

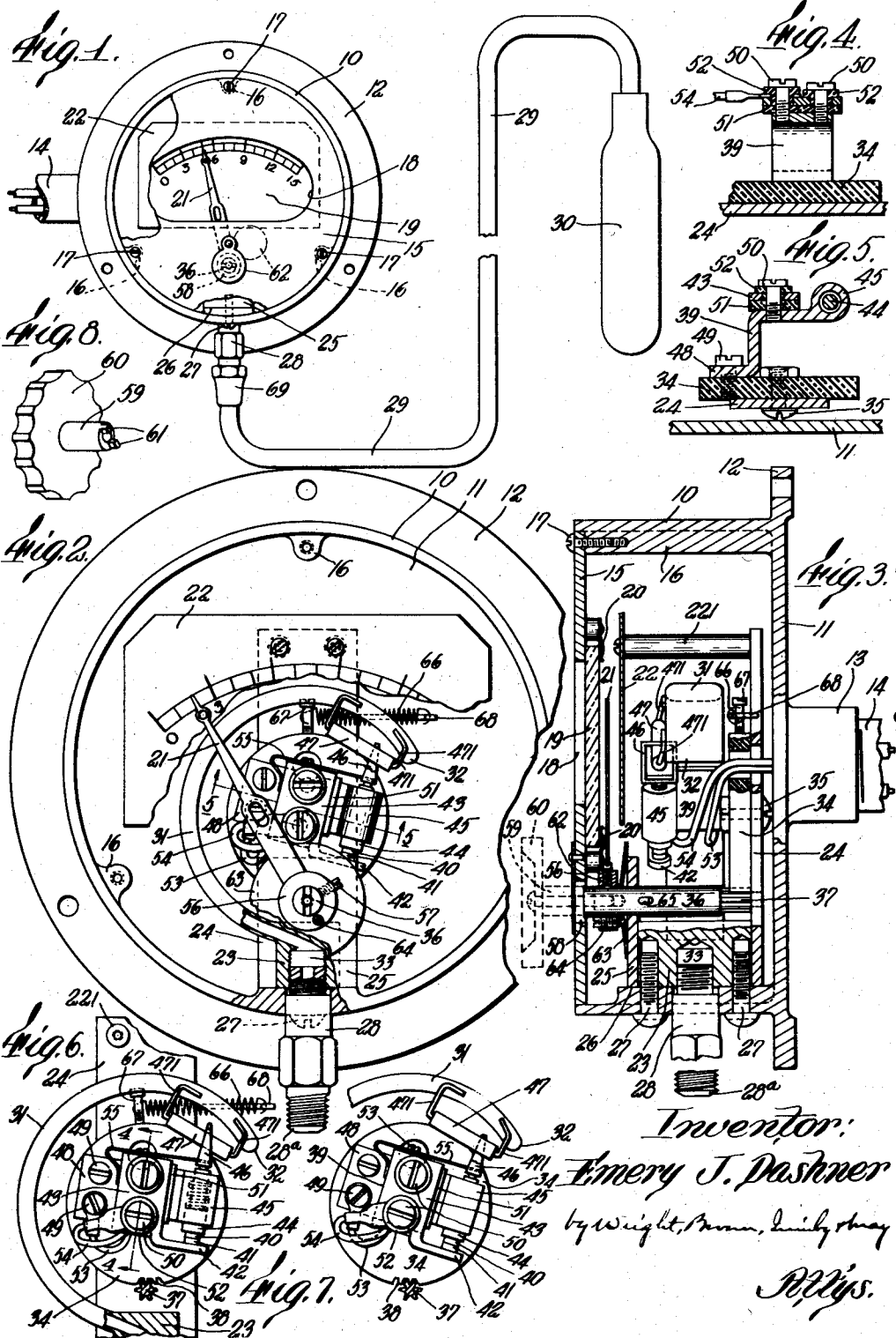
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PRESSURE OPERATED ELECTRIC SWITCH

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UNITED STATES PATENT OFFICE

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PRESSURE OPERATED ELECTRIC SWITCH

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This invention relates to electric switches adapted to be operated by fluid pressure, heat generated, or by other heat-responsive means, so as to open or close an electric circuit controlling a heating unit when the temperature of a body or medium heated by such unit reaches a prescribed maximum or minimum value as the case may be. A switch of that type is illustrated in my pending application Serial No. 330,312, filed January 4, 1929. The switch there shown is equipped also with adjusting means by which to regulate the point or points in the temperature and pressure range at which opening and closing of the switch contacts will occur.

The present invention has for its object to provide certain improvements and new features in an electric switch of the type above indicated by which, first, to adapt the switch to conditions of wiring prescribed by the insurance underwriters, and at the same time avoid disarrangement of the delicately adjusted contacts and operating parts; second, to simplify and reduce the cost of providing case and switch combinations in different capacities and designs; third, to provide improved adjustable friction means for retaining the adjustments of the switch; fourth, to provide easily mountable and demountable means for taking up backlash in the moving parts by which such pressure adjustments of the switch are made. There are also other improvements which will appear as the detailed description of the invention proceeds.

In the drawing,—

Fig. 1 is a front elevation of a pressure operated switch embodying this invention; Fig. 2 is a front elevation on a larger scale of the interior parts of the switch;

Fig. 3 is a vertical central section of the switch;

Figs. 4 and 5 are detail sections taken on the lines 4—4 and 5—5 respectively of Figs. 2 and 6;

Figs. 6 and 7 are elevations of the switch and its adjustable mount, showing two of the different adjustments thereof;

Fig. 8 is a perspective view of a demountable switch adjusting key.

Like reference characters designate the same parts wherever they occur in all the figures.

For purposes of illustration the switch and actuating parts here shown are substantially like that shown in my aforesaid prior application, except for the new improvements hereinafter described, and the circuit making and breaking elements are operated by fluid pressure generated by heat. However, it is to be understood that the new features may be embodied in instruments of specifically different characteristics, and the temperature governed effects may be performed by other means than a confined fluid.

Describing now this specific illustration, but without limiting intent, it comprises a cylindrical case 10 open at the front and having a back wall 11 with an encircling outer flange 12 and an internally threaded nipple 13 at the rear, into which is screwed a pipe or conduit 14 containing the electrical conductors of the circuit to be controlled by the switch. A cover plate 15 is fitted within the rim of the case, abutting against bosses 16 therein and is secured by screws 17. This cover plate has a window opening 18 across which is set a transparent pane 19 held by spring clips 20 which are mounted on the back of the plate. This window gives a view of a pointer or hand 21 and a dial or scale plate 22.

Requirements of the insurance underwriters necessitate enclosing the electrical conductors running to and from the switch in a conduit screwed to the case substantially as above described, or in an equivalent way. Workmen in screwing these parts together are liable to distort the case more or less. I have found that with instruments where the movable parts of the switch are mounted directly on the case there is a tendency for such distortion to throw such parts out of adjustment so that after installation they will operate differently than before. These switches have delicately adjusted parts, which need to be set within a close range of accuracy in order to serve their intended pur-

poses, and the mal-adjustment resulting from the distortion referred to may seriously impair the performance of the switch, or at least change the relation between its operating and indicating parts. I have overcome this difficulty, and also simplified and reduced the expense of manufacture, by mounting the switch and its adjustable parts in an independent frame which is mounted on the case in such a way as to be unaffected by distortion of the character referred to. This constitutes one of the important phases of the invention.

Such frame consists of a block 23 having secured to one end a plate 24 and to the other end a plate 25. It is secured against a flattened abutment surface 26 of the side wall of the case by screws 27, and is drilled and tapped to receive a pipe fitting or nipple 28 for connection with a tube 29 (Fig. 1) filled with fluid and leading from a fluid container 30 which is adapted to be heated, directly or indirectly, by the electric heating unit of which the circuit is controlled by the switch. A curved spring tube 31, of flattened cross section and closed at its outer end 32, adapted to be distorted by pressure variations in proportion to the degree of pressure, is secured to the block 23 so as to communicate with the socket 33 therein which is entered by nipple 28. As the ultimate cause of distortion of the tube is a change of temperature, the tube may be considered generically as a temperature-responsive distortable element.

A switch base 34 is connected to the rear plate 24 of the frame by means of a pivot 35 about which the base plate is adapted to turn. A shaft 36 is journaled in the frame plates 24 and 25 and has a gear pinion 37 which meshes with teeth 38 in the circumference of base plate 34, as shown in Figs. 6 and 7, whereby the base plate may be turned through any desired angle.

A holder 39 is secured to the base plate and supports switch contact 40. The complementary switch contact 41 is mounted on an arm 42 which projects from a plate 43 mounted on the front of holder 39. Contact 40 is carried by a plunger 44 mounted slidingly in a cylindrical guide 45 which forms part of holder 39. This plunger is pressed toward the contact 41 by a spring contained in the cylindrical guide. It protrudes from the opposite end of the guide and there carries a frame 46 which embraces a bar 47 carried by the spring tube.

It may be noted that the switch base 34 is of insulating material, that the holder 39 is of metal having a flange 48 which is attached to the base by screws 49, and is offset from the base between this flange and the guide portion 45, and that the plate 43 is of metal secured to the holder 39 by screws 50, but insulated therefrom by an interposed slab of

insulating material 51 and insulating bushings 52 which surround the respective screws. One of the circuit conductors, designated 53, is connected by one of the screws 49 to the holder 39. The other conductor, 54, is applied to the plate 43 by one of the screws 50, but is insulated therefrom by the bushing 52 which surrounds that screw. Contact 40 is in conducting connection with the wire 53 through the plunger 44 and the body of holder 39, and also through a flexible conductor 55 which is made fast to the holder 39 and extends over into engagement with the protruding upper or back end of the plunger. Insulation between the plunger and spring tube is effected, preferably, by making the bar 47 as a tube or sleeve of glass, rubber, or other nonconducting material, placed on a stiff wire 471, the ends of which are bent around and soldered to the spring tube. The conductor wires 53 and 54 pass from the conduit 14 through registering holes in the frame plate 24 and the switch base 34, as shown best in Fig. 3.

The pivot for the switch base is mounted at or near the approximate center of curvature of the spring tube 31, and the bar 47 is arranged eccentrically, or at an inclination, to the arc in which frame 46 moves with rotation of the switch base, so that it permits a greater or less amount of lost motion of the spring tube, when distorted by pressure, before the switch will be opened, according to the position of adjustment of the switch. That is, these parts constitute a lost motion coupling having a variable extent of lost motion. With the adjustment shown in Figs. 2 and 7, little or no lost motion is possible, while with the adjustment of Fig. 6 a greater amount of lost motion is permitted. These and other adjustments enable the switch to be automatically opened and closed at any degree of pressure and temperature within the range of the instrument.

The setting of the switch is indicated by pointer 21 with reference to the dial 22. Such pointer is carried by the operating shaft 36, being secured to a collar 56 which surrounds the shaft and is clamped thereto by a set screw 57. Thus the pointer is supported by the frame before described. The dial also is supported by the frame, being secured to posts 221 which project forwardly from the rear plate 24.

The shaft 36 registers with a hole 58 in the cover plate 15 and terminates within the outer surface of such plate. It is centrally drilled and tapped, and transversely slotted, at its outer end so that it may be turned either by a tool such as a screw driver, or a wrench 59 of the type shown in Fig. 8. Such wrench has a knob or handle 60 and lugs 61 on the inner end of its shank to enter the slot in the shaft, and it may be

permanently attached to the shaft by a screw passing through a central bore in the wrench shank and screwed into the tapped hole in the shaft. But the wrench may be removed, and the hole 58 normally closed by a shutter 62 pivoted to the cover plate.

Another feature of the invention resides in an adjustable friction device on the shaft 36 for retaining the latter in its various adjusted positions. Such friction device is a dished disk or washer 63 of resilient material, which surrounds the shaft and bears at and near its rim on the frame plate 25, its central part being offset toward the pointer-carrying collar 56. A screw 64 is threaded through this collar parallel to the shaft and has a reduced end or extension entering a hole or slot in the offset part of the disk, which compels the disk to turn with the shaft, while the shoulder on the screw adjacent to the reduced end provides an abutment which may be advanced or withdrawn so as to increase or reduce respectively the pressure exerted by the disk on the frame. A cotter pin 65 is passed through the shaft back of the frame plate 25 as a reaction abutment for the thrust of the friction disk.

Backlash between the driving pinion 27 and the gear teeth 38 of the switch base and between the base and pivot 35, and the effects of wear, are taken up by a helical spring 66 having loops or hooks on its ends, one of which is passed over a pin 67 protruding from the rim of the switch base, while the other is engaged with a hook on the outer end of a rod 68 which protrudes from the edge of the frame plate 24. This mode of mounting the spring has novel features which make for simplicity and ease of assembling. The inner end of the rod 68 is freely and removably contained in a socket hole in the frame plate. In assembling these parts the hook or loop formed on one end of the spring is first passed around the pin 67, the hook or loop on the other end of the spring is then engaged with the hook on the anchor rod (such rod being at that time disengaged from the frame), and the rod is then placed in its socket in the frame. The spring is stretched in the course of thus mounting the rod, and its tension thereafter secures the rod firmly in its socket.

By virtue of mounting all parts of the switch, including the circuit making and breaking contacts, and the pointer and dial, on a self-contained frame which is independent of the case, except at the point of attachment with the case where this frame is abundantly rigid, any distortion which the case may suffer in the course of securing it to the conduit for the wires, or to an uneven support of any kind, has no effect on the switch or on the index means or on its adjustment indicating means. Consequently these delicate and necessarily accurately re-

lated parts may be set up, tested and calibrated outside of the case, and then mounted in the case with full assurance that their accuracy and calibration will remain unimpaired in spite of rough handling to which the case may afterwards be subjected. Also the separate manufacture and assemblage of the switch proper and case makes for economy in manufacture, for it avoids the necessity of a manufacturer carrying in stock an equal number of cases and switch instruments. The process of building, testing and calibrating the switch and spring tube assemblages consumes much more time than is required to make cases, and switch assemblages of any given capacity, dimensions and design may be applied in cases of various designs and sizes. Therefore by making these units separately and assembling them as needed to fill orders, a large saving may be made in the quantity of manufactured stock necessary to be kept on hand by the maker to meet demands.

Another feature of the invention is concerned with the nipple 28. It will be noted that the outer end of this nipple has a beveled surface 28a. When the outer threaded end of the nipple is screwed into the socket 69 by which it is coupled to a tube 29, this beveled end provides a space adapted to receive any excess of lead or solder which may be used by a careless workman in sealing the joint, and avoids liability of clogging the bore of the tube and the nipple.

The switch herein described can be coupled directly in the circuit of a heating unit, in suitable circumstances, or in a relay circuit when the heating unit requires more current than is advisable to be passed through the switch; and it may be used with either alternating or direct current.

What I claim and desire to secure by Letters Patent is:

1. In an electric switch of the character set forth, a frame, a switch base pivoted to said frame and having gear teeth, an adjusting shaft rotatably mounted in said frame and having a pinion meshing with said teeth, a dished friction disk surrounding the shaft and bearing at its edge part on an adjacent member of the frame, and an adjustable abutment carried by the shaft, bearing on the inner part of the disk, and operable to vary the pressure exerted by the disk on the frame.

2. An electric switch as set forth in claim 1, in which the abutment is a screw extending lengthwise of the shaft and having a reduced end entering a recess in the disk, and a shoulder adjacent such end abutting on the disk.

3. In an electric switch having a frame and an adjustable switch base pivoted to the frame, a shaft for turning said base about its pivot, and friction means for resisting

turning movement thereof comprising a disk surrounding the shaft, bearing at its rim on the frame and offset in its central part from the plane of the rim, and
5 an abutment carried by the shaft and adjustable along the same to apply pressure on the offset part of the disk toward said plane.

4. In an electric switch having a frame and an adjustable switch base pivoted to the
10 frame, a shaft for turning said base about its pivot, and friction means for resisting turning movement thereof comprising a disk surrounding the shaft, bearing at its rim on the frame and offset in its central part
15 from the plane of the rim, a collar surrounding and secured to the shaft adjacent to the offset part of the disk at the side thereof away from said plane, and a screw threaded through the collar parallel to the shaft, bearing
20 on the offset part of the disk and having a reduced extension entering the disk.

5. In an electric switch of the character described, a frame, a switch base pivoted to the frame, an adjusting member geared to
25 said base for turning it, a spring coupled to the base at one side of its pivot, for taking up backlash, and an anchor rod contained in a socket in the frame and coupled with the spring in a location such that the tension
30 of the spring tends to retain it in the socket.

6. In an electric switch, a frame, a switch base pivoted thereto having a projection from its rim and a series of gear teeth, an
adjusting shaft having a pinion meshing
35 with said gear teeth and rotatable in the frame, an anchor rod seated removably in a socket in the frame and projecting therefrom having a hook spaced away from said projection in a line tangent to the base, and
40 a spring coupled at its opposite ends to said projection and said hook, respectively, under tension tending to hold the anchor rod in its socket.

7. In a switch of the character described,
45 a rotatable shaft, a switch base geared to the shaft for rotation thereby, a case enclosing the switch and having an opening in line with the shaft, a wrench having a shank passing into said opening and a handle portion outside of the case, and a screw passing
50 through the wrench into threaded engagement with the shaft; the wrench shaft having lugs on its inner end and the shaft having a slot in its outer end receiving said lugs
55 and adapted to receive a screw driver when the wrench is removed.

In testimony whereof I have affixed my signature.

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EMERY J. DASHNER.

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