

May 11, 1943.

E. M. CLAYTOR

2,318,671

ELECTRIC SWITCH

Filed April 2, 1941

2 Sheets-Sheet 1

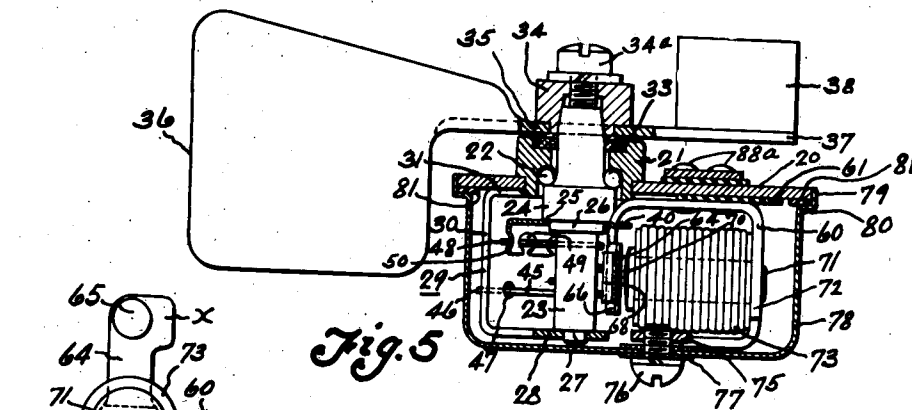


Fig. 5

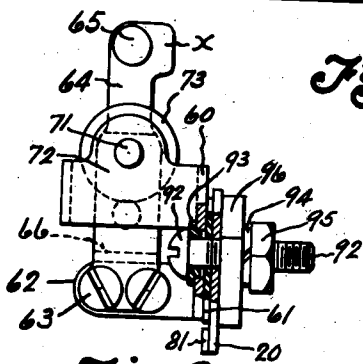


Fig. 3

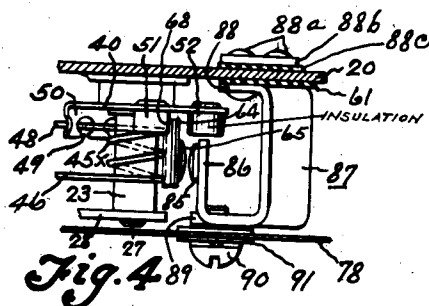


Fig. 4

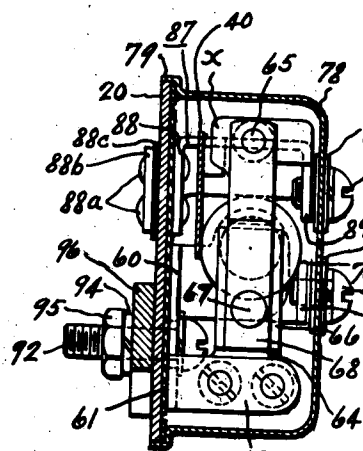


Fig. 2

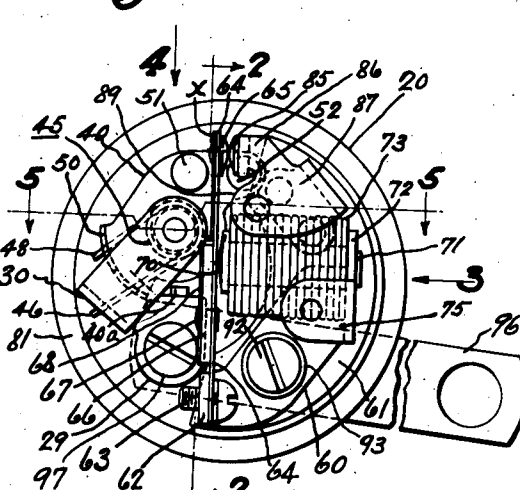


Fig. 1

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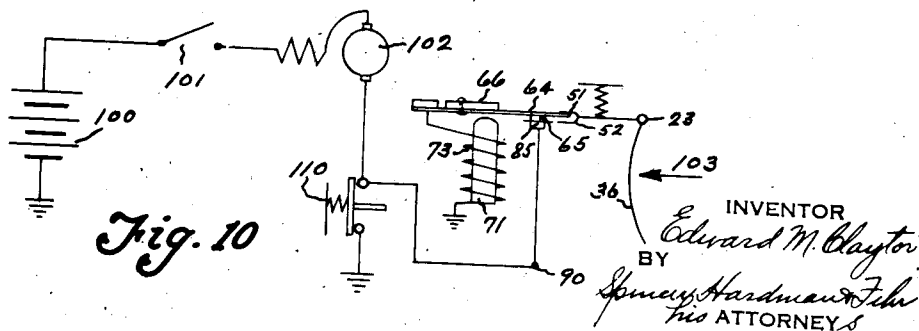
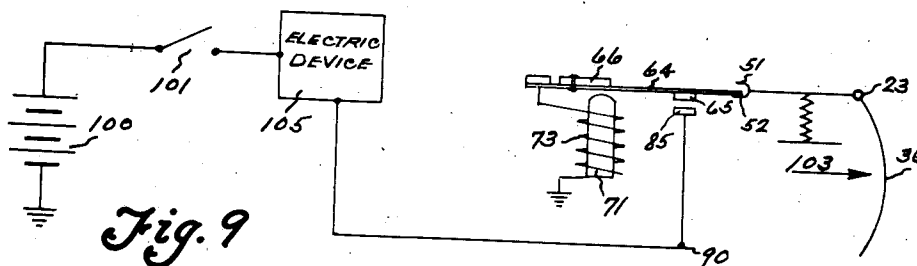
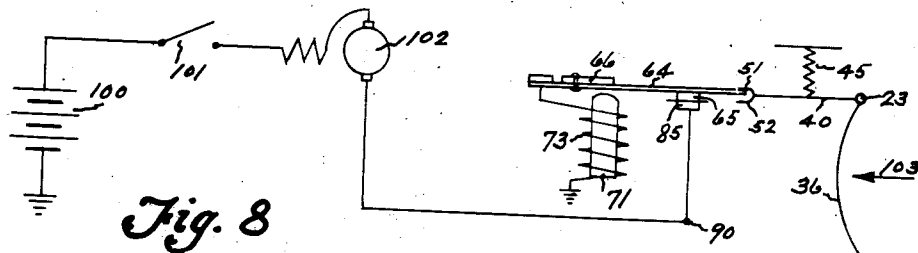
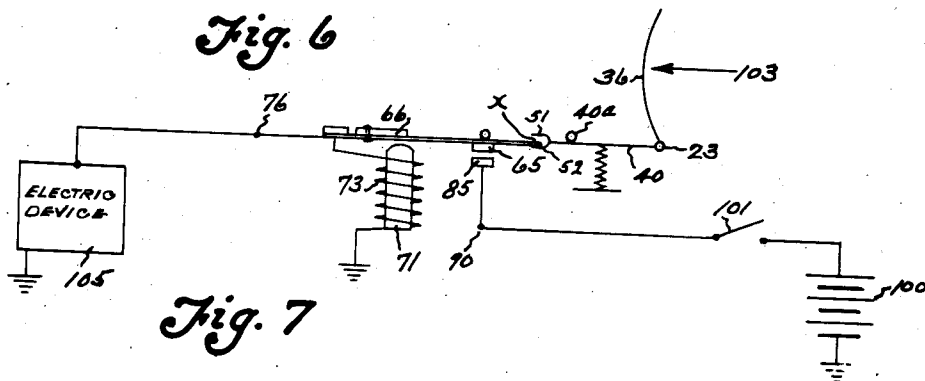
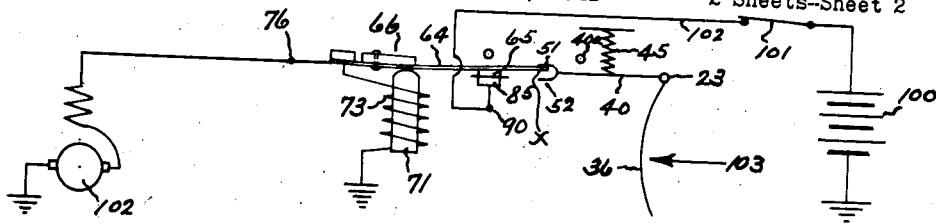
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2 Sheets--Sheet 2



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2,318,671

ELECTRIC SWITCH

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Application April 2, 1941, Serial No. 386,493

11 Claims. (Cl. 200—87)

This invention relates to speed responsive electrical switches and more particularly to air vane switches for use on automotive vehicles for controlling certain electrical devices according to the speed of the vehicle.

It is an object of the present invention to provide an air vane switch of economical, durable and compact construction which provides for the quick make and break of its contacts.

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

In the drawings:

Fig. 1 is a plan view of the switch with its cover removed.

Fig. 2 is a sectional view on the line 2—2 of Fig. 1 showing the cover in section.

Fig. 3 is a view of the magnet and armature assembly looking in the direction of the arrow 3 in Fig. 1.

Fig. 4 is a fragmentary view partly in section looking in the direction of the arrow 4 of Fig. 1.

Fig. 5 is a sectional view on the line 5—5 of Fig. 1.

Figs. 6, 7, 8, 9 and 10 are wiring diagrams illustrating various uses of the air switch.

The switch comprises a circular base 20 to which is attached a bushing 21 (Fig. 5) providing the outer race for bearing balls 22, the inner race of which is provided with a shaft 23 having an enlarged portion 24 providing a shoulder 25 which steps down to a portion 26 of less diameter. Shaft 23 is provided with a journal portion 27 having a bearing in the arm 28 of a bracket 29 having a portion 30 joining the portion 28 with a portion 31 parallel to portion 28, the portion 31 being attached to the base 20. The shaft 23 extends through a packing member 33 and into a bushing 34 fitting on the tapered end of the shaft and clamped by a screw 34a. Bushing 34 provides the hub for a plate 35 shaped to provide an air vane 36 and having an arm 37 carrying a weight 38 which, by adding inertia, stabilizes movement of the vane.

The portion 26 of shaft 23 extends through a hole in a plate 40 and the part 26 is staked against the plate 40 at certain places so that the shaft will drive the plate. Rotation of the shaft 23 in one direction is resisted by a spring 45 coiled around shaft 23 and having one end 46 passed through a hole 47 in part 30 of bracket 29 and having the other end 48 received by one of several notches 49 formed in a flange 50 of

the plate 40. Plate 40 carries studs 51 and 52 either of which may engage a lug X of an armature to be described. Since the studs 51 and 52 are spaced a distance greater than the thickness of the lug X it is evident that a lost motion connection is provided between the plate 40 and the lug X. The studs 51 and 52 may be made of Bakelite or Bakelite coated steel rivets so that the parts touching the lug X are nonconducting.

The base 20 insulatingly supports a bracket 60, there being a nonconducting segment 61 interposed between these parts. The bracket 60 which is made of magnetizable metal provides an arm 62 to which two screws 63 attach a magnetizable resilient armature blade 64 carrying a contact 65 and a magnetizable flux carrying block 66 attached by rivet 67 which also secures a conductor strip 68 also secured by the shank of the rivet which provides contact 65.

The armature 64 moves relative to a pole face 70 of a core 71 attached to an arm 72 of the bracket 60 and surrounded by a magnet coil 73 attached at one end to the bracket 60 and attached at the other end to the base 20 in order to provide a ground connection. From the arm 72 of bracket 60 there extends an ear 75 which is provided with a threaded hole for receiving a terminal screw 76 passing through nonconducting bushing 77 in a cover 78 in order to secure the cover in position with its flange 79 surrounding the peripheral edge of the base 20 as shown in Figs. 2 and 5 and with its shoulder portion 80 in engagement with a gasket 81 previously cemented to the base 20. The screw 76 therefore is a terminal which is common to the armature contact 65 and to the nongrounded end of the coil 73.

The contact 65 cooperates with a stationary contact 85 fixed to an arm 86 of a bracket 87 having a part 88 attached to the base 20 and insulated therefrom as shown in Fig. 4. Rivets 88a pass through metal plate 88b, insulating plate 88c, base 20, insulating plate 61 and bracket part 88. The bracket 87 has an ear 89 provided with a threaded aperture for receiving a terminal screw 90 which, like the screw 76, passes through a nonconducting bushing 91 attached to the cover 78. The screws 76 and 90 therefore provide means for attaching wires to the switch and also for securing the cover 78 to the base 20.

The manner of securing the armature supporting and magnet supporting coil bracket 60 to the base 20 is shown best in Fig. 3. A screw 92 passes through a nonconducting bushing 93 which spaces the screw and insulates it from the

bracket 60. The screw 92 passes through the insulating plate 61, the base 20, a mounting plate 96 and a washer 94 and receives a nut 95. By tightening the nut 95 the bracket 60 and the plate 96 are clamped to the base 20. In a similar manner, plate 96 and bracket 29 are attached to base 20 by a screw 97.

When the spring 45 is arranged as shown in Fig. 1, it is biased to cause stud 51 to engage armature lug X in order to close the contacts 65 and 85 as shown diagrammatically in Fig. 6. Fig. 6 illustrates the use of the switch in a circuit including the storage battery and the heater motor of an automobile. Battery 100 is connected by a switch 101 and wire 102 with terminal 90 of the air switch. Terminal 76 is connected with the heater motor 102 which is grounded. When the switch 101 is closed, the heater motor 102 is connected with battery 100 through the contacts 65 and 85 of the air switch. When a certain vehicle speed is maintained, it is desirable to turn off the motor 102 automatically and this is accomplished by the separation of the contacts 65 and 85 due to the pressure of air from the engine cooling fan impinging upon the vane 36 as indicated by arrow 103. The separation of contact 65 and the contact 85 takes place rapidly due to the fact that the pressure required to overcome the magnetic pull on the armature is considerably greater than that required merely to overcome the spring 45. This spring 45 is first overcome taking up the lost motion between the armature lug X and the stud 52 on plate 40. The pressure of the air acting upon vane 36 tending to rotate it clockwise in Fig. 6 must be great enough not only to overcome the spring 45 but to overcome the magnetic pull afforded by the magnet coil 73 which is also connected with the battery through the contacts 65 and 85. As soon as the pull is overcome the contacts 65 and 85 separate quickly, because the instant they separate, the coil 73 is deenergized and the plate 40 will then move quickly against stop 40a, said stop being provided by an ear on bracket 29 as shown in Fig. 1. When the vehicle speed air pressure on vane 36 decreases the spring 45 will overcome the air pressure on vane 36, and the contact 65 will reengage the contact 85. At the instant this occurs the coil 73 will be reexcited and will increase the contact pressure between 65 and 85 which is most desirable. In fact the magnetic pull afforded by the electromagnet is great enough to cause the armature spring 64 to bow slightly so that it will seal against the core. The bowing of the spring 64 causes a slight rubbing action by the contact 65 upon the contact 85 which is desirable in order to keep the contacts clean.

As stated before, the spring 45 shown in Fig. 1 biases the plate 40 into contact closing position. If a spring 45X shown in Figs. 4 and 5 is substituted, the plate 40 will be biased into contact open position, thus holding the contact 65 normally separated from contact 85. The vane 36 can be relocated on the shaft 23 so that air pressure will tend to move the plate 40 into contact closing position as shown in Fig. 7. When the air switch is adapted for making contact under air pressure, it may be used to control some electrical device on the automobile which is desirable for use when driving at high speed. In Fig. 7 the switch closes with a snap action when a certain high speed is reached and

opens with a snap action when the speed falls below a predetermined value.

In the installations shown in Figs. 6 and 7 the air switch is provided with two insulated terminals 76 and 90. This requires that two wires lead from the switch (which is usually located near the front end of the engine under the hood) to the battery and to the heater motor or other electrical accessory. Figs. 8 and 9 show installations similar to Figs. 6 and 7, respectively, except that only one wire connected with switch terminal 90 is required. The heater motor 102 in Fig. 8 or the electrical device 105 in Fig. 9 is provided with two insulated terminals connected, respectively, with the control switch 101 and with terminal 90 of the air switch. In the installations shown in Figs. 8 and 9, the circuit of the motor or electrical device includes not only the contacts of the air switch, but the magnet winding 73 as well. Therefore the magnet winding 73 should be of low resistance so as not substantially to reduce the voltage impressed upon the current consuming device. Fig. 10 shows an installation in which the heater motor 102 is connected with a battery ground circuit through a switch 110 which is normally closed except when the transmission gears are in high or third speed. The heater motor will operate when the switch 101 is closed in low and intermediate speed regardless of the status of the air switch. When the transmission is in high or third speed, switch 110 is automatically opened by means not shown; therefore the air switch controls the stopping of the heater motor when a certain high speed is obtained and restores its operation again when the speed drops back to some lower value.

From the foregoing description of the construction of the air switch and the various ways in which it may be installed, it is apparent that the air switch can easily be adjusted for normally closed contacts opened by air pressure or normally opened contacts closed by air pressure. While it is provided with two terminals, it is adapted for use in a circuit where only one of its terminals (terminal 90) is required, the circuit being completed when the switch contacts are closed and through the grounded magnet coil of the switch which is used to effect increase of contact pressure when the contacts close and to cause a build-up in operating forces so that the contacts open quickly when the opening force becomes effective.

The armature 64 and parts supported thereby divide the switch compartment into two parts. The part to the left of armature 64 (Fig. 1) is occupied by shaft 23, bracket 29 and biasing spring 45 or 45X. The part to the right of armature 64 is occupied by bracket 61, magnet core 71, magnet coil 73 and by bracket 67. The space within the case 78 is therefore used to the best advantage. For automobile use, the switch can be made small and compact. In fact the switch is much smaller than shown in the patent drawings.

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. An electric switch having a magnetizable resilient armature blade carrying a contact, a stationary contact engaged thereby and connected with a terminal, means for controlling the position of the blade with respect to its contact mak-

ing-and-breaking status, and electromagnetic means for retaining the blade in contact making position and including a magnet coil, a core, a magnetizable bracket supporting the core and one end of the armature blade; and a flux carrying block attached to the armature near its fixed end and on the side thereof remote from the core, thus permitting the armature blade to seal against the pole face of the core so as to produce a wiping action between the contacts and bend beyond the block when the magnet coil is energized.

2. An electric switch comprising in combination; a base; a shaft journaled in a bearing provided by the base; a pair of mounting brackets attached to the base; a flexible armature extending between the shaft and the brackets, said armature having one end fixed to one of the brackets and having its free end provided with a contact for engagement with a stationary contact carried by the other bracket, at least one of the contacts having a convex surface; a plate fixed to the shaft and having provisions cooperating with the armature to open and close the contacts; an electromagnet for attracting the armature and including a magnet coil and a core carried by the bracket to which the armature is attached; a flux carrying block attached to the flexible armature and on the side remote from the core face, thus permitting the armature to bend toward the core face so as to change the relation of the contacting surfaces of the contacts when the magnet coil is energized.

3. An electric switch comprising in combination; a base; a shaft journaled in a bearing provided by the base, said shaft being located on one side of a medial line of the base; a pair of mounting brackets attached to the base on the other side of the medial line of the base; a flexible armature extending substantially along the medial line and having one end secured to one of the brackets and having its free end provided with a contact adapted to engage a stationary contact fixed to the other mounting bracket, at least one of the contacts having a convex surface; means fixed to the shaft and operable upon the armature to open and close the contacts; electromagnetic means for attracting the flexible armature in contact making position and including a magnet coil, and a core carried by the bracket supporting the armature; a flux carrying block attached to the armature and on the side remote from the core and thereby permitting the armature to bend and seal against the face of the core so as to shift the engaging portion of the contacts when the magnet coil is energized.

4. An electric switch comprising in combination; a base; a shaft journaled in a bearing provided by the base and in a bearing spaced from the base and supported by a bracket attached to the base, said shaft being located on one side of a medial line of the base; a pair of mounting brackets attached to the base on the other side of the medial line; a flexible armature extending substantially along the medial line and having one end secured to one of the mounting brackets and having its free end provided with a contact adapted to engage a stationary contact fixed to the other mounting bracket, said other mounting bracket supporting an electromagnet having a coil connected with the armature; a flux carrying block carried by the armature and on the side remote from the core of the electromagnet whereby the flexible armature will bend when the magnet coil is energized causing the movable

contact to slide over the face of the stationary contact.

5. An electric switch comprising in combination; a base; a bearing carried by the base on one side of a medial line; a support having a flange provided with a bearing in alignment with the base bearing; an actuating shaft journaled in the bearings; a pair of mounting brackets supported by the base on the other side of the medial line; a resilient armature extending substantially along the medial line and fixed at one end to one of the mounting brackets and carrying a contact at its free end adapted to engage normally a stationary contact carried by the first mentioned bracket having a coil connected with the armature; means for actuating the shaft in one direction of rotation; a drive plate movable with the shaft for moving the armature to separate the contacts; yieldable means for resisting the movement of the shaft in said one direction and operating to move the shaft through the drive plate in the opposite direction as the shaft actuating means is reduced; an enclosure for the base, support and the brackets; and means for securing the enclosure to the brackets, said securing means operating as terminals for the switch.

6. An electric switch comprising, a base and a cover providing a compartment; a mounting bracket of magnetizable metal supported from the base; a resilient armature blade extending across the compartment and fixed at one end to the mounting bracket and carrying a contact at the other end; armature retaining means in the compartment on one side of the armature, said retaining means comprising an electromagnet having a core extending from the bracket and having a coil connected with the armature; a support on the same side of the armature with the magnet and carrying a contact engageable with the armature contact and providing a terminal for the switch; a magnetizable plate secured to the armature near its fixed end, thus permitting the armature to seal against the pole face of the core and permitting the armature portion projecting beyond the magnetizing plate to bend and thereby produce a wiping action between the contacts when the electromagnet is energized; and means journaled in the base and on the other side of the armature for controlling the position of the armature.

7. An electric switch comprising, a base and a cover providing a compartment; a mounting bracket of magnetizable metal supported from the base; a resilient armature blade extending about midway across the compartment and fixed at one end to the mounting bracket and carrying a contact at its free end; armature retaining means in the compartment on one side of the armature, said retaining means comprising an electromagnet having a core extending from the bracket and having a coil connected with the armature; a support on the same side of the armature with the magnet and carrying a contact engageable with the armature contact and providing a terminal for the switch; a magnetizable plate secured to the armature near its fixed end, thus permitting the armature to seal against the pole face of the core and permitting the armature portion projecting beyond the plate to bend to produce a wiping action between the contacts when the electromagnet is energized; and means for controlling the position of the armature, said means including a shaft journaled in the base; means for actuating the shaft in one direction of rotation; means carried by the shaft for

transmitting motion from the shaft to the armature; and resilient means engaging said shaft carrying means so as to apply a force to said carrying means in opposition to said actuating means.

8. An electric switch comprising, a base and a cover providing a compartment; a mounting bracket of magnetizable metal supported from the base; a resilient armature blade extending about midway across the compartment and fixed at one end to the mounting bracket and carrying a contact at the other end; armature retaining means in the compartment on one side of the armature, said retaining means comprising an electromagnet having a core extending from the bracket and having a coil connected with the armature; a support on the same side of the armature with the magnet and carrying a contact engageable with the armature contact and providing a terminal for the switch; a magnetizable plate of lesser dimension than the armature secured to the armature in a manner to permit the armature to bend and produce a wiping action between the contacts when the electromagnet is energized; a shaft journaled in the base; fluid actuated means for rotating the shaft in one direction of rotation; a plate carried by the shaft having provisions for operating the armature; and spring means cooperating with the plate for resisting movement of the shaft in said one direction and operating to move the shaft in the opposite direction as the fluid actuated means is reduced.

9. A switch of the type described comprising, a support, a shaft rotatably carried by the support; a pair of spaced abutments movable with the shaft; a flexible armature having one end fixed relative to the support and having its free end so positioned that it will be located between the abutments; normally spaced contacts, one of said contacts being movable with the armature; spring means for urging the shaft in one direction whereby one of the abutments engages the armature to hold normally the movable contacts out of engagement with the other contact; fluid means for rotating the shaft in the opposite direction and causing the other abutment to bias the armature to urge the movable contact into

engagement with the other contact; an electromagnet having a coil electrically connected with one of the contacts; and a flux carrying member carried by the armature and so arranged with respect thereto to permit the flexible armature to bend upon energization of the coil so as to change the relation of the contacting surfaces of the contacts.

10. An electric switch comprising in combination; a rotatable shaft; fluid actuated means for the shaft; a flexible armature having one end fixed and having a contact at the other end; a stationary contact; an electromagnet including a core and a winding; an energizing circuit for the winding including said contacts; means movable with the shaft to bend the armature and move its contact into engagement with the stationary contact causing the winding to be energized whereby the magnet core will exert a force to distort the armature and thereby cause the armature contact to shift the point of engagement; means for actuating the shaft in one direction; and resilient means for resisting movement of the shaft in said one direction.

11. An electric switch comprising in combination; a rotatable shaft; fluid actuating means for the shaft; a flexible armature having one end fixed and having a contact at the other end; a stationary contact; an electromagnet including a core and a winding; an energizing circuit for said winding including said contacts; devices on opposite sides of the armature and movable with the shaft, one of said devices operating to move the armature contact into engagement with the stationary contact when the shaft is rotated in one direction by the fluid actuated means causing the winding to be energized whereby the magnet core will exert a force to distort the armature and causing the armature contact to slide over the stationary contact to change the point of engagement; spring means for resisting the movement of the shaft, said spring means operating to rotate the shaft in the opposite direction as the fluid actuating means is reduced to cause the other device to move the armature and separate the contacts.

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