March 5, 1940. J. W. LAWSON 2,192,793

QUICK BREAK AIR OPERATED SWITCH

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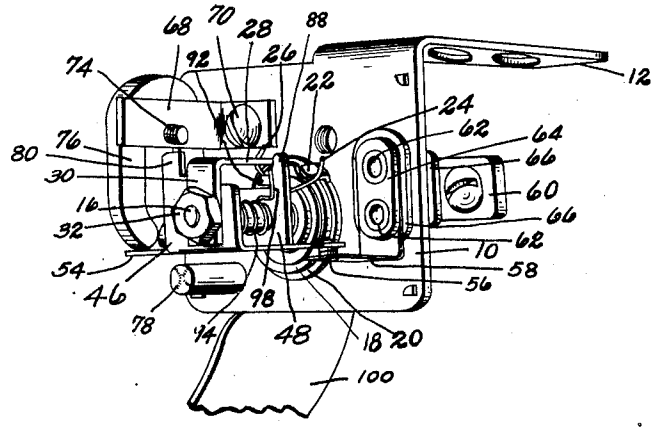


Fig. 1

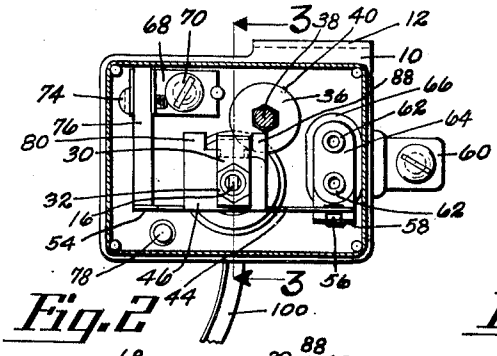


Fig. 2

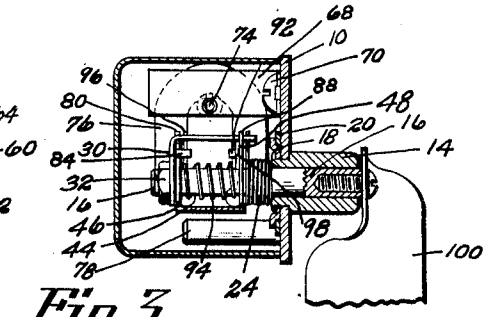


Fig. 3

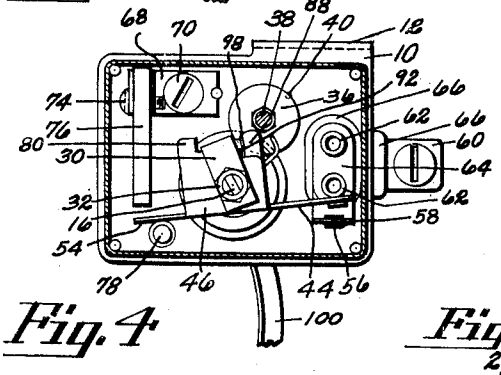


Fig. 4

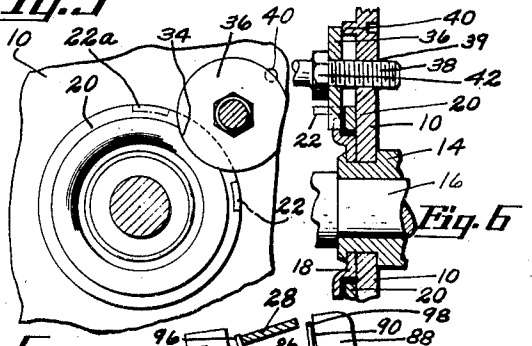


Fig. 5

Fig. 6

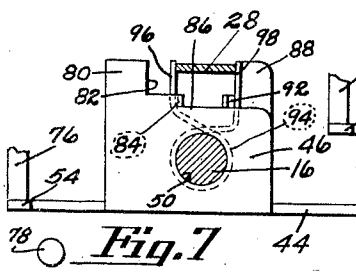


Fig. 7

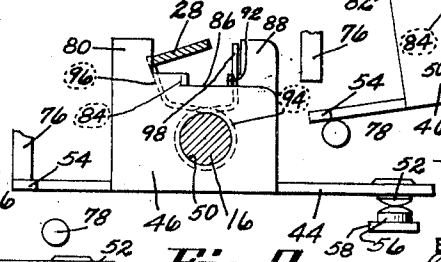


Fig. 8

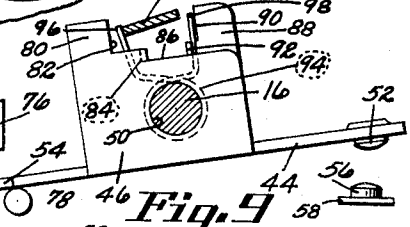


Fig. 9

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QUICK BREAK AIR OPERATED SWITCH

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Application December 1, 1937, Serial No. 177,433

12 Claims. (Cl. 200—81)

This invention relates to air operated switches, and has for an object to provide a device sensitive to low potential air streams, that will effect a quick break of circuit connections in response to air movement.

A further object of the invention is to provide a sensitive fluid operated switch, that will maintain firm contact pressure until one of the contacts is forceably moved away.

A further object of the invention, is to provide means for accelerating the contact movement, directly that the opening force becomes effective.

A further object of the invention is to provide a lost motion connection between a movable contact arm and an actuator therefor, whereby opening movement of a contact may be accelerated once the opening movement has been started by the actuator, and whereby efficient contact engaging pressure is increased while the contact mechanism is maintained in a rest position.

A still further object of the invention is to provide an abutment for the rest position of the actuator, that incorporates a part of the contact supporting arm, whereby the contact pressure is increased by the force of the actuator return spring, for maintaining the contacts closed.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawing wherein a preferred embodiment of the present invention is clearly shown.

The several objects of the invention are accomplished, by providing an oscillatable actuator mechanism, including a spring urged bumper arm passing between a pair of spaced abutments, carried by a contact supporting member, against one of which abutments the bumper arm is spring urged but adapted to be moved against the other, while the contact carrying arm is maintained in circuit closed position under the influence of a permanent magnet or other holding device. Actuation of the oscillatable shaft, stores up spring force to be released only upon positive movement of the contact carrying arm out of the field of the magnet or upon cancellation of the holding force.

In the drawing:

Fig. 1 is a perspective view, of a switch device incorporating the instant invention, the storm cover having been removed.

Fig. 2 is a plan view, of the switch device including a section through the storm cover.

Fig. 3 is a transverse sectional view, substantially as indicated by the line and arrows 3—3 of Fig. 2.

Fig. 4 is a plan view, with the contact mechanism and actuator moved to the circuit open position.

Figs. 5 and 6 are enlarged detail views, of the adjusting means for the return spring.

Figs. 7, 8 and 9 are fragmentary views, on a large scale, illustrating the positions of the contact mechanism and actuator element in the rest position, at the instant just prior to contact separation, and at the circuit open position, respectively.

In air operated switches of the prior art devices, there has been a tendency toward fluttering of the contact making function, when the device is subjected to air potentials of magnitude closely approaching that at which the device is designed to be actuated. That fluttering is due to the delicacy of the mechanical construction heretofore necessary for mechanism responding with fidelity to air streams of low potential. The fault was manifest in what might be termed a high frequency oscillation, or at least a relative frequent oscillation of the actuating member, when subjected to air potentials close to the designed cut-in value, which would result in alternate make and break of the contacts, though no appreciable change was experienced in the actual speed of the vehicle or other carrying device.

With particular reference to the drawing, the device that solves the problem, and that is herein disclosed, includes a base member 10 provided with an attaching bracket 12. A bearing sleeve 14 supporting an oscillatable shaft 16 passes through the base 10, and has its projecting end turned over to secure a flanged washer 18 in clamping relation to the base. Beneath the flange of the washer 18, and in rotatable relation therewith, is a ring 20 having an upstanding lug 22 providing an abutment for one end of a return spring 24, coiled about the shaft 16. The other end 26 of the spring hooks behind a bumper arm 28, having an angular portion 30 secured to the end of the shaft 16, by a clamp nut 32.

For the purpose of holding the spring supporting ring 20 in any adjusting position, the flange of the washer 18 is notched, as at 34, to receive the peripheral edge of a clamp member 36 that is secured to the base 10 by a cover supporting stud 38, the clamp member 36 resting on the edge of the ring 20, as well as a squirt 40 struck up from the base 10. The stud 38 is threaded into the base 10 as indicated at 39, and has a shoulder 42 engaging the clamp member

36 for maintaining it in clamped relation against the ring 20 and the end of the squirt 40. It will be appreciated that, by loosening the stud 38 the ring 20 may thence be rotated in either direction beneath the flange or the washer 18, which rotation effects a change in the angular position of the spring supporting post 22, and thereby alters the force of the return spring 24. One such altered position is indicated in Fig. 5, by the dot-and-dash line at 22*a*.

Also, carried by the oscillatable shaft 16, there is a movable contact carrying member 44 that provides a pair of parallel flanges 46 and 48, with aligned apertures 50 for loosely passing over the shaft 16. The member 44 is extended in both directions beyond the flanges to provide, in one instance a contact 52, and in the other instance an armature portion 54. Supported from the base 10, there is a relatively fixed contact 56, that is carried by a bracket 58 that is in electrical communication with an outside terminal 60, and in non-conductive relation with respect to the base 10, by means of rivets 62, clamp plate 64 and appropriate insulators 66. A bracket 68 secured to the base 10 by a screw 70 is provided with a clamp plate 72, and a screw 74 for supporting a horse-shoe or other permanent magnet 76, adjacent the armature portion 54 of the contact carrying arm, when the device is in the rest position, or when the contacts 52 and 56 are closed. While a permanent magnet is illustrated as the holding device, other means may be substituted. A contact opening stop 78 is also mounted on the base, to be engaged by the armature portion 54, when the mechanism is moved to circuit open position.

As hereinbefore mentioned, a lost motion driving connection is afforded between the bumper arm 28 and the contact carrying arm 44. Making for this relation, the flanges 46 and 48 are both cut away in step formation substantially as illustrated, the flange 46 providing an extension 80 joining a notch 82, having an ear 84 projecting towards the opposite flange 48, at one end of a second notch 86. The other flange 48 provides a similar extension 88 with an adjacent notch 90, and a corresponding adjacent ear 92, which ear in this instance projects toward the opposite flange 46. The extensions 80 and 88 are more widely spaced apart than the cross-sectional dimension of the bumper arm 28, and are disposed one on each side of the arm which allows for oscillatory movement of the arm 28 between the extensions 80 and 88, without engagement with either one. A contact actuating spring 94 is coiled about the shaft 16, and has end extensions 96 and 98 engaging behind the ears 84 and 92, that provide rigid stops for maintaining the spring under a certain condition of stress. The spring ends 96 and 98 after passing behind the ears 84 and 92, project outwardly to engage on either side of the bumper arm 28.

These provisions make for firm pressure of the contacts 52 and 56 when the switch is in the circuit closed position as illustrated in Figs. 1, 2 and 7, since the return spring 24 tends to rotate the shaft 16 and the attached bumper arm 28 in a clockwise direction, by which the bumper arm 28 engages the extension 88, and through which rotary movement of the bumper arm is transmitted to the contact 52. By this rotative movement, as may be noted by reference to Fig. 7, the bumper arm 28 engages the extension 88 and flexes the spring arm 98 away from the ear 92. Even this slight amount of spring flexing tends to wind up the spring 94, causing its arm 96 engaging the ear 84 to urge the contact carrying arm 44 in a clockwise direction. When the contact carrying arm 44 is in that position pressure of the contacts 52 and 56 will be increased, by reason of the magnetic field operating on the armature portion 54.

An air stream directed upon the paddle or vane 100 tends to rotate it with its shaft 16 and bumper arm 28 in a counter-clockwise direction, and toward that position illustrated in Fig. 4. In the disclosed embodiment, the paddle 100 is capable of oscillation to about 25° before any circuit change is effected by way of the contacts 52 and 56. The relation of the parts at this stage of the switch operation, as illustrated in Fig. 8, where it will be observed that the bumper arm 28 has been rotated counter-clockwise until it just engages the extension 80. During that movement the spring arm 98 has been allowed to engage the ear 92, and the spring arm 96 has been moved to the left by the bumper arm 28 away from the ear 84. That movement winds up the spring, and builds up force in the spring 94 to actuate the contact carrying member with a snap action, as soon as the contact arm is forceably moved, ever so slightly, away from the magnet, or to a position where the holding force of the magnet is nullified.

The effect of that further movement of the bumper arm 28 in a counter-clockwise direction, is illustrated in Fig. 9, wherein the armature portion 54 of the contact carrying lever 44 rests against the stop 78, and wherein the contacts 52 and 56 are separated. The spring 94 has partially recovered from the extreme position of Fig. 8, in that the spring arm 96, acting upon the edge of the bumper arm 28 as a fixed stop, has acted through the engagement of the spring arm 98 on the ear 92 to rotate the contact carrying arm 44 in a counter-clockwise direction, until the spring arm 98 engages the opposite edge of the bumper arm 28. That restoring force of the spring 94, is the final contact actuating force by which the contacts are opened with a snap action, and takes effect immediately that the bumper arm 28, acting through the extension 80, pushes the armature portion 54 out of the effective field of the magnet 76.

On reverse movement of the paddle 100, which is due to a drop of the potential of the air stream impinging against it, the movable contact assembly will be oscillated in a clockwise direction substantially as though rigidly connected with the actuating shaft 16, until the armature portion is brought within the field of the magnet 76, whereupon its magnetic effect will oscillate the contact carrying arm 44 in a clockwise direction relative to the shaft 16, and thereby accelerate the contact closing function, and return the contact mechanism to the positions illustrated in Figs. 1, 2 and 7. Thus a sensitive mechanism is provided that will operate in response to low potentials of air movement, and the contacts of which when once started on the opening function will be quickly snapped apart, or to a circuit open position, with an attendance of little or no arcing at the contacts.

The instant of circuit opening, can be adjusted by means of the ring 20 and the clamping means involving the cover holding stud 38, and the circuit holding function of the magnet, can be modified by loosening the screw 74 and sliding the magnet back and forth between the clip 72 and bracket 68, so as to vary the spacing between

the poles of the magnet and the armature portion 54.

While the embodiment of the present invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. In a quick break circuit closer the combination comprising, an oscillatable actuator, a contact bearing arm oscillatable on the actuator, lost motion driving connections between the arm and the actuator including a bumper arm and spaced extensions, spring means taking up the slack of the lost motion connection, and means restraining movement of the contact arm until a predetermined oscillation of the actuator effects engagement between the bumper arm and one of said extensions.

2. The combination set forth in claim 1, wherein the spring take up means accelerates movement of the arm as soon as the actuator starts to move it.

3. The combination set forth in claim 1, wherein the restraining means comprises a permanent magnet disposed to attract the arm when it is in the rest position, and thereby restrain movement of the arm throughout a predetermined movement of the actuator.

4. In an electric switch having an oscillatable actuator, the combination comprising, a contact carrying arm adapted to be moved by the actuator, and having lost motion connections therewith, said contact carrying arm having parallel spaced extensions, a bumper arm carried by the actuator and extending in spaced relation between the extensions for providing the lost motion connection, means urging the bumper arm to engage one of the extensions but permitting movement of the bumper arm to engage the other extension before movement of the contact arm is effected, said urging means operating to accelerate movement of the contact arm after its movement is started by the bumper arm.

5. An electric switch, comprising in combination, a base having a bearing, an actuating shaft journaled for oscillation in the bearing, a bumper arm driven by the shaft, a contact carrying member oscillatable on the shaft and having spaced extensions adapted to be engaged by the bumper arm, and means acting upon the contact carrying member restraining its movement from a rest position, said shaft being capable of limited oscillation without actuating the contact carrying arm.

6. The combination set forth in claim 5, wherein yielding means are provided for urging the bumper arm into engagement with one of the extensions.

7. The combination set forth in claim 5, wherein means are provided for accelerating movement of the contact carrying arm once the movement has been started by the bumper arm.

8. In a switch having an air vane and an oscillatable shaft for actuating a contact assembly, the combination of means providing a snap action, comprising, a contact arm loosely mounted for oscillation on the shaft, a bumper arm carried by the shaft for actuating the contact arm, said contact arm having spaced abutments for engagement with either side of the bumper arm, and a spring urging the bumper arm into engagement with one abutment.

9. In a switch having an air vane and an oscillatable shaft for actuating a contact assembly, the combination of means providing a snap action, comprising, a contact arm loosely mounted for oscillation on the shaft and having spaced abutments, a bumper arm carried by the shaft and extending between the abutments for actuating the contact arm, provisions including spaces between the bumper arm and abutments for oscillating the vane and shaft through a definite angle without engagement with either abutment, and means for yieldably holding the contact arm at a position of rest, while the vane and shaft so oscillates; oscillation of the vane in one direction substantially more than the definite angle operating to positively move the contact arm irrespective of the force of the holding means.

10. An air operated switch, comprising in combination, an oscillatable vane having a shaft and bumper arm driven thereby, a base providing a relatively fixed contact and supporting the shaft, a magnet supported by the base, an armature pivoted on the shaft and carrying a cooperating contact, said armature having means providing a lost motion connection with the bumper arm, spring means for holding the contacts closed and the armature in close proximity to the magnet, and spring means for accelerating contact separation, upon movement of the armature by the bumper arm.

11. An air operated switch, comprising in combination, an oscillatable vane having a shaft and bumper arm driven thereby, a base providing a relatively fixed contact and supporting the shaft, an arm pivoted on the shaft and carrying a cooperating contact, said arm having means including spaced extensions disposed on each side of and providing a lost motion connection with the bumper arm, spring means for urging the bumper arm against one of the extensions, means for holding the contacts closed until the bumper arm engages the other extension, and spring means for accelerating contact separation, upon movement of the armature by the bumper arm.

12. The combination set forth in claim 11 wherein the contact holding means is a permanent magnet acting upon one end of the arm when near the contact closed position.

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