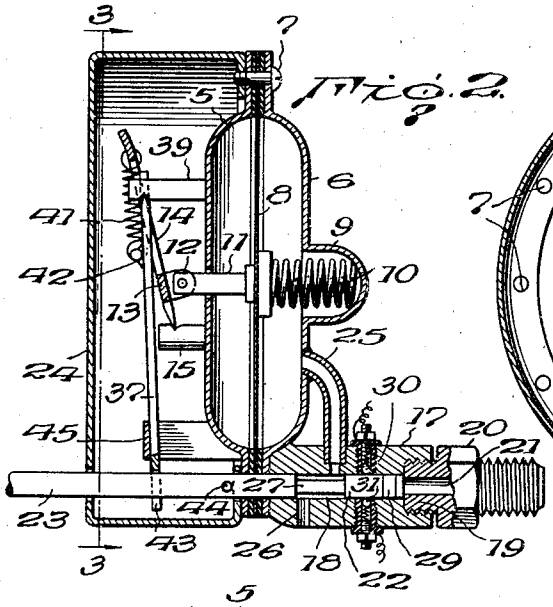


Fig. 3.

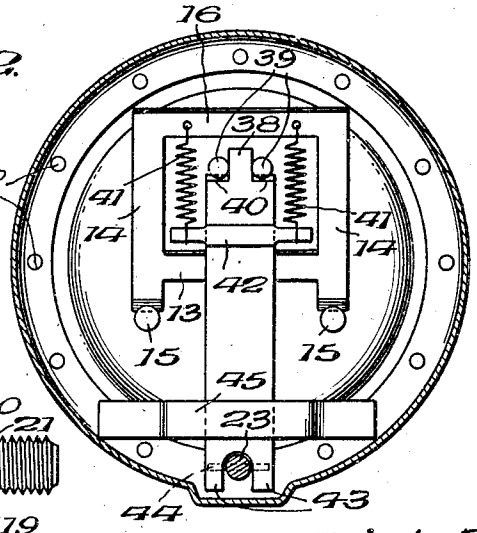
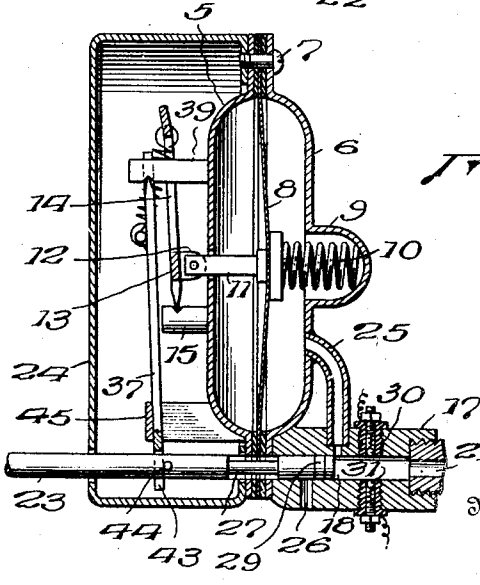


Fig. 4.



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CIRCUIT MAKER AND BREAKER

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Application March 31, 1941, Serial No. 386,162

4 Claims. (Cl. 200—83)

This invention relates to circuit makers and breakers, and the present application is a continuation-in-part of my prior application, Serial No. 259,671, filed March 3, 1939, entitled Automatic direction switch, now matured into Patent No. 2,241,164, of May 6, 1941.

In the art of electric signaling there are many circuit systems which have associated means for effecting intermittent opening and closing of a circuit as a function thereof. The present invention has particular utility in this field, but is applicable to any system requiring the intermittent make and break of an electrical circuit.

An object of the invention is to provide a circuit maker and breaker of the fluid pressure type, having self-contained means for effecting sustained automatic operation thereof to cause intermittent opening and closing in rapid succession of an electrical circuit with which it is associated.

Another object is to provide, in a fluid pressure circuit maker and breaker, control means biased to inoperative position and movable therefrom by manual operation, and actuator mechanism that is set in automatic operation by initial manual movement of the control means.

Still another object is to provide, in a circuit maker and breaker, switch means manually operative from an initial position to establish pressure differences at opposite sides of a fluid pressure responsive member movable in accordance with such pressure differences to effect automatic, sustained, intermittent movement of the switch means to and from the initial position.

Related objects include the provision of a novel quick acting actuator means in operative association with the fluid pressure responsive element of a fluid pressure circuit maker and breaker, and a novel structural arrangement of control valve and circuit switch. In the drawing:

Figure 1 is a schematic representation of a practical embodiment of the invention.

Figure 2 is substantially a central vertical sectional view through the circuit maker and breaker shown in elevation in Figure 1.

Figure 3 is a section taken on the line 3—3 of Figure 2.

Figure 4 is a section similar to Figure 2, but showing a different position of certain of the parts, assumed in operation.

In detail, the invention comprises a chamber enclosed by two half-sections of casing 5 and 6 having mating edge flanges connecting by securing elements 7, with a flexible diaphragm 8 clamped therebetween and dividing the chamber into two non-communicating portions. One casing section is provided with a central socket 9 that seats spring means 10 which bears against the diaphragm under a compression urging it in the direction of the opposite section.

A draw bar 11 is secured at its inner end to the diaphragm center and extends laterally therefrom on the side opposite that against which the spring bears. The bar projects through the adjacent casing wall, which is apertured to permit its free movement therethrough, and at its outer end is pivotally connected to an ear stud 12 on a strut 13 that extends transversely between and connects a pair of parallel throw levers 14. The lower ends of the levers have a knife-edge fulcrum bearing in rigid support members 15 carried by and projecting from the adjacent casing section, and at their upper ends the levers are connected by a transverse top bar 16. Preferably, but not necessarily, the levers 14, strut 13, and top bar 16 are of integral construction and occupy a common plane. The assembly of levers, strut, and top bar constitutes, in effect, a unitary throw member which is a lever pivoted at its lower end to a fixed part of the casing assembly, and which is capable of oscillation in a vertical plane under propulsion by the draw bar.

That portion of the diaphragm chamber through which the draw bar 11 operates is at all times open to the atmosphere through the draw bar aperture in the casing wall, so that fluid pressure therein is constant. The chamber at the other side of the diaphragm is, however, subjected to pressure that is variable in accordance with operating movement of valve means under both automatic actuation and remote manual control.

The valve means includes a casting 17 rigidly attached to the casing assembly and extending laterally therefrom centrally of its bottom edge to provide a tubular valve casing having an axial, cylindrical bore 18 entirely therethrough. At one end the valve casing abuts the edge flange of the variable pressure chamber, and at its other end is formed with an internally threaded socket to receive the threaded nipple 19 of a pipe coupling 20. The bore 21 of the pipe coupling is reduced relative to the valve casing bore 18, with which it is axially aligned, whereby the end of the nipple constitutes a seat for a cylindrical valve plug 22 on the inner end of a stem 23. The valve and its stem is slidably reciprocable in the bore 18, with the stem being passed through apertures in the casing section edge flanges and wall structure of a protective housing secured to the casing, indicated by the numeral 24. In the normal inoperative position of the apparatus parts the inner end of the valve plug 22 seats firmly against the end of the nipple 19 and closes off communication between the bores 18 and 21, while the variable pressure chamber is in open communication with the atmosphere through a conduit 25 which establishes communication between the chamber interior through the casing section 6 to the bore

18 of the valve casing and a lateral port 26 leading therefrom to the exterior of the valve casing.

The points at which the conduit 25 and port 26 communicate with the bore 18 are spaced apart axially of the bore a distance sufficient so that when the valve 22 is at its extreme open position, shown in Figure 4, the port 26 will be fully closed and the pipe bore 21 will be in unobstructed communication with the conduit 25 from the variable pressure chamber. When the valve is fully closed, as shown in Figure 3, a diametrically reduced portion 27 of the valve stem registers with the conduit 25 and port 26 for communication therebetween, while the conduit is cut off from any communication with the pipe bore 21. Preferably, the port 26 is controlled by a needle valve 28.

The body of the valve plug 22 is of insulating material except for an annular band 29 of electro-conductive material disposed around its periphery intermediate the ends, preferably adjacent the inner end of the valve. The band 29 provides a valve carried means for electrically bridging a pair of diametrically opposed ball and spring contacts 30 and 31 mounted in the usual manner in bushings of insulating material disposed through the body of the valve casing. The contacts are part of an electrical circuit C, indicated generally as also including translating means L and a current source B.

The organization shown in Figure 1 illustrates a practical application of the invention in which B is the battery of an automobile, L is a stop light, and the valve stem 23 has a cable connection 32 with a brake pedal 33; a spring connector 34 being interposed in the cable. The pipe coupling 20 connects with a tubing line 35 to a vacuum tank 36 in which suction is maintained by operation of the motor, not shown. Figures 1 and 3 show the initial, inoperative position of the parts, with the valve 22 closed and retained against its seat by suction in the line 35 and pipe coupling bore 21.

When the pedal 33 is advanced to brake applying position a pull is exerted on the cable 32 to shift the valve stem and move the valve 22 from its seat to fully open position as shown in Figure 4, uncovering the mouth of the conduit 25 and subjecting the variable pressure chamber to suction by reason of vacuum in the tank 36 and line 35. As the valve moves to open position, the bridging member 29 is brought into registry with the contacts 30 and 31 to close the circuit C and light the lamp L.

Immediately upon the setting up of a vacuum behind the diaphragm 8, a sudden pull is exerted on the draw bar 11 by the corresponding flexing of the diaphragm into the casing section 6, and the spring 10 is compressed. The movement of the draw bar correspondingly rocks the throw levers 14 into the position shown in Figure 4. Movement of the throw lever means brings into play a snap action lever 37 which operates to return the valve 22 to initial closed position and break the circuit, as will be described.

The lever 37 constitutes a valve actuator, and comprises a flat bar having at its upper end a guide finger 38 that plays between the outer ends of a pair of parallel supports 39 rigidly secured to the casing section 5 and extending laterally therefrom. The upper end of the bar is further provided with knife edge shoulders 40 which pivot in fulcrum sockets in the under faces of the supports 39, and the shoulders are retained in their sockets by the positive upward pull exerted by a pair of contraction springs 41 connected at their upper ends to the throw lever top bar 16 and at their lower ends to the laterally projecting ends of a cross bar 42 rigidly secured to the lever 37. At its lower end the actuator lever 37 is bifurcated to straddle the valve stem 23 with sufficient clearance to permit free swing of the lever over and along the valve stem and to provide arm portions 43 adapted to engage a cross pin abutment 44 carried by the valve stem. The lever 37 oscillates in a vertical plane; its extent of outward swing being limited by a stirrup member 45 attached to the casing assembly, and its inward swing being limited by the throw lever strut 13.

It will be noted that the pivot of the actuator lever 37 is above the pivot point of the throw lever 14 and laterally offset relative thereto outwardly from the casing; also, that motive power is applied to the lever 37 from the springs 41 at a point above the fulcrum of the throw lever. In the rocking of the throw lever assembly, its top bar 16 passes above the fulcrum of the actuator lever in the supports 39, so that, as it passes dead center, the pull of the springs rocks the actuator lever 37 with a quick snap action.

In operation, when the valve 22 moves to open position its stem abutment 44 moves correspondingly until it engages the inner face of the lower end portion of the actuator lever 37 which, being held by the stirrup 45 arrests further movement of the valve. During opening travel of the valve the circuit will have been first closed and then opened across the contacts 30 and 31. When the valve reaches fully open position to establish a vacuum behind the diaphragm as explained, the pull of the draw bar 11 rocks the throw lever assembly which, in turn, rocks the actuator lever 37 with a quick snap action that kicks the valve stem abutment 44 inwardly and thus returns the valve to initial closed position; during which movement the circuit will once again have been made and broken. The force exerted by the actuator lever is sufficient to overcome the tension of the spring connector 34 in the brake pedal cable, but when the lever comes to rest the pull of the spring, as it contracts, pulls the valve back again to open position, which again opens and closes the circuit. It will be understood that the tension of the spring 34 is sufficient to overcome the force of suction in the line 35 tending to hold the valve 22 closed against its seat, but is insufficient to resist the pull on the valve stem exerted by the actuator lever 37 in returning the valve to closed position.

As soon as the valve returns to initial closed position, the exhausted variable pressure chamber is opened to the atmosphere through the conduit 25 and port 26, so that pressure at both sides of the diaphragm becomes equal. The equalization of pressure permits expansion of the spring 10 to push the draw bar outwardly, whereupon the throw lever assembly is rocked to snap the actuator lever 37 back against the stirrup 45 in its initial position, freeing it from the valve stem abutment 44. The valve immediately starts to open, under pull of the spring 34, and in moving to open position it again makes and breaks the circuit. When the valve reaches open position vacuum is again established in the variable pressure chamber, whereupon the valve is again kicked back to closed position by operation of the actuator lever 37 as described, and the circuit is again opened and closed. This operation

of the valve continues rapidly and automatically so long as the brake pedal 33 is held in brake applying position, and the stop light L is thus caused to flash on and off by the continuous making and breaking of the circuit. This condition endures until the brake pedal is released, whereupon the parts reassume their initial positions, with the valve 22 closed and the circuit broken. The valve is normally retained in closed position against its seat by the urge of suction acting in the line 35 to bias the valve closed position.

It is to be understood that, within the scope of the invention as claimed, the structural details and arrangement of parts herein disclosed may be varied as desired. The illustrated pedal 33 is representative of any means manually operative to accomplish work; the diaphragm is representative of any fluid pressure responsive means; the valve 22, chamber assembly, vacuum line and tank may be any means for establishing fluid pressure differences to effect movement of the pressure responsive means; the circuit contacts 30 and 31 and bridging contact 29 may be any switch operatively associated with the valve means to open and close an electrical circuit; the throw lever assembly and actuator lever 37 represents any mechanism operated by movement of the pressure responsive means to effect automatic operation of the valve and switch; and the cable 32 with spring 34 is a remote control connection between the member 33 and the means for establishing fluid pressure differences.

I claim:

1. Electrical circuit control means comprising a member movable in response to difference in fluid pressure at opposite sides thereof, means biased to a normal position establishing a pressure balance at opposite sides of the member and being movable to a limit position establishing a pressure difference between opposite sides of the member whereby to cause movement of the member, a circuit switch connected with said means to open and close as said means is moved, a manual control member movable to work position, an operating connection between said control member and the pressure establishing means for moving said means to its limit position on movement of the control member to work position, said operating connection including a resilient member, mechanism connected to and operative by movement of the pressure responsive member to engage and restore said pressure establishing means to its normal position against tension imposed by said resilient member, and means operative upon balancing of pressure on the pressure responsive member to release said mechanism to permit said resilient member to again move the pressure establishing means to its limit position.

2. A circuit maker and breaker comprising a diaphragm flexible in accordance with variations in fluid pressure on opposite sides thereof, a casing enclosing said diaphragm to form non-communicating chambers on opposite sides thereof, one chamber being open to the atmosphere, a conduit leading from the other chamber, a valve controlling said conduit and being shiftable to one position opening said conduit to the atmosphere and to another position closing said conduit to the atmosphere and placing said conduit in communication with a source of fluid pressure other than atmospheric thereby permitting the establishment in its chamber of a pressure other than atmospheric whereby to flex said diaphragm, said valve having an operating stem, an actuator lever fulcrumed on the casing structure to oscillate longitudinally of the valve stem, an operating member secured to said diaphragm for movement therewith as it flexes, quick throw means connecting said operating member and lever for oscillation of the lever on movement of the operating member, and cooperative means on said lever and valve stem engageable to shift the valve stem in one direction during oscillation of the lever, said valve having an electro-conductive portion, and normally separated circuit contacts adapted to be bridged by said conductive portion during movement of the valve.

3. Electrical circuit control means comprising a source of fluid pressure, a fluid pressure operated device, valve means controlling communication between said source of fluid pressure and said pressure operated device, a control member manually movable to operative and inoperative positions, a mechanical connection including a spring member between said control member and said valve means adapted, upon movement of said control member to operative position to open said valve means to actuate said pressure operated device, a linkage between said pressure operated device and said valve means operative, upon actuation of said pressure operated device, to return said valve to closed position against the opposition of said spring member and to relieve the pressure from said pressure operated device whereupon said spring member causes reopening of said valve means and the opening and closing of said valve means continues so long as said control member remains in operative position, said valve means including an electrical circuit control operative to make and break an electrical upon each opening and closing of said valve means.

4. Electrical circuit control means comprising a casing, a flexible diaphragm dividing the interior thereof into two non-communicating chambers, a valve casing on the diaphragm casing and having an axial bore in communication with a fluid pressure line, a valve slidable in said bore to open and close the fluid pressure line, a conduit establishing communication between a chamber at one side of the diaphragm and the valve casing bore, said valve casing having a port opening from its bore to the atmosphere, said valve when in open position placing the conduit in communication with the fluid pressure line through the bore and when in closed position placing the conduit in communication with said port through the bore, a stem for operating said valve and projecting beyond an end of the valve casing, a support on the diaphragm casing, an actuator lever pivoted at one end on said support, the other end of said lever having a portion loosely straddling the valve stem, an abutment on the stem engageable by said lever portion to move the valve and stem with the lever as it moves in one direction, a draw bar secured to the diaphragm, a snap throw lever pivoted at one end on the casing, said draw bar having pivotal connection with the snap lever intermediate its ends, and spring means connecting the free end portion of the snap lever with an intermediate portion of the actuator lever, said valve including means for making and breaking a circuit as the valve is moved.

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