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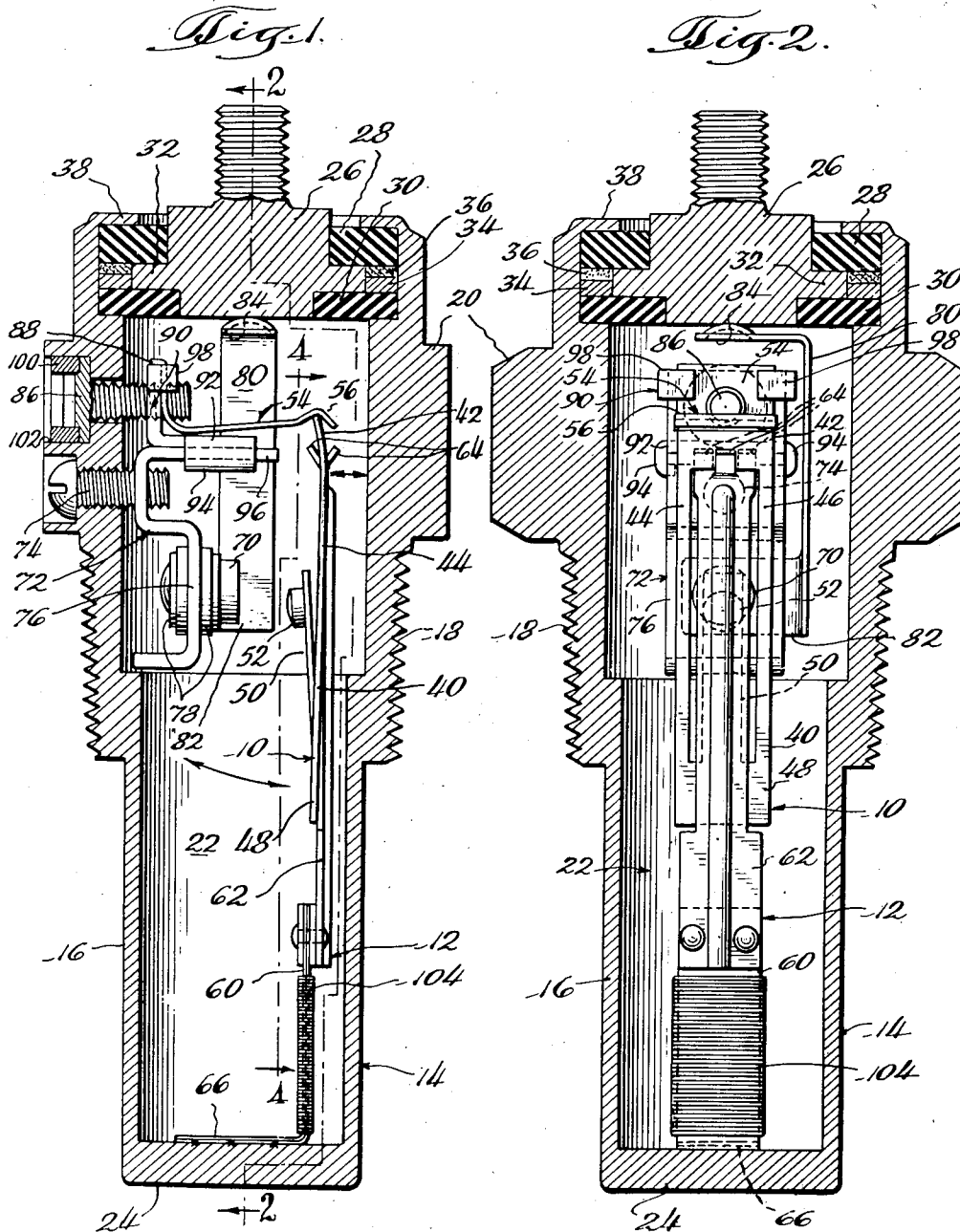
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ELECTRIC SWITCH

Filed Nov. 30, 1944

2 Sheets-Sheet 1



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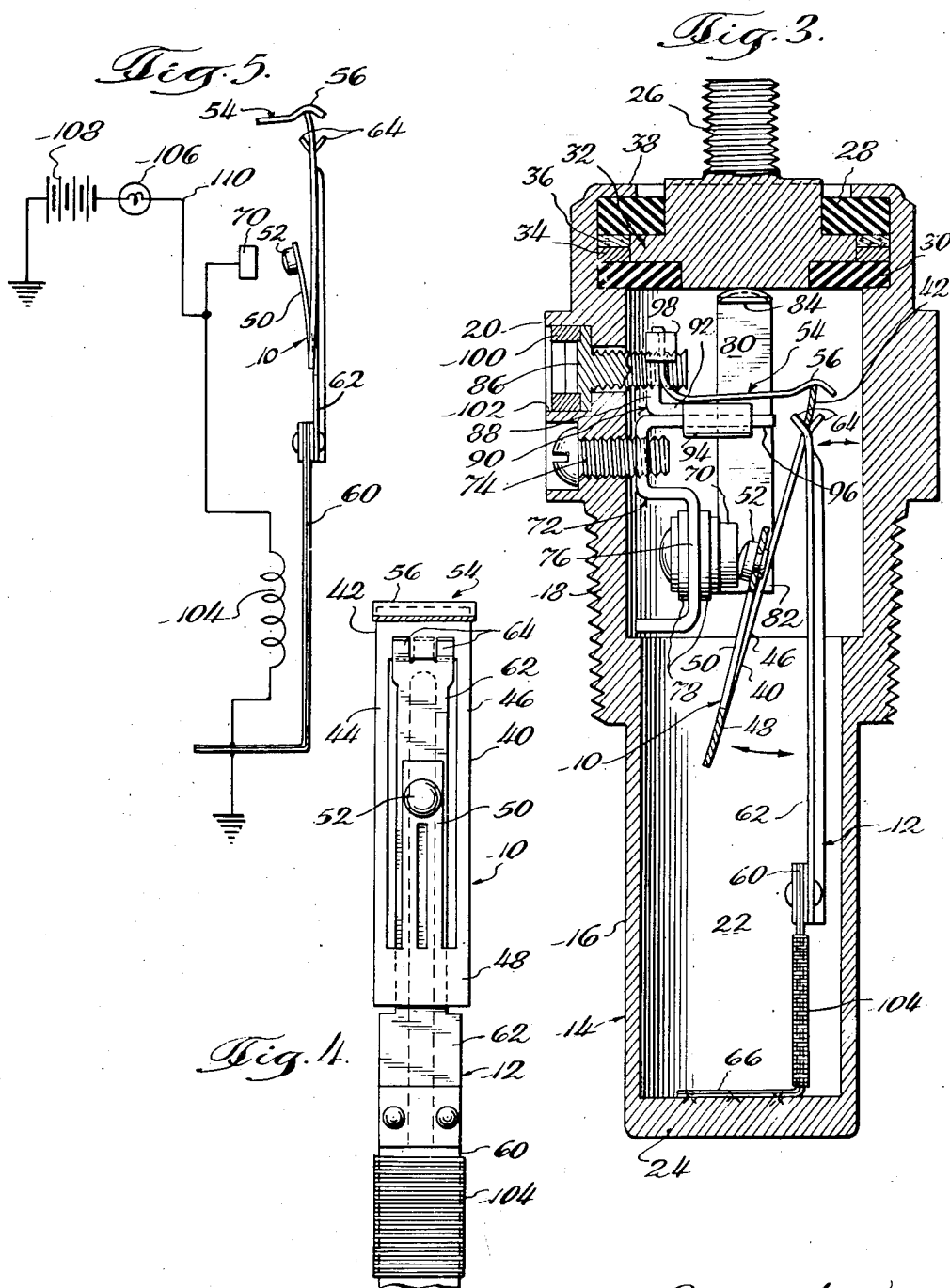
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ELECTRIC SWITCH

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6 Claims. (Cl. 200—138)

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The present invention relates to electric switches and more particularly to temperature responsive snap action switches.

An object of the present invention is to provide a new and improved snap action switch constructed of a minimum of parts and which may be assembled readily and held assembled by a minimum number of securing means, whereby the switch may be manufactured readily and economically.

Another object of the present invention is to provide a new and improved snap action switch wherein the movable contact is moved over a considerable distance and the circuit is both made and broken with a wiping action.

Another object of the present invention is to provide a new and improved snap action switch wherein but slight movement of the actuating means is required to produce a considerable movement of a circuit controlling contact.

A further object of the present invention is to produce a new and improved thermally responsive snap action switch wherein a considerable movement of the circuit controlling contact is effected in response to but a slight movement of thermally actuated means.

A further object of the present invention is to provide a new and improved snap acting toggle switch having a short arm fulcrumed between actuating and biasing means acting upon said arm in a direction normal to the movement of the actuating means.

Another and more specific object of the present invention is to provide a new and improved toggle switch of the character aforesaid wherein the short arm is supported between the switch actuating means and resilient fulcrum and wherein the limits of movement of the contact carrying member, of which the short arm forms a part, are determined by a fixed contact and the actuating means.

A further object of the present invention is to provide a new and improved snap acting electrical switch, the operating range of which may be readily adjusted.

A further object of the present invention is to provide a new and improved thermally responsive snap acting switch which may be readily mounted within a cartridge type housing for insertion into a desired heat exchange medium.

Other objects of the present invention will become apparent from the ensuing description of an embodiment thereof, in the course of which reference is had to the accompanying drawings, in which:

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Fig. 1 is an axial cross-sectional view, upon a considerably enlarged scale, taken through the novel switch and housing of the present invention;

Fig. 2 is a generally axial cross-sectional view of the device shown in Fig. 1, the view being taken along the broken line 2—2 of Fig. 1;

Fig. 3 is a view similar to Fig. 1 illustrating the switch in circuit closing position, as distinguished from the circuit opening position in which it is illustrated in Fig. 1;

Fig. 4 is a fragmentary elevational view of the movable contact carrying member and actuating means, the view being taken along the line 4—4 of Fig. 1; and

Fig. 5 is a diagrammatic circuit arrangement illustrating a manner in which the switch may be used to control a circuit and illustrating also means employed to reduce the operating differential of the switch.

The switch of the present invention is a novel snap acting toggle type switch indicated generally by the reference character 10 operated by actuating means 12 and mounted within a housing 14.

The housing is of a character which may, for convenience, be termed a cartridge housing. It is made of heat conducting metal and is adapted to be inserted into a conduit or the like to contact a heat exchange medium. It comprises a generally tubular thin walled inner end portion 16 and a threaded intermediate portion 18 whereby it may readily be secured to suitable supporting structure, such as a conduit, not shown. Adjacent to and located outwardly from the threaded portion is a portion 20, which may be polygonal in cross section or knurled on its exterior or otherwise configured, to provide a good gripping surface so that the cartridge may be grasped and turned when it is secured to or detached from its supporting structure. The cartridge has a hollow interior 22 closed at the inner end by a bottom 24 integral with the cartridge and at the top by a sealing terminal plug 26.

The terminal plug 26 is insulated from the housing proper by annular insulating washers 28 and 30, securing between them an annular collar 32 integral with the plug. The peripheral surface of the collar 32 is insulated from the housing by an insulating gasket 34 and by a sealing gasket 36 which is also made of insulating material. The plug and insulating material assembly is suitably secured to the outer end of the cartridge as by rolling a portion 38 of the cartridge over the uppermost washer 28. The construction is thus

such that the interior 22 of the housing may be effectively and easily sealed after the switch has been secured within it and adjusted, as will be described shortly.

The novel switch 10 of the present invention is constituted in the main by a preferably resilient and generally rectangular apertured and movable contact carrying member 40 having a short transversely extending toggle arm 42 at its upper end and interconnecting the side pieces 44 and 46 of the member. The lower ends of the side pieces 44 and 46 are connected by a transverse portion 48 from which there extends a tongue 50 carrying a contact 52 and preferably apertured to give it greater resilience. The tongue extends upwardly so that the contact is located at about the center of the member 40. The tongue may be permanently moved or displaced relative to the carrying member so that its normal position is to one side of the member 40 as indicated best in Fig. 1. It may be moved further in that direction should the particular fixed contact mounting be so constructed and arranged that it might be struck by the lower end 48 of the contact carrying member.

In accordance with one of the principal features of the present invention, the toggle arm 42 is made relatively short and the contact 52 is mounted at a distance therefrom so that only a slight movement of the toggle portion is required to effect considerable movement of the movable contact and so that only a short movement need be given to the toggle arm in order to effect the movement of the contact member between its two positions.

In accordance with another feature of the present invention, the snap action is provided by applying a force to the upper end of the toggle portion 42 by resilient means such as the leaf spring 54 provided with a downwardly facing V-shaped fulcrum 56 at its free end adapted to receive the upper end of toggle arm 42.

The movable contact supporting member 40 is moved by the switch actuating means 12 which, in this embodiment of the invention, includes a bimetallic actuating member 60 and an extension 62 secured thereto and terminating in an upwardly facing V-shaped, three-part fulcrum 64 at its upper end adapted to engage the lower side of the toggle arm 42.

The two fulcrums 56 and 64 thus secure the movable contact supporting member 40 in place. In the illustrated embodiment, the major portion of member 40, including the movable contact 52, is disposed to the left of the extension 62. The bimetallic portion 60 is provided with a foot 66 extending at right angles therefrom so that it may readily be secured to the bottom 24 of the cartridge as by spot welding or the like. The switch actuating means is secured near the inner wall of the cartridge, but far enough to provide sufficient clearance for proper operation of the switch and yet provide space for the fixed contact and adjustment means.

The switch includes also a fixed contact 70 mounted upon a stationary bracket 72 secured within the interior of the housing by suitable means such as a screw 74. The contact 70 is secured to a longitudinally extending inset portion 76 of the bracket but is insulated therefrom by suitable means, as a pair of bushings 78. The bracket is prevented from moving by engagement of the lower part thereof with the interior of the cartridge although this movement could be prevented by other suitable means.

The plug terminal 26 is conductively connected to the fixed contact 70 through a resilient contact 80, the lower end 82 of which is secured to and abuts against contact 70, and the upper rounded end 84 of which resiliently engages the underside of the plug 26.

The temperature range of operation of the switch is readily adjusted by shifting one, preferably the upper, fulcrum in a direction normal to the plane of movement of the other fulcrum and the contact supporting member 40. The adjustment is effected by moving the leaf spring 54 as by a rotatable adjusting screw 86 accessible from the exterior of the cartridge and threaded into the upwardly extending portion 88 of a spring supporting bracket 90. The bracket 90 includes a horizontal portion 92 having bent over lugs 94 partly encircling an inwardly extending portion 96 of the stationary contact supporting bracket 72. The leaf spring 54 is secured to the bracket 92 by suitable means such as the bent over lugs 98 at the upper end of the portion 88 of the bracket.

The adjusting screw 86 is held against longitudinal movement by any suitable means such as by a washer 100 secured in an opening 102 at the exterior of the housing and abutting against the head of the screw. Thus, as the screw is rotated, the bracket 92 and leaf spring 54 are movable to shift the fulcrum 56 in opposite directions, depending upon direction of rotation of the screw.

The operating differential of the switch, i. e., the temperature difference required to effect opening and closing of the contacts, may be reduced by the application of heat from a local source in proximity to the bimetallic switch operating member 60. In the illustrated embodiment, the heat is applied by a resistance type heater 104 in heat transfer relationship with the bimetallic member 60. For instance, the heater may comprise a coil of wire wound around but insulated from the bimetallic member. If it is assumed that the bimetallic member 60 itself would open switch at 220 degrees and close at 245 degrees, i. e., with a temperature differential of 25 degrees, this differential can be reduced to a desired lower value by the addition of heat to the bimetallic member when the switch is open. Thus, if the heater 104 adds 20 degrees to the temperature of the bimetallic member when the switch is open, then the switch would still open at 220 degrees, but the actual temperature differential of the fluid medium necessary to effect reclosure would be but 5 degrees.

The switch may control any desired device and in Fig. 5 it has been illustrated as controlling an indicator lamp 106. The lamp is supplied with energy, as is the auxiliary heater 104, from a suitable source of power such as the battery 108, one terminal of which is grounded, and the other connected to the lamp. A conductor 110 leads from the lamp to the fixed contact 70 and to the heater 104. The other terminal of the heater is connected to ground as is the movable contact 52. The ground is constituted by the cartridge 14. The heater is thus effective when the switch is open and is short circuited when the switch is closed.

From the foregoing detailed description of the invention, it may be noted that the switch of the present invention includes but a minimum of parts and that these parts may be assembled readily and held in assembled relation by a minimum of securing means. The switch actuating means may be readily secured to the interior of the casing, as may be the fixed contact and adjusting

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structure. The movable toggle operated switch member is held in position by the stationary part of the switch and by the switch operating mechanism and, primarily, by and between the two fulcrums 56 and 64. After the switch mechanism has been installed within the cartridge, the cartridge is sealed by the plug and insulating means.

The switch is operable between circuit opening and circuit closing positions by the bimetallic thermally responsive means. In the circuit opening position, the movable contact supporting member 40 is biased against the switch actuating means by the action of the leaf spring 54 and the mounting of the toggle arm 42 between the two fulcrums 56 and 64. Thus, the open position of the switch is determined by the switch actuating means, at which time the circuit is opened because the two contacts 52 and 70 are out of engagement.

The switch is closed, in the instant embodiment of the invention, by the application of heat to the bimetallic member 60, which heat flows to it from a fluid heat exchange medium about the closed end of the cartridge. As the bimetallic member is heated, it moves gradually to the left, as viewed in Fig. 1, against the force of the leaf spring, with the result that the fulcrum 64 is gradually moved to the left. When the fulcrum goes beyond a point at which the spring 54 applies a maximum pressure, i. e., when it goes "beyond center," the member 42 snaps to the left and in so doing, the movable contact 52 engages the stationary contact 70. This engagement completes a circuit from terminal 26 to ground, the circuit extending through connector 80, the stationary and movable contacts 70 and 52, the movable contact supporting member 40, and the switch actuating means, of which the bimetallic element 60 is grounded through the connection of portion 66 thereof to the bottom 24 of the cartridge.

The closed position of the switch is illustrated in Fig. 3, from which it may be seen that the movable contact is held against the stationary contact by the leaf spring 54. A comparison of Figs. 1 and 3 indicates also that the movable contact 52 moves over a considerable distance and that such movement occurs as a result of but a relatively slight movement of fulcrum 64 and the switch actuating means. These figures also indicate that a wiping action occurs because of the resilience of the movable contact supporting means.

When the switch cools, the bimetallic member tends to move to the right and, looking now at Fig. 3, it may be seen that as the switch moves to the right, the contact 52 remains in engagement with contact 70 because of the resiliency of member 40 and especially of the tongue 50 and the fulcrum 64 is again moved over center with respect to fulcrum 56. Immediately this happens the spring 54 again moves the movable contact supporting member 40 suddenly to the position in which it is shown in Fig. 1.

The circuit is both made and broken with a wiping action of contact 52 whereby the surface of both contacts is kept clean to insure efficient operation of the switch mechanism.

The adjustment of the temperature range in which the switch operates is effected by moving the fulcrum 56 which is accomplished through rotation of the adjusting screw 86. In initially setting the switch to operate at some temperature, the screw 86 is rotated until the spring sup-

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porting bracket 90 is at its extreme left position as viewed in Figs. 1 and 3. The temperature of the medium is brought up to the temperature at which it is desired the switch should operate. The adjusting screw is then turned so that the fulcrum 56 is moved to a position whereat the switch is unstable and whereat the switch operates. Thereafter, the terminal and sealing means is secured to the open end of the cartridge.

While I prefer to employ the form and arrangement of the parts as shown in the drawings and as above described, the invention is not to be restricted thereto except so far as the claims may be so limited, it being understood that changes might well be made in the form and arrangement of the parts without departing from the spirit of the invention.

I claim:

1. A thermally actuated electric switch, including in combination, a bimetallic thermally actuated longitudinally extending member, means securing one end of said member, an extension secured to the free end of said member having an outwardly facing fulcrum at its free end, a leaf spring extending transversely of said member and said extension having a fulcrum at its one end, means supporting the other end of said spring so that its fulcrum faces the first mentioned fulcrum and is spaced a short distance beyond it, a generally rectangular longitudinally extending contact supporting member having a central longitudinally extending aperture and a tongue-like contact carrying projection extending longitudinally into said aperture from one end thereof, one end portion of said supporting member being secured between and in direct contact with both said fulcrums with the tongue-like projection located to one side of said extension, and a stationary contact mounted further to said one side for engagement by said first mentioned contact when the contact supporting member is in one position.

2. A thermally actuated electric switch, including in combination, a bimetallic thermally actuated longitudinally extending member, means securing one end of said member, an extension secured to the free end of said member having an outwardly facing fulcrum at its free end, a leaf spring extending transversely of said member and said extension having a fulcrum at its one end, means supporting the other end of said spring so that its fulcrum faces the first mentioned fulcrum and is spaced a short distance beyond it, a generally rectangular longitudinally extending contact supporting member having a central longitudinally extending aperture and a tongue-like contact carrying projection extending longitudinally into said aperture from one end thereof, one end portion of said supporting member being secured between said fulcrums with the tongue-like projection located to one side of said extension, and a stationary contact mounted further to said one side for engagement by said first mentioned contact when the contact supporting member is in one position, said supporting means for the leaf spring being adjustable to shift its fulcrum portion transversely of the other fulcrum to adjust the operating temperature of the switch.

3. A thermally actuated electric switch, including in combination, a heat conducting cylindrical housing having a bottom, a bimetallic thermally actuated longitudinally extending member, means securing one end of said member to the bottom of said housing so that said member is located near the inner wall of the housing, an extension secured to the free end of said member having an

outwardly facing fulcrum at its free end, a leaf spring extending transversely of said member and said extension and having a fulcrum at its free end, means securing the other end of said spring to a wall of said housing so that its fulcrum faces the first mentioned fulcrum and is spaced a short distance beyond it, a generally rectangular longitudinally extending contact supporting member having a central longitudinally extending aperture and a tongue-like contact carrying projection extending longitudinally into said aperture from one end thereof, the other end of said supporting member being secured between said fulcrums with the tongue-like projection located at the side of said extension which faces away from the near wall of said housing, and a stationary contact mounted in said housing in position for engagement by said first mentioned contact when the contact supporting member is in circuit closing position, said means which secures the leaf spring to the wall of the housing being accessible from the outside of the housing and adjustable to shift the fulcrum portion of said spring transversely of the other fulcrum to adjust the operating temperature of the switch.

4. A thermally actuated electric switch, including in combination, a heat conducting cylindrical housing having a closed bottom and an open top, a bimetallic thermally actuated longitudinally extending member, means securing one end of said member to the bottom of said housing so that said member is located near the inner wall of the housing, an extension secured to the free end of said member having an outwardly facing fulcrum at its free end, a leaf spring extending transversely of said member and said extension and having a fulcrum at its free end, means securing the other end of said spring to a wall of said housing so that its fulcrum faces the first mentioned fulcrum and is spaced a short distance beyond it, a generally rectangular longitudinally extending contact supporting member having a central longitudinally extending aperture and a tongue-like contact carrying projection extending longitudinally into said aperture from one end thereof, the other end of said supporting member being secured between said fulcrums with the tongue-like projection located to the side of said extension opposite the near wall of said housing, a stationary contact mounted in said housing at said opposite side for engagement by said first mentioned contact when the contact supporting member is in circuit closing position, an insulated sealing cap for the upper end of the housing having circuit completing means for the stationary contact, and a conductor extending from said contact engageable with said circuit completing means by placement of the cap in sealing position.

5. A thermally actuated electric switch, including in combination, a heat conducting cylindrical housing having a bottom, a bimetallic thermally

actuated longitudinally extending member, means securing one end of said member to the bottom of said housing so that said member is located near the inner wall of the housing, local heating means in said housing in heat transfer relationship to the bimetallic member, an extension secured to the free end of said member having an outwardly facing fulcrum at its free end, a leaf spring extending transversely of said member and said extension and having a fulcrum at its free end, means securing the other end of said spring to a wall of said housing so that its fulcrum faces the first mentioned fulcrum and is spaced a short distance beyond it, a generally rectangular longitudinally extending contact supporting member having a central longitudinally extending aperture and a tongue-like contact carrying projection extending longitudinally into said aperture from one end thereof, the other end of said supporting member being secured between said fulcrums with the tongue-like projection located to the side of said extension opposite the near wall of said housing, and a stationary contact mounted in said housing at said opposite side for engagement by said first mentioned contact when the contact supporting member is in circuit closing position.

6. An electric switch including in combination, means defining a first fulcrum, means defining a second and movable fulcrum spaced a short distance from the first, a movable contact supporting member supported by said fulcrums and having a contact carrying portion extending therefrom, a stationary contact disposed to one side of said movable contact supporting member, means biasing said first mentioned fulcrum toward the second, means for moving said second fulcrum over center with respect to the first fulcrum, thereby to move said contact supporting member to effect engagement of said contacts when the movement is in one direction and to effect disengagement when the movement is in the opposite direction, and means on said movable contact supporting member engageable with said fulcrum moving means to limit movement of said contact supporting means in the direction in which disengagement of said contacts is effected.

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