Jan. 13, 1959 F. L. GLEASON 2,868,914

SNAP-ACTION ELECTRIC SWITCH

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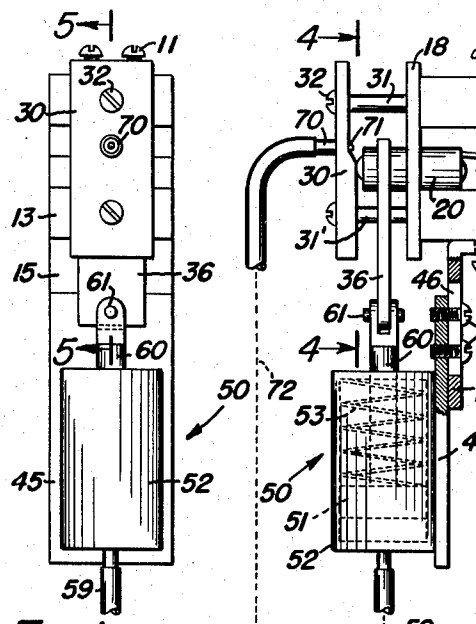


FIG. 1.

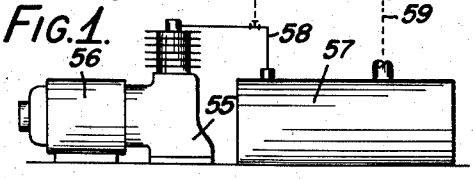


FIG. 2.

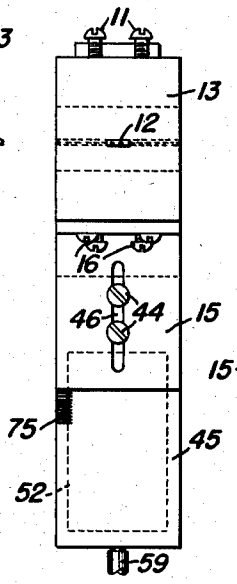


FIG. 3.

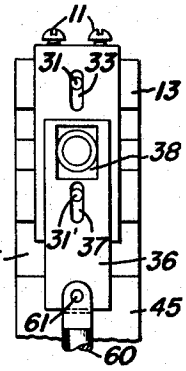


FIG. 4.

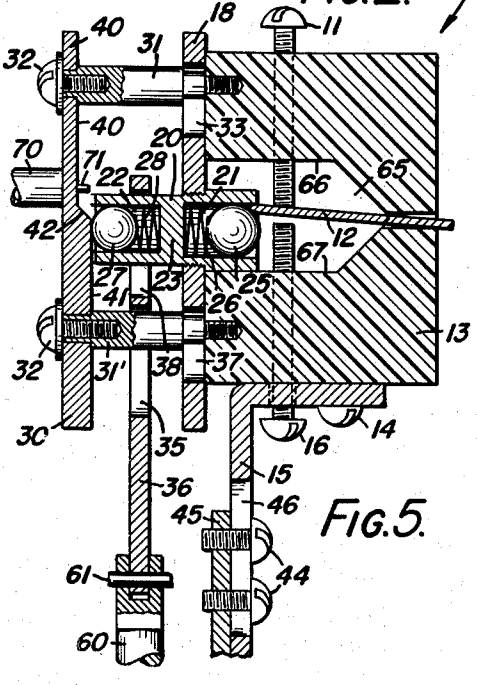


FIG. 5.

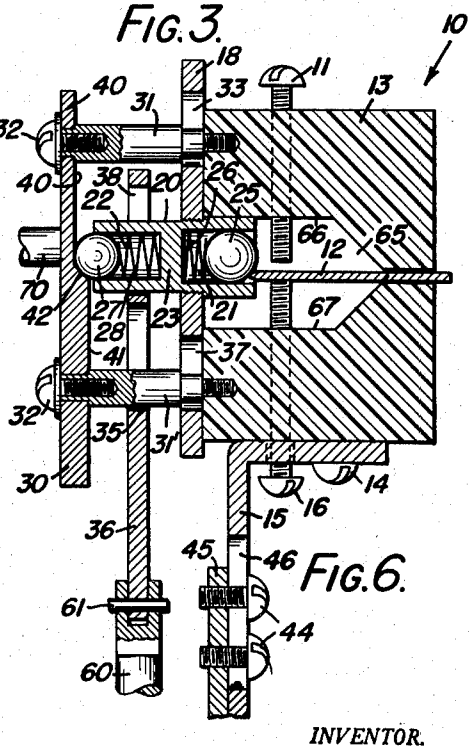


FIG. 6.

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SNAP-ACTION ELECTRIC SWITCH

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4 Claims. (Cl. 200—68)

The present invention relates to electric switches, and more particularly to a quick-make and quick-break type of switch.

The invention has for its purpose, among other objects, to provide an improved construction for electric switches which will act to snap a switch quickly over from one position to another so as to avoid arcing, and which will be simple in construction, thoroughly reliable and durable, and relatively inexpensive.

Another object of the invention is to provide an electric switch, which can be used to control the operation of an air compressor, or other fluid pressure-operated apparatus, or a liquid-level, temperature-controlled, or other condition-responsive apparatus, so as to precisely control the condition of such apparatus.

Other objects of the invention will be apparent hereinafter from the specification and from the recital of the appended claims.

In the drawing:

Fig. 1 is a part front elevation of a switch constructed according to one embodiment of this invention, and showing one means for operating the same;

Fig. 2 is a side elevation of the switch showing its mounting partly in section, and showing, also, diagrammatically how this switch may be connected to an air compressor to control the operation of the same;

Fig. 3 is a rear view of the switch, its mounting, and associated parts;

Fig. 4 is a fragmentary section on the line 4—4 of Fig. 2 looking in the direction of the arrows;

Fig. 5 is a fragmentary section on an enlarged scale on the line 5—5 of Fig. 1, looking in the direction of the arrows, and showing the switch in contact position; and

Fig. 6 is a corresponding section showing the switch at the opposite end of its movement in open position.

In the embodiment shown the switch, which is denoted as a whole at 10, comprises a pair of terminal screws 11, and a rockable contact plate 12 (Figs. 2, 5 and 6) which makes and breaks contact with the terminals 11. The terminal screws 11 are adjustably threaded downwardly in parallel, spaced relation into the upper portion of an insulating block 13 in which the contact plate 12 is rockably mounted. The block 13 is secured by screws 14 to a bracket 15. Bracket 15 also carries screws 16 that are threaded upwardly, adjustably in parallel spaced relation in the insulating block 13. The screws 16 serve to limit the downward, breaking movement of the contact plate 12. Suitable lead wires from the electrical device, which is to be controlled by the switch, are secured to the terminal screws 11.

Quick break and quick make of the switch is achieved by the use of a load and fire mechanism now to be described. Threaded into a plate 18 is a nipple 20 which is formed with two chambers 21 and 22 separated by a partition wall 23. Mounted in the chamber 21 in position to engage the V-shaped free end of the contact plate 12 is a ball 25 which is constantly pressed outwardly into engagement with this plate by a coil

spring 26. This spring is interposed between the ball and the partition 23. Mounted in the chamber 22 is a ball 27 that is constantly pressed outwardly by a coil spring 28. The ball 27, which is of smaller diameter than the ball 25, is disposed to ride on the surface of a cam plate 30. This cam plate is fixedly secured on two shouldered studs 31, 31' by screws 32 that thread into the studs. The two studs thread into insulating block 13. The upper stud 31 passes through an elongate slot 33 in plate 18. The lower stud 31' passes through an elongate slot 35 in a plate 36 and through an elongate slot 37 in plate 18.

The purpose of plate 36 will appear hereinafter. The nipple 20 extends through an elongate slot 38 in this plate.

The cam plate 70 has flat surfaces 40 and 41 that are parallel to but offset from one another and that are connected by an inclined portion 42. The inclined portion 42 of the plate 30 is offset slightly with reference to a plane containing the centers of the two balls 25 and 27, or with reference to the center line of the V edge of the contact plate 12 when the plate 12 is in its central, or neutral, position, so that the plate 12 will not be able to stop on dead center.

As previously indicated, the switch may be actuated in any suitable manner, either manually, or automatically. The bracket 15, which supports the insulating block 12 and thereby the cam plate 30 and the nipple 20, may be mounted on any suitable support. As shown, it is adjustably secured by means of screws 44 to a plate or bracket 45 which, in turn, is mounted on any suitable support. Screws 44 pass through an elongate slot 46 in bracket 15 and thread into plate 45.

Welded, riveted or otherwise secured to bracket 45 is a conventional piston valve 50 (Figs. 1 and 2). This valve comprises a reciprocable member 51 which is reciprocable in a cylinder 52. The valve member 51 is constantly urged downwardly in the cylinder toward closed position by a coil spring 53, which is interposed between the upper face of the valve member and the upper end of the cylinder.

In the embodiment of the invention illustrated, the valve 50 is intended to actuate the switch 10, which in turn controls the operation of a conventional electrically-driven pump 55 that supplies compressed air at a desired pressure to a compressed air storage tank 57. Pump 55 is connected with storage tank 57 by piping 58. The tank 57 has a conventional relief valve (not shown). When the pressure in the tank rises above a desired maximum, this relief valve is opened and the air at the excess pressure passes through piping 59 into the bottom of cylinder 52 to raise the valve member 51 off its seat against the resistance of spring 53.

The valve member 51 is connected by rod 60 and pin 61 with plate or bar 36 so that the movement of piston 51 is imparted to plate or bar 36. In the positions of the parts shown, when the pressure in the storage tank 37 rises above the desired limit, the valve member 51 will be lifted off its seat and raised upwardly against the resistance of spring 53. This will cause the piston rod 60 to raise the bar 36 upwardly. The lower wall of slot 38 will thus engage the nipple 20 and raise the nipple 20 and the plate 18 upwardly, raising both from the positions shown in Fig. 5 to those shown in Fig. 6. As the nipple moves upwardly, the conductor plate 12 rides down over the ball 25, forcing the ball 25 to the left in the socket 21 against the resistance of the spring 26. At the same time, the ball 27 rides down the beveled portion 42 of the plate 30. As soon as the conductor plate 12 passes the center of the ball 25, the ball snaps behind, that is, above, the conductor plate 12, snapping the plate quickly to the position of Fig. 6, quickly break-

ing the electric circuit through the terminals 11, shutting off the motor 56 which drives the pump 55. Because the beveled portion 42 of the plate 30 is slightly offset from the center of the ball 25 in either position of the switch, there is no possible dead center position of the ball 25; and so the conductor plate 12 is snapped positively and quickly from one position to the other.

To prevent any possible retardation of this snap action, the slot 38 in plate or bar 36 is made longer than the outside diameter of nipple 20 so that the nipple and the plate 18 can move independently of plate or bar 36 in the slot 38 under impetus of the snap action produced by balls 25 and 27 and springs 26 and 28 and cam surface 42, once the plate or bar 36 has moved the nipple far enough for ball 25 to snap behind contact plate 12. The slots 33 and 37 in plate 18 are also long enough to permit this desired free movement of nipple 20. The nipple projects laterally into a chamber 65 in the insulator block 13; and the upward movement of nipple 20 continues until it abuts against the upper wall 65 of this chamber 65.

As the pressure in the tank drops, the spring 53 will return the valve member 51 to its lower closed position, causing the bar or plate 36 to be moved downwardly from the position shown in Fig. 6 to that of Fig. 5, carrying with it, after a slight lost motion, due to slot 38, the nipple 20. As the nipple 20 is moved downwardly, the ball 25 rides over the edge of the conductor plate and the ball snaps underneath the plate to snap the plate quickly to the position shown in Fig. 5 to remake contact through the terminal screws 11. Again, the length of slot 38 permits free throw of the switch once it is kicked over by ball 25. The movement of the nipple 20 continues downward until it abuts against the lower wall 67 of chamber 65.

The abutment of the nipple against the lower wall 67 of the chamber 65 in insulating block 13 enables the ball 25 to hold the contact plate 12 in contact with the terminal screws 11 until the nipple 20 and plate 18 are positively moved upwardly again by piston rod 60 and bar 36.

Ball 27 is preferably smaller than ball 25 to increase the effectiveness of inclined cam surface 42. The larger the ball, which engages this surface, the longer it takes the cam surface to become effective. The cam surface can readily get under a small ball and move that small ball inwardly quicker than it could a large ball. Thus the small ball 27 leads itself to quicker snap action of the switch.

By mounting an ordinary plunger type air valve 70, (Figs. 2, 5 and 6) such as used in a bicycle tire, in cam plate 30 in position so that ball 27 will engage and open the plunger 71 of this valve, air entrapped in the line 58 between the pump 55 and the tank 57 can be vented, during the time the motor 56 and pump 55 are shut down, so that there will be no air resistance to restarting of the pump when it is called for. Air valve 70 can be connected by piping 72 with line 58. Thus, when switch 10 is open, and the pump 55 and motor 56 are shut down, the valve 70 will be held open by ball 27 to permit venting of air entrapped in line 58 between the conventional check valve of the tank and the pump.

By loosening the screws 44 (Fig. 6) and adjusting the bracket 15, and block 13 relative to nipple 20, the amount of air pressure in tank 57 required to trip the switch 10 can be adjusted. Graduations 75 (Fig. 3) may be provided on bracket 45 to read against bracket 15 to enable this adjustment to be made accurately. The contact position of the conductor plate 12 with the terminal screws 11 can also be adjusted, by adjustment of these screws in block 13.

Instead of using only one pair of terminal screws 11, which make the device a single-throw switch, the screws 16 might also be made terminal screws and might be connected electrically to a device which is to be operated so that the switch would become a two way switch which would in operation shut off one electrically-operated device and turn on another.

The principal feature of the invention is the floating contact plate 12 which has a V-shaped edge, and the use of balls to throw this contact plate from one position to another with a snap or quick action, thus causing quick make and break of the contact. When the contact plate 12 is being moved from on position to off position, the initial movement tightens the plate on the contact screws 11 by compressing the spring 21; but as the plate slips over the end of the ball 25, it is thrown in the opposite direction to off position. The second ball 27, in conjunction with the ball 25, acts as a spreader moving with the plate 18 and, by exerting pressure against the beveled portion 42 of cam plate 30 throws the other ball 25 past what would be dead center of the ball 25. Thus, there can be no dead center. The ball 25 is a lever, not a plunger. If the device is operated automatically, as by means of fluid pressure, as shown, the switch will throw itself past dead center. If the switch is manually operated, the pressure used to move the plate 18 and compress the ball spring 25 will have to be sufficient to carry past dead center on both ends, thus making the device usable as a two-way wall switch.

Obviously instead of plate 30 with an inclined portion 42 connecting two parallel plane portions 40, 41, a plate might be employed similar to contact plate 12, but with its V-edge disposed opposite to the V-edge of plate 12 to engage ball 27, the V-edges of the two plates being offset vertically from one another in the central positions of both, thereby to insure throw-over of contact plate 12 as it moves from one of its limit positions to the other. Obviously also plate 30 might be made with two closely-spaced, oppositely disposed inclined surfaces 42, one to act during movement of nipple 20 in one direction, and the other to act during movement of nipple 20 in the opposite direction.

While a single contact plate 12 and a single reciprocable plate 18 are shown, for heavy duty such as in a 220 volt system, two pairs of terminals 11, two contact plates 12, and two reciprocable plates 18 insulated from one another, and each carrying a ball 25 may be used. Only one cam plate 30 need be provided, and therefore, only one plate 18 need carry the two balls 25 and 27.

While the invention has been described in connection with a particular embodiment thereof and different uses therefor, it will be understood that it is capable of further modification; and this application is intended to cover any variations, uses, or adaptations of the invention following, in general, the principles of the invention and including such departures from the present disclosure as come within known or customary practice in the art to which the invention pertains, and as fall within the scope of the invention or the limits of the appended claims.

Having thus described my invention, what I claim is:

1. An electric switch comprising a pair of terminals, a contact plate for bridging said terminals intermediate the ends of said plate to make an electric circuit between said terminals, a support on which said plate is rockably mounted adjacent one end of said plate, a second support, one of said supports being reciprocable relative to the other support and parallel thereto, a ball mounted on said second support in position to engage the end of said contact plate remote from its pivot, and spring means for yieldingly holding said ball in engagement with said remote end of said contact plate, a member secured to said first support, a second ball aligned generally with the first-named ball, said member having a cam surface inclined to the direction of movement of the movable support and on which said second ball rides during movement of said movable support, and spring means for yieldingly holding said second ball in engagement with said member, whereby said balls and spring means act to snap said plate about its pivot in a direction opposite to the

direction in which said movable support moves to make or break contact instantaneously with said terminals as said end of said plate travels over the top of said first-named ball in the movement of said movable support.

2. An electric switch comprising a pair of terminals, a contact plate for bridging said terminals intermediate the ends of said plate to make an electric circuit between said terminals, a support on which said plate is rockably mounted adjacent one end of said plate, a second support, one of said supports being reciprocable relative to the other parallel thereto, a ball mounted on said second support in position to engage the end of said contact plate remote from its pivot, and spring means for yieldingly holding said ball in engagement with said remote end of said contact plate, a member secured to said first support, a second ball aligned generally with the first-named ball, said member having a cam surface inclined to the direction of movement of the movable support and on which said second ball rides during movement of said movable support, and spring means for yieldingly holding said second ball in engagement with said member, said cam surface being offset in either limit position of its movement relative to a plane containing the centers of said balls, whereby said balls and spring means act to snap said plate about its pivot in a direction opposite to the direction in which said movable support moves to make or break contact instantaneously with said terminals as said end of said plate travels over the top of said first-named ball in the movement of said movable support.

3. An electric switch comprising a pair of terminals, a first support, a contact plate for bridging said terminals intermediate the ends of said plate to make an electric circuit between said terminals, said contact plate being pivotally mounted at one end on said first support, a second support mounted on said first support to reciprocate in parallelism to said first support, a socket member secured on said second support, a ball mounted in said socket member opposite the free end of said contact plate to engage and ride over the free end of said contact plate, a spring mounted in said socket member to continuously press said ball outwardly of said socket member against the free end of said contact plate, a second socket member aligned axially with the first-named socket member, a plate disposed on the side of said second support opposite from the first-named support, said second plate being secured to the first-named support, a second ball in said second socket member in alignment with the first-named ball, said second plate having a cam surface thereon which is offset at either limit of movement of the first plate from a plane containing the centers of the two balls, and spring means for maintaining the second ball in contact with the second plate to ride on the second plate as said second support reciprocates, whereby as the first-named ball rides on the end of said contact plate on movement of the second support it snaps said contact plate about its pivot in a direction opposite to the direction in which said second support is moving to make or break contact with said terminals depending on the direction of movement of said second support.

4. An electric switch comprising a pair of terminals, a first support, a contact plate for bridging said terminals intermediate the ends of said plate to make an electric contact between said terminals, said contact plate being pivotally mounted in said first support adjacent one end of said plate, a second support, one of said supports being reciprocable relative to the other in parallelism therewith, a socket on said second support, a ball mounted in said socket and disposed opposite the free end of said contact plate, spring means for yieldingly holding said ball in engagement with said free end, and spring means for preventing stoppage of the movement of said movable support with said contact plate in the dead center position of its pivotal movement, said last-named means comprising a second ball, a member on which said second ball rides during movement of said movable support, said member having a surface inclined to the direction of movement of said movable support, and spring means for holding said second ball in position to ride over said inclined surface during said movement.

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