June 3, 1941. E. W. RICKMEYER 2,244,347

SWITCH

Filed March 15, 1939 3 Sheets-Sheet 1

Fig. 1

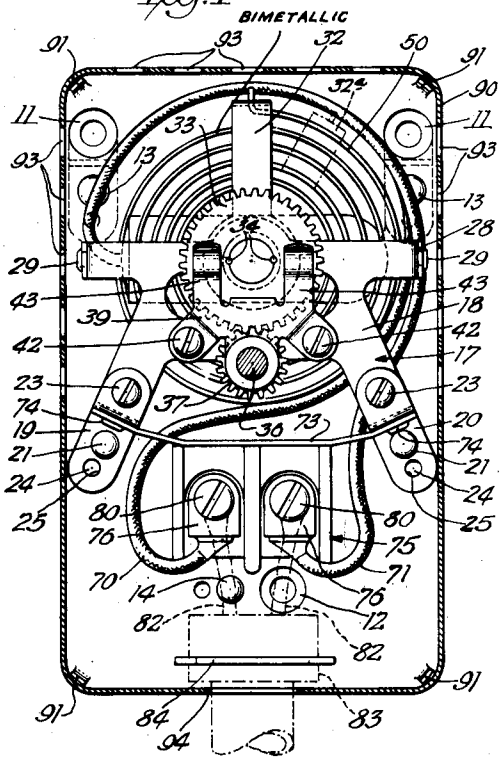


Fig. 2

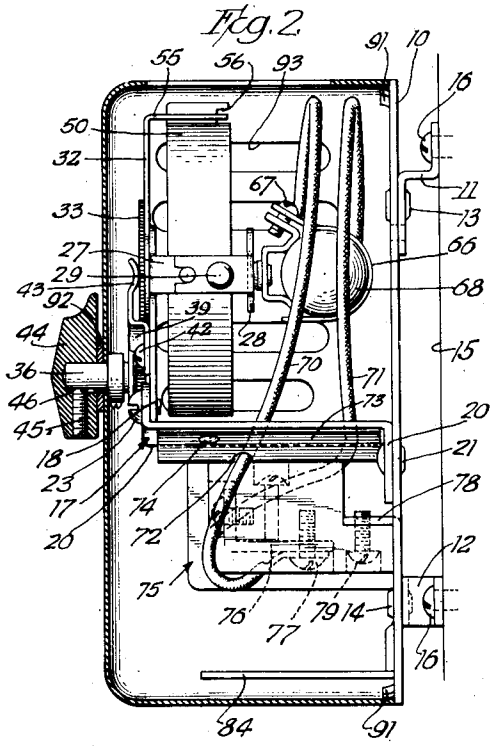


Fig. 3

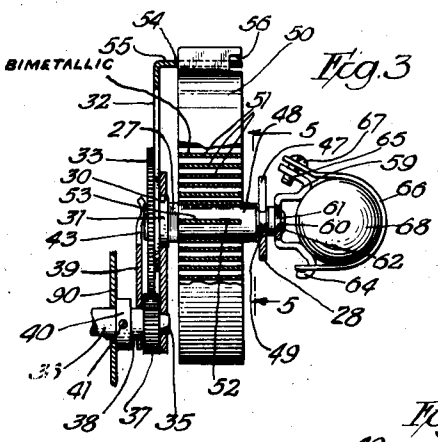


Fig. 4

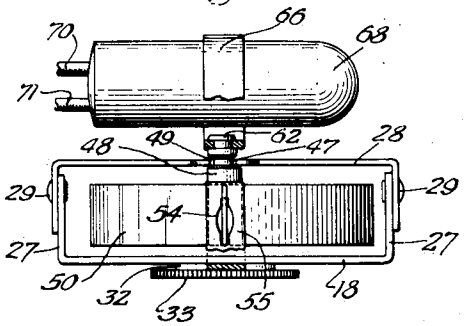
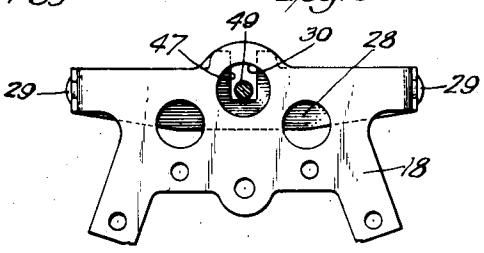


Fig. 5



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SWITCH

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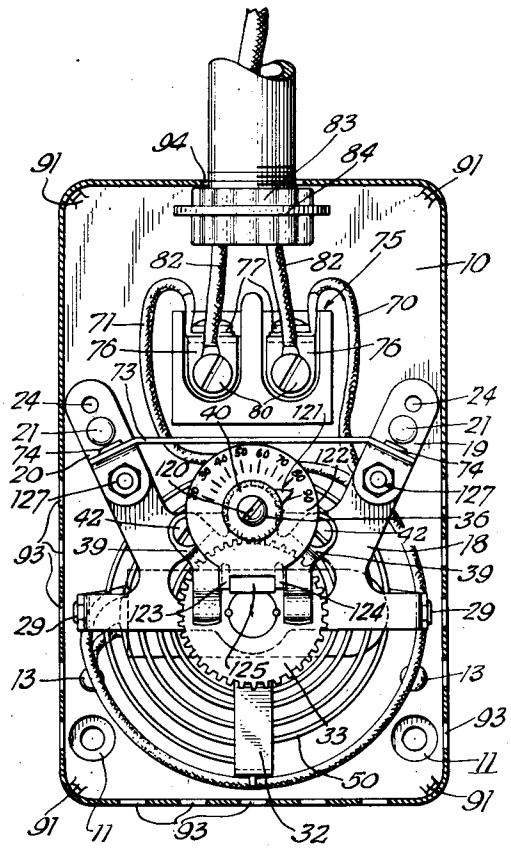


Fig. 6

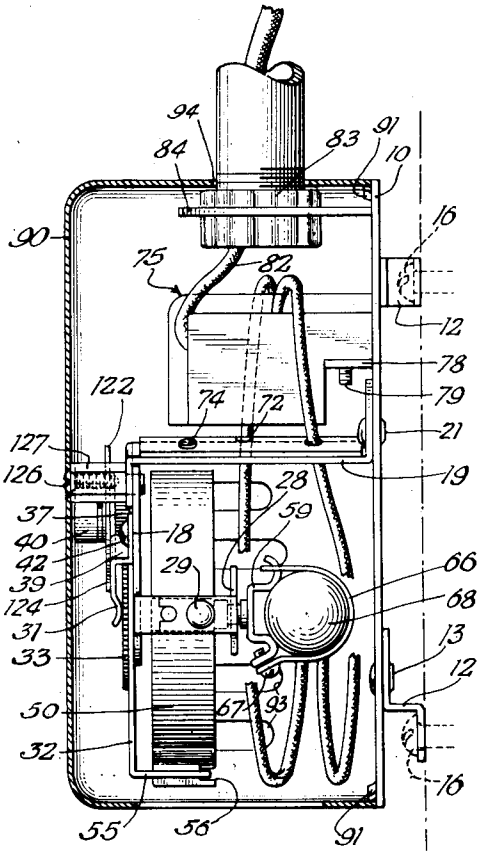


Fig. 7

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SWITCH

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Fig. 8

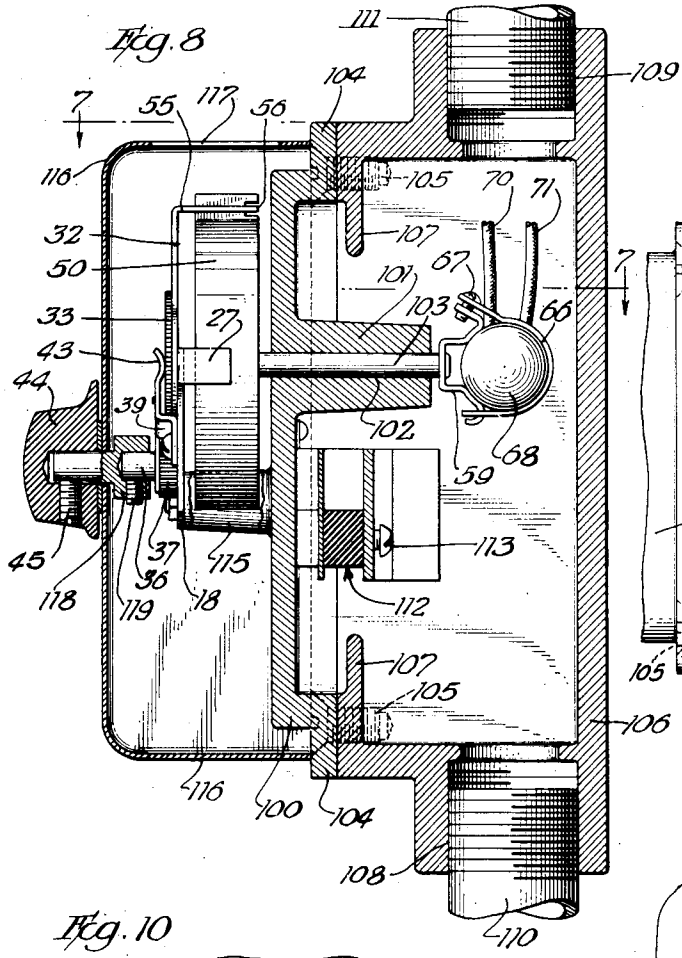


Fig. 9

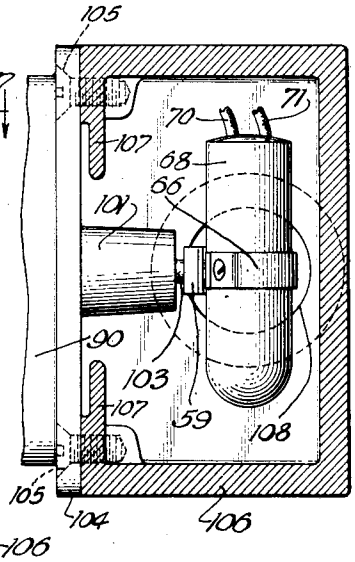


Fig. 10

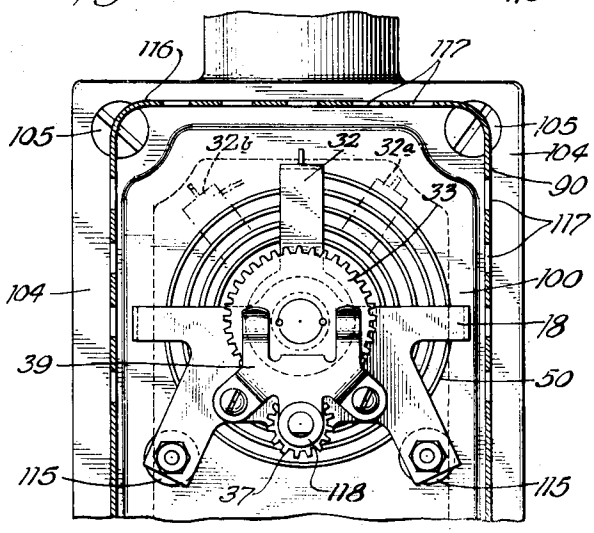
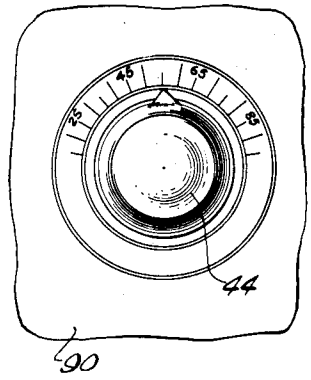


Fig. 11



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Patented June 3, 1941

2,244,347

UNITED STATES PATENT OFFICE

2,244,347

SWITCH

Ernst Walter Rickmeyer, Elmhurst, Ill., assignor to Jefferson Electric Company, Bellwood, Ill., a corporation of Illinois

Application March 15, 1939, Serial No. 261,993

10 Claims. (Cl. 200—139)

My invention relates to switches, and more particularly to adjustable automatic switches.

It is an object of my invention to provide a switch having a temperature responsive element for actuating a mercury switch or contact unit.

Another object of my invention is to provide a switch utilizing a mercury switch or contact unit for making and breaking an electrical circuit responsive to actuation by a temperature responsive element, which switch is easily and quickly adjustable to vary the temperatures at which operations of the mercury switch unit are effected.

Another object of my invention is to provide an automatically actuated switch, the structure of which is such that frictional resistance to movement and binding of the operating parts thereof are minimized.

Another object of my invention is to provide a compact, adjustable, thermostatically operated switch that is easily manufactured and assembled.

Other objects and advantages of my invention will be apparent from the following description taken in connection with the accompanying drawings in which similar characters of reference indicate similar parts throughout the several views.

In the drawings:

Figure 1 is a front elevation of a switch embodying a preferred form of my invention with a part thereof shown in section.

Figure 2 is a side elevation of the switch shown in Figure 1 which also has a part thereof shown in section.

Figure 3 is a fragmentary side view of a portion of the switch shown in Figures 1 and 2 having parts thereof cut away to show the construction thereof.

Figure 4 is a fragmentary top view of a portion of the switch shown in Figures 1 and 2 with parts thereof cut away to show details of construction.

Figure 5 is a fragmentary sectional view taken substantially on line 5—5 of Figure 3 and in the direction of the arrows.

Figures 6 and 7 are respectively front and side elevations of a switch embodying a modified form of my invention and each having a part thereof shown in section.

Figure 8 is a side elevation of a modified form of my present invention having parts thereof shown in section.

Figure 9 is a fragmentary sectional view taken substantially on line 7—7 of Figure 8 and in the direction of the arrows.

Figure 10 is a fragmentary front view of the switch shown in Figure 8 having a part thereof shown in section.

Figure 11 is a fragmentary view of a portion of the switches shown in Figures 2 and 8.

Having particular reference to Figures 1 to 5 inclusive, the switch has a base plate 10 to which feet such as 11 and 12 are secured by rivets 13 and 14 respectively, or other suitable fastening means, for securing the switch in spaced relation with respect to a wall or mounting 15. The feet are secured to the wall or mounting 15 by screws such as 16 or other suitable fastening means. A bracket 17 comprising a yoke 18 and yoke supports 19 and 20 is secured to the base 10 by rivets 21 or other suitable fastening means. The yoke supports 19 and 20 are secured to the yoke 18 by screws 23 that are preferably threaded into the yoke 18. The yoke supports 19 and 20 are preferably angularly located and prevented from rotation by extruded portions 24 of the base that extend into openings 25 in the yoke supports. The yoke 18 has angularly disposed arms 27 on the sides thereof to which a frame member 28 is secured by rivets 29 or other suitable fastening means.

The yoke 18 has an opening 30 therein in which a stud 31 is rotatably mounted. The stud 31 has an arm 32 and a gear 33 press-fitted thereon and secured thereto by riveting as at 34, the arm 32 being located intermediate the gear 33 and the yoke 18. The yoke 18 also has an opening 35 therein which provides a bearing for a shaft 36 on which a pinion gear 37 is pressed, which pinion gear 37 meshes with the gear 33. The shaft passes through an opening 38 in a friction yoke 39 which friction yoke is intermediate the gear 37 and a collar 40 which is secured to the shaft by a set screw 41 or other suitable means. The friction yoke 39 is secured to the yoke 18 by screws 42 that extend through the friction yoke and are threaded into the yoke 18. The friction yoke 39 has fingers 43 that press against the surface of the gear 33 to hold that gear and the stud 31 in position with respect to the yoke 18. The friction yoke 39 also holds the shaft 36 and the pinion gear 37 in position with respect to the yoke 18 and the gear 33. A manual adjusting knob 44 is secured to the shaft 36 by a set screw 45 that is preferably threaded into the knob 44 and engages a flat portion 46 of the shaft. By manual adjustment of this knob 44 rotation of the arm 32 is effected through the meshing gears 37 and 33.

The frame member 28 preferably has an open

slot 47 therein that is substantially in axial alignment with the opening 30 in the yoke 18 and provides a support for a shaft 48. The shaft 48 has a grooved portion 49 that fits into the slot 47. The width of the section of the grooved portion 49 is preferably less than the width of the slot 47 and the width of the groove of the grooved portion 49 is preferably greater than the thickness of the frame member 28 so that the shaft has freedom of movement transverse to the axis thereof and angularly as well as in rotation. This bearing structure limits binding of the shaft and provides an anti-friction self-aligning support for the shaft 48.

A bi-metallic temperature or thermal responsive element 50 is spirally wound with the turns thereof spaced from each other as indicated at 51 in Figure 3. The inner end 52 of the temperature responsive element 50 is secured to the shaft 48 by engagement with a slot 53 in the shaft. The turns of the temperature responsive element 50 surround the shaft and the outer end thereof is anchored in a slot 54 in an angularly disposed portion 55 of the arm 32. The temperature responsive element 50 is preferably notched at 56 to lock the anchored end in assembled position with respect to the portion 55 of the arm 32. Also the anchored end of the temperature responsive element 50 preferably fits loosely into the slot 54 to provide some play and to thereby prevent distortion or resistance to the movement of the temperature responsive element 50 due to movement of the arm 32 or normal flexure of the temperature responsive element. It is, therefore, apparent that the shaft 48 is supported by the temperature responsive element 50 and the bearing provided by the slot 47 in the frame member 28.

A bracket 59 has an opening 60 therein through which a portion 61 of the shaft extends. The bracket 59 is secured to the shaft by riveting the end of the shaft as at 62. The bracket 59 has a hook 64 on one side thereof and a lug 65 on the other side. A strap 66 engages the hook 64 and is secured to the lug 65 by a screw 67 that extends through the strap and is threaded into the lug 65. The bracket 59 and the strap 66 provide a clamp for securing a mercury switch or contact unit 68 to the shaft for movement thereby. The mercury switch or contact unit 68 may be any standard mercury switch element, the structures of which are well known in the art and which make and break an electrical circuit by the movement of a quantity of mercury within a housing or enclosure which is preferably sealed. With this type of switching element the making and breaking of the electrical circuit controlled thereby is dependent upon the position of the mercury switch which in turn controls the position of the mercury within the switch.

Connections are made to the mercury switch or contact unit 68 by lead wires such as 70 and 71. These lead wires 70 and 71 preferably extend through openings such as 72 in a lead support 73 that is preferably made of insulating material. The lead support 73 is secured to the yoke supports 19 and 20 by rivets 74 or other suitable fastening means. The leads 70 and 71 are preferably anchored to a terminal block assembly 75, the leads being attached to terminal strips such as 76 by screws 77. The terminal block assembly 75 is secured to a bracket 78 on the base 10 by screws such as 79. Screws 80 that are threaded into the terminal strips 76 provide binding posts for anchoring connecting wires 82 that extend to the switch from the controlled circuit through a conduit 83 such as that indicated by dotted lines in Figure 1. A bracket 84 that is secured to the base 10 provides an anchor for a conduit such as 83.

A cover or housing 90 engages the base 10 and is located with respect thereto by lugs such as 91 that are integral with the corners of the base 10. The cover is held in position by the adjusting knob 44 and a washer 92 is preferably interposed between the knob 44 and the cover or housing 90 to space the knob from the cover and to prevent the knob from rubbing on the cover. The cover 90 has openings such as 93 in the sides thereof to permit the circulation of air through the housing or cover and around the temperature responsive element 50. The housing or cover 90 also has an opening 94 through which the connecting wires such as 82 and the conduit such as 83 pass.

In the assembly of the switch shown in Figures 1 to 5 inclusive, the yoke supports 19 and 20, the yoke 18, the frame member 28 and the terminal block assembly are secured in position with respect to the base 10 and as described. The sub-assembly, comprising the temperature responsive element 50 and the shaft 48 that is secured thereto, is assembled with respect to the arm 32 that has the gear 33 secured thereto by hooking the outer end of the temperature responsive element 50 into the slot 54. The grooved portion 49 of the shaft is then dropped into the slot 47 and the stud 31 is put into the opening 30. While held in this position the sub-assembly including the shaft 36, pinion gear 37, collar 40, and friction yoke 39 is put in position with the pinion gear 37 meshing with the gear 33 and secured in that position by the screws 42 that extend through the friction yoke 39 and are threaded into the yoke 18. Since the friction yoke holds the pinion gear 37 and the shaft 36 in place and has fingers 43 that engage the gear 32 to hold the sub-assembly, including the gear 33, arm 32 and stud 31, in place, the operating parts of the switch are held in assembled relation with respect to the base 10 and support structure by the friction yoke 39. Thus final assembly or disassembly of the various sub-assemblies of the switch structure is effected by the tightening or removal of the screws 42.

In the operation of the switch the mercury switch or contact element is secured to the end of the shaft for rotation therewith responsive to flexure of the bi-metallic temperature responsive element 50. Since the position of the mercury switch or contact element 68 determine whether a circuit is made or broken thereby, the necessary movement for effecting a given operation of the switch or contact element 68 and the necessary flexure of the bi-metal for producing that movement may be adjusted or varied by varying the position of the anchored end of the temperature responsive element 50. Manual adjustment of the position of the anchored end of the temperature responsive element 50 is effected by adjustment of the knob 44 which, through the meshing gears 33 and 37, turns and adjusts the position of the arm 32. The frictional engagement between the gear 33 and the fingers 43 on the friction yoke 39 is sufficient to hold the arm 32 in its adjusted position. Inasmuch as the necessary flexure of the tem-

perature responsive element 50 for effecting operation of the mercury switch or contact element 68 is varied by the adjustment of the arm 32, the temperatures at which the circuit controlled by the switch will be made and broken will also be varied by the adjustment.

Since the slot 47 is wider than the grooved portion 49 of the shaft and the groove in the shaft is wider than the thickness of the frame member 28, the operation of the shaft is practically frictionless. As an additional feature of this bearing support for the shaft the tendency toward resistance of the movement of the shaft due to binding is also limited by the freedom of the shaft to move angularly or transversely without binding.

With particular reference to Figures 6 and 7, the switch disclosed therein is substantially similar to that disclosed in Figures 1 to 5 inclusive, except that it is mounted in an inverted position and includes an adjusting means that is more tamper-proof than that utilized in the switch shown in Figures 1 to 5 inclusive. Reference numerals in Figures 6 and 7, similar to those previously used, refer to like parts. The shaft 36 in Figures 6 and 7 is shorter than that shown in Figures 1 and 2 and has a slot 120 in the end thereof for accommodating a screw driver or similar instrument in effecting adjustment of the switch. The collar 40 has an indicator or pointer 121 thereon adjacent an indicating plate 122, which plate has numbers thereon for indicating the setting of the switch. The indicating plate 122 is held in position with respect to the shaft 36 by the collar 40 and has fingers or lugs 123 and 124 that engage the sides of the lug 125 on the friction yoke 39 to prevent the indicating plate from turning with the shaft 36. The cover 90 is secured in position by screws such as 126 that extend through the cover and are threaded into studs such as 127 which studs are secured to the yoke supports 19 and 20. When the cover 90 is thus secured in position it covers the indicating plate 122 and the end of the shaft 36 so that changes in the adjustment cannot be made without removal of the cover.

Referring particularly to Figures 8 to 11 inclusive, reference numerals similar to those previously used designate like parts.

The switch shown in Figures 8 to 10 inclusive is quite similar in structure and operation to the switch shown in Figures 1 to 5 inclusive, but is modified in certain respects to be explosion-proof and particularly adapted for use where there is danger of explosion from any arc that might occur in an open switch. In the disclosed embodiment of this explosion-proof switch a base 100 is preferably heavier than the base 10 and has an integral extending portion 101 that provides a sleeve bearing 102 for a shaft 103, the surface of which bearing is preferably long. The base 100 has flanges such as 104 integral with the edges thereof through which screws such as 105 extend to secure the base 100 to a housing 106, the screws 105 being threaded into flanges such as 107 on the housing 106. The base 100 and housing 106 provide an enclosure for the mercury switch or contact element 68 and the lead wires 70 and 71 that are connected thereto. The housing 106 also has threaded openings 108 and 109 therein into which conduit pipes such as 110 and 111 are screwed to enclose the wiring from an outside circuit that extends to this switch. An insulating terminal block assembly 112 is secured to the base 100 within the housing 106 and has screws such as 113 for anchoring the wiring.

The temperature responsive element 50 is secured to the shaft 103 on the opposite side of the base 100 from the mercury switch or contact element 68. The adjusting structure and the operation of the temperature responsive element are quite similar to the adjusting structure and operation of the switch shown in Figures 1 to 5 inclusive. However, the yoke 18 is secured to posts 115 that are preferably integral with the base 100 and the frame member 28 is unnecessary because the shaft bearing is provided by the base 100. A cover 116 having openings 117 for the circulation of air around the temperature responsive element adjoins the base 100 and is held in position by the knob 44. The knob 44 of this switch is mounted on a shaft extension 118 that is secured to the shaft 36 by a set screw 119.

While I have illustrated and described a preferred embodiment and certain modifications of my invention, many modifications may be made without departing from the spirit of my invention, and I do not wish to be limited to the precise details set forth, but desire to avail myself of all changes within the scope of the appended claims.

I claim:

1. A switch comprising, in combination, support means including a bracket and a frame member, said frame member having a slot therein, a shaft having a diameter greater than the width of the slot and having a circumferential groove therein the inner diameter of which is less than the width of the slot by an amount such that free side play of the shaft is provided for, the grooved portion of said shaft being disposed in said slot to provide an anti-friction support bearing for the shaft, a mercury switch unit carried by the shaft for movement therewith, an adjustable arm supported by the bracket, a spirally disposed bi-metallic temperature responsive element having one end connected to the arm and adjustable to various positions therewith and the other end secured to the shaft for effecting rotary movement of the shaft responsive to flexure of the element.

2. A switch comprising, in combination, support means including a bracket and a frame member, said frame member having a slot therein, a shaft having a diameter greater than the width of the slot and having a circumferential groove therein the inner diameter of which is less than the width of the slot, the grooved portion of said shaft being disposed in said slot and free for limited side and end play to provide an anti-friction support bearing for the shaft, switch means actuated by rotary movement of the shaft, a bi-metallic temperature responsive element connected to the shaft for effecting rotary movement thereof in response to temperature changes, and means adjustably supporting the other end of the bi-metallic element.

3. A switch comprising, in combination, support means including a bracket and a frame member, said frame member having a slot therein, a shaft having a diameter greater than the width of the slot and having a tapered circumferential groove therein the width of which is greater than the thickness of the frame member and the inner diameter of which is less than the width of the slot, the grooved portion of said shaft being loosely disposed in said slot to provide an antifriction support bearing for the shaft, switch means actuated by rotary move-

ment of the shaft, a temperature responsive element for rotating the shaft to actuate the switch means, and means for adjusting the movement of the temperature responsive element necessary to effect operation of the switch means.

4. A switch comprising, in combination, support means including a frame member, said frame member having a slot therein, a shaft having a portion of smaller diameter than the width of the slot, said portion of the shaft being loosely disposed in the slot to provide an anti-friction bearing for the shaft, switch means actuated by movement of the shaft, a temperature responsive element secured to the shaft, and means connected to and supporting the temperature responsive element, said anti-friction bearing and the temperature responsive element being the only supports for the shaft.

5. A switch comprising, in combination, support means including a frame member, said frame member having a slot therein, a shaft having a portion of smaller diameter than the width of the slot, said portion of the shaft being loosely disposed in the slot to provide an anti-friction bearing for the shaft, switch means actuated by movement of the shaft, a temperature responsive element secured to the shaft, and means connected to and supporting the temperature responsive element, said anti-friction bearing and the temperature responsive element being the only supports for the shaft, the engagement between said slot and said portion of the shaft and the supporting connection between the last mentioned means and the temperature responsive element being sufficiently loose to allow play and limit binding and friction in movement.

6. A switch comprising, in combination, support means, a shaft, switch means actuated by movement of the shaft, self-aligning bearing means providing a support for the shaft, a temperature responsive element secured to the shaft, and means loosely anchoring the temperature responsive element, said temperature responsive element having sufficient freedom of movement with respect to the last mentioned means that movement thereof and movement of the shaft in the self-aligning bearing means limits binding and friction in the operation of the switch.

7. A switch comprising, in combination, support means, a shaft, switch means actuated by movement of the shaft, self-aligning bearing means providing a support for the shaft, a temperature responsive element secured to the shaft, and means anchoring the temperature responsive element, the last mentioned means being adjustable to various positions to vary the operating temperature of the switch, said temperature responsive element having sufficient freedom of movement with respect to the last mentioned means that movement thereof and movement of the shaft in the self-aligning bearing means limits binding and friction in the operation and adjustment of the switch.

8. A switch comprising, in combination, support means including a bracket and a frame member, said bracket having an opening therein and said support having an open slot bearing therein, a shaft rotatably supported in said open slot bearing, an arm secured to a stud, said stud being rotatably mounted in said opening for adjustment to various positions, a spirally wound thermostatic element supported by said arm and secured to the shaft, a member secured to the bracket and having fingers holding the stud in position, and switch means actuated by rotary movement of the shaft effected by the thermostatic element.

9. A switch comprising, in combination, support means, a shaft, a stud, an arm secured to the stud, said support means providing one bearing for rotatably supporting the shaft and another bearing for rotatably supporting the stud, a thermostatic element secured to the shaft and supported by the arm, switch means actuated by the shaft, and means removably secured to the support means for holding the stud in position and thereby holding the arm, thermostatic element and shaft in assembled relation.

10. In a switch, the combination comprising a switch operating shaft, a mercury switch carried by the shaft for movement therewith, means providing an open slot bearing for the shaft, said shaft having a tapered circumferentially grooved portion of smaller diameter than the width of the slot disposed loosely in said slot to provide an anti-friction bearing for rotary movement of the shaft.

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