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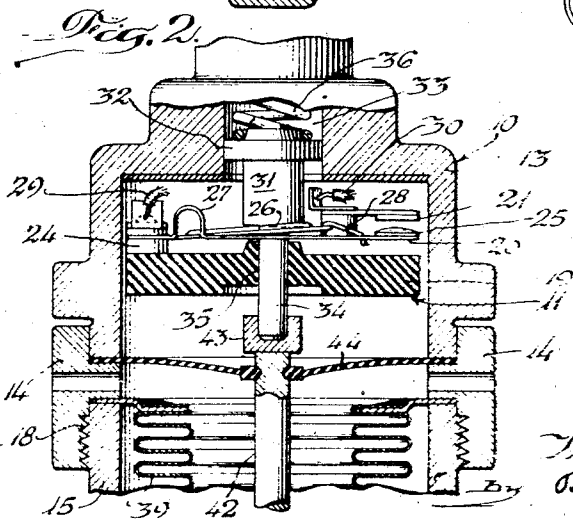
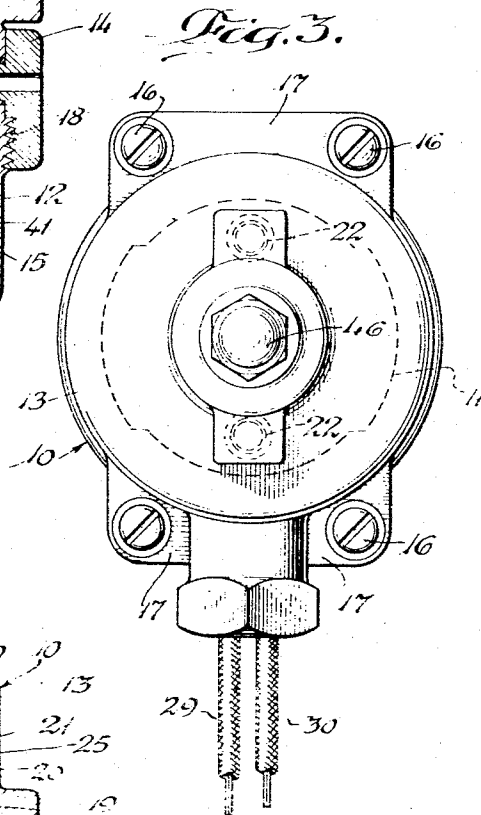
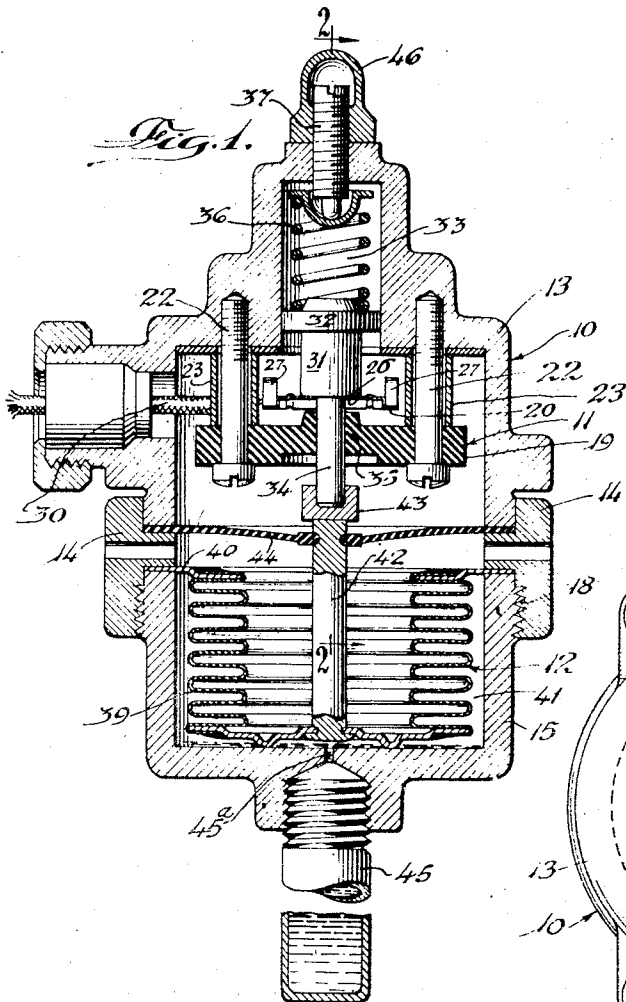
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2,421,284

PRESSURE ACTUATED SWITCH

Filed June 24, 1944

2 Sheets-Sheet 1



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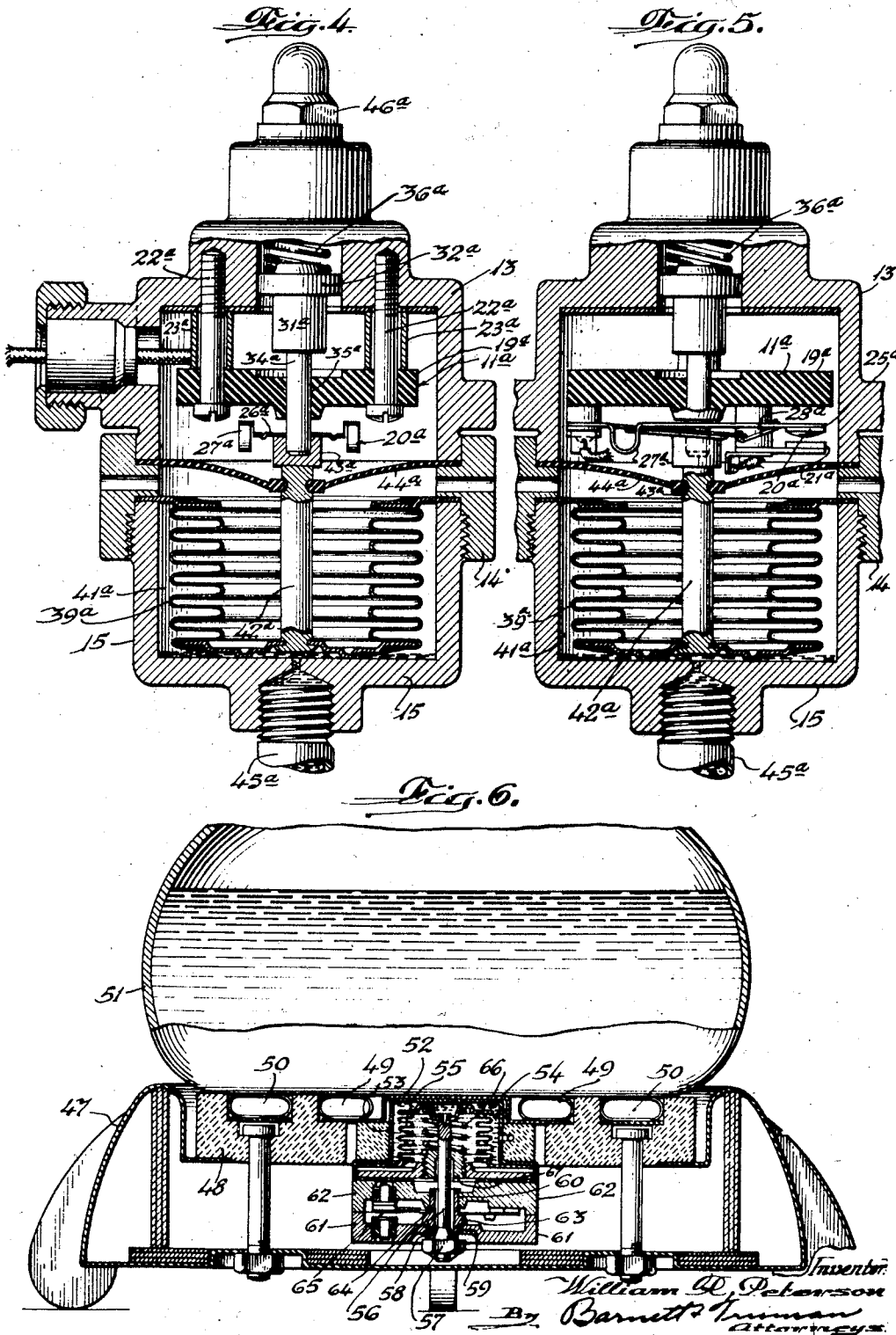
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2 Sheets-Sheet 2



## UNITED STATES PATENT OFFICE

2,421,284

## PRESSURE ACTUATED SWITCH

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5 Claims. (Cl. 200—83)

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This invention relates to certain new and useful improvements in a pressure actuated switch adapted to open or to close an electric circuit in response to predetermined changes in temperature.

The invention is directed principally to improvements in the construction of the several parts which simplify the assembly of the combination structure as a whole.

One of the principal aims of the present invention is to provide a temperature responsive switch of the above character in which the parts may be conveniently assembled so that the switch may be normally maintained either in its closed or opened positions so as to meet the requirements of the particular circuit in which the switch is used.

Another and more specific object is to provide a temperature actuated switch including a switch assembly and a temperature responsive motor for actuating the switch, both of which are enclosed in a housing of novel construction. In this connection the invention includes the provision of a sectional housing, in which the switch assembly and the motor assembly are mounted in separate compartments with capacity for quick and convenient disconnection of said assemblies for purposes of inspection or repair.

A further object is to provide a temperature actuated switch including a switch member and a bellows motor for actuating the same, and means associated with the bellows motor and adapted to be heated at a location remote therefrom to generate pressure for actuating the bellows. One means herein shown for accomplishing this object includes the provision of a tube containing a thermal sensitive fluid and adapted to extend into a heat zone, whereby the expansion of the thermal fluid in the tube results in operating the bellows motor. In another embodiment the fluid is contained wholly within an expansion chamber of the motor and the heat is transmitted to a wall of said chamber by a metallic heat conductor.

The invention is illustrated in certain specific embodiments in the accompanying drawings wherein:

Fig. 1 is a vertical sectional view taken through a pressure actuated switch constructed in accordance with this invention.

Fig. 2 is a fragmentary view of the structure shown in Fig. 1, the section being taken on line 2—2 of Fig. 1 and looking in the direction of the arrows.

Fig. 3 is a plan view of the structure shown in Figs. 1 and 2.

Figs. 4 and 5 are views similar to Figs. 1 and 2 but showing the switch assembly in a position inverted relative to the position shown in Figs. 1 and 2.

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Fig. 6 is a sectional view through a modified form of switch which is particularly suitable for use in situations of the character illustrated.

The embodiment of the invention illustrated in Figs. 1 to 3, inclusive may be described briefly as comprising a sectional housing 10, a switch assembly 11, and a bellows motor 12. The said housing includes an upper section 13 in which the switch assembly 11 is mounted. An intermediate section 14 and a bottom section 15 of said housing define the chamber in which the bellows motor 13 is supported. The upper member and the intermediate member are secured together preferably by means of four bolts designated 16 which extend through suitable flanges 17. The lower member 13 is secured to the intermediate member by means of a threaded connection shown at 18.

The switch assembly, herein shown, comprises a base 19 on which a switch arm 20 and a fixed contact 21 are cooperatively mounted. Preferably, the base 19 of the switch assembly is secured to the inner upper surface of the housing by means of four screws 22. Spacing sleeves 23 of insulating material surround the said screws and hold the base 19 in a predetermined spaced position relative to said inside upper surface of the housing. The switch arm 20 is fixed to a boss 24 formed on the base so that its contact 25 on the movable end of the arm will assume a predetermined position relative to the fixed contact 21.

The switch arm 20 may be and preferably is of the special construction described and claimed in the copending application of William R. Peterson and Allen G. Ford, Serial No. 464,580, filed November 5, 1942. Inasmuch as the switch arm per se is claimed in said copending application, it will be sufficient for a full understanding of the invention to describe the said switch arm 20 as comprising a spring metal plate, the center portion of which is severed from the main body and bent outwardly at an angle thereto to provide an operating lever 26. The main body of the switch arm is formed intermediate its ends with U-shaped bends 27, whereby the switch arm is made yieldable in the direction of its length as well as flexible transversely. A rigid rocker member 28 is interposed between the outer end of the operating lever 27 and the contact end of the switch arm 20. Consequently, when the operating lever 26 is depressed from the position indicated in Fig. 2 to a position below the center of arm 21, the resiliency of the arm causes it to snap upwardly against the fixed contact 21 and thereby closes an electrical circuit through the lead wires 29 and 30.

With the switch assembly mounted as shown in Figs. 1 and 2, the switch arm 20 is caused to move into engagement with the fixed contact 21 by application of pressure downwardly against

the operating lever 26. This pressure is provided by means of a spring pressed plunger 31, the upper end 32 of which is slidably fitted in a spring chamber 33 formed in the upper portion of the housing. The lower portion 34 of the plunger is reduced in diameter and extends through a central opening 35 in the base 19 so as to support and guide the plunger in its reciprocating movements. The plunger, it will be seen, bears upon the operating lever 27 and is pressed downwardly by means of a helical spring 36 interposed between the upper end of the plunger and an adjusting screw 37. When this spring pressure is relieved, the resiliency of the switch arm 20 will cause the arm 20 to snap across its dead center position, but in the opposite direction. The said spring pressure is relieved by means of a pressure motor, preferably a bellows 39 closed at its lower end and having its outwardly flanged upper end 40 clamped between the lower and intermediate sections 14 and 15 of the housing. This manner of attachment provides a pressure chamber 41 between the outer face of the bellows and the inner face of the lower section 13 of the housing. A push rod 42 is fixed to the bottom wall of the bellows and is provided at its upper end with a cup 43 which receives the lower end 34 of the operating plunger 31. It will be seen, therefore, that upon the development of pressure in the pressure chamber 41, the bellows will be caused to contract and thereby force the operating plunger 31 upwardly against the compression of the helical spring 36. This upward movement of the plunger removes the pressure from the switch operating lever 26 and thereby permits the switch arm to snap away from said fixed contact 21.

In order to protect the switch contacts from the collection of dust and at the same time make the switch suitable for use in situations where the likelihood of an open spark would be objectionable, a flexible diaphragm 44 is clamped between the upper and intermediate sections of the housing and engages in a groove formed in the push rod 42 so as to provide a sealed chamber in which the switch assembly is mounted.

In Figs. 1, 2 and 3 the pressure chamber 41 communicates with a tube 45 containing a volatile fluid which upon a rise of temperature will volatilize or otherwise expand so as to increase the pressure in chamber 41, thereby causing the bellows 39 to contract and thereby effect movement of the switch arm 20 in the direction previously described.

The particular pressure required to operate the switch may be obtained by appropriate adjustment of screw 37. A bonnet cap 46 fits over the upper end of the screw and serves as a lock nut to hold the screw 37 in any desired position.

In Figs. 4 and 5 the switch assembly designated 11<sup>a</sup> is mounted in the housing in an inverted position so that the switch arm designated 20<sup>a</sup> will be normally held spaced from the fixed contact designated 21<sup>a</sup>.

With the arrangement of parts, as shown in Figs. 4 and 5, the pressure of spring 36<sup>a</sup> functions to move the switch arm 20<sup>a</sup> to its normally open position. The development of pressure in the pressure chamber 41<sup>a</sup> causes the bellows 39<sup>a</sup> to contract and thereby presses the cup shaped portion 43<sup>a</sup> of push rod 42<sup>a</sup> against the switch operating lever 27<sup>a</sup>. When this lever is pressed upwardly beyond the center of switch arm 20<sup>a</sup>, the rigid rocking member 28<sup>a</sup> assumes an angular

position to snap the contact end 25<sup>a</sup> into engagement with the fixed contact 21<sup>a</sup>.

In the embodiment illustrated in Fig. 6, the pressure actuated switch is designed for use in the special situation illustrated, to-wit as a control for the electric heater circuit of a coffee maker. In this embodiment the reference numeral 47 designates a supporting structure, 48 a heat resistant disk, and 49 and 50 designate ring shaped cases in which heating wires (not shown) are suspended in a heat-resisting filler. The heat generated in the heating wires is conducted through the casings 49 and 50, to the container 51 in which the coffee is being made. The heat from the heating elements 49 and 50 is transmitted through a plate 52 to the outer face of a casing 53 defining the outer wall of the pressure motor chamber 54. The pressure motor in the present embodiment comprises a bellows 55 of a construction similar to that illustrated in the preceding embodiments arranged within the casing 53 so as to provide said chamber 54. An operating rod 56 extends downwardly from the closed upper end of the bellows, and carries at its lower end an adjusting nut 57. The adjusting nut engages a sleeve member 58 guided in openings 59 and 60 in the base members 61, 62. The said sleeve member 58 includes an enlarged portion 63 which engages the operating lever 64 of the switch arm 65. The switch arm 65 of the present embodiment may be, and preferably is, identical with the switch arms employed in the preceding figures. A helical spring 66 is interposed between a screw plug 67 and the upper end of the bellows. The adjustment of said nut 57 determines the pressure required to operate the switch arm in one direction and consequently determines the temperature at which the switch is set to operate.

While the invention is illustrated herein in connection with the specific embodiments shown, and in one specific situation, it will be understood that the invention is not to be restricted to the specific embodiments shown or to the specific use illustrated except in so far as specific limitations may appear in the appended claims.

#### I claim:

1. A pressure actuated switch, for controlling an electric circuit comprising, in combination, a switch assembly formed with an opening there-through, a temperature responsive motor positioned at one side of said switch assembly for moving the switch arm thereof in one direction, resilient means positioned at the other side of said switch assembly, a movable element associated with said resilient means extending through said opening in said switch assembly and engaging the switch arm operating member of the motor for moving the motor in the opposite direction, adjustable means associated with said resilient means to vary the pressure exerted thereby and thereby determine the temperature at which the switch arm will function, means for mounting the switch assembly relative to said motor and said resilient means, a housing in which said switch assembly and said temperature responsive motor are enclosed, and a flexible diaphragm extending across said housing intermediate said motor and said switch assembly, whereby the said switch assembly is contained in a dust-proof compartment.

2. A pressure actuated switch comprising, in combination, a casing, a switch means mounted in said casing for opening and closing an electric circuit, a temperature responsive motor in said

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casing for actuating the switch; the said casing including a plurality of separable sections and the motor comprising a bellows closed at its lower end and having its other end clamped between two adjacent sections of the casing so as to facilitate the assembly of the structure and to provide an expansion chamber between the bellows and one of said sections of the casing for containing a thermosensitive liquid adapted to vary the pressure in said expansion chamber in relation to temperature changes, means comprising a push rod connected to the closed lower end of the bellows for detachably connecting the said motor with a movable element of said switch, and a flexible diaphragm between two adjacent sections of the casing and connected with said push rod so as to provide a dust-proof chamber for said switch.

3. A pressure actuated switch comprising, in combination, a casing, a switch means mounted in said casing for opening and closing an electric circuit, a temperature responsive motor in said casing for actuating the switch; the said casing including a plurality of separable sections to provide ready access to the upper and lower portions of the casing and the motor comprising a bellows closed at its lower end and having its other end clamped between two adjacent sections of the casing so as to facilitate the assembly of the structure and to provide an expansion chamber between the bellows and one of said sections of the casing for containing a thermosensitive liquid adapted to vary the pressure in said expansion chamber in relation to temperature changes, means comprising a push rod connected to the closed lower end of the bellows for detachably connecting the said motor with a movable element of said switch, a flexible diaphragm between two adjacent sections of the casing and connected with said push rod so as to provide a dust-proof chamber for said switch, and a tubular extension for said expansion chamber adapted to contain a portion of thermosensitive liquid, whereby the said motor is made responsive to temperature changes at a location remote from the motor.

4. A pressure actuated switch comprising, in combination, a casing, a switch means mounted in said casing for opening and closing an electric circuit, a temperature responsive motor in said casing for actuating the switch; the said casing including a plurality of separable sections to facilitate assembly of the structure and the motor comprising a bellows closed at its lower end and having its other end clamped between two ad-

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jacent sections of the casing so as to provide an expansion chamber between the bellows and one of said sections of the casing for containing a thermosensitive liquid adapted to vary the pressure in said expansion chamber in relation to temperature changes, means comprising a push rod connected to the closed lower end of the bellows for detachably connecting the said motor with a movable element of said switch, a flexible diaphragm between two adjacent sections of the casing and connected with said push rod so as to provide a dust-proof chamber for said switch, and means associated with said expansion chamber for conducting heat thereto from a location remote from said chamber.

5. A pressure actuated switch comprising, in combination, a casing, a switch means mounted in said casing for opening and closing an electric circuit, a temperature responsive motor in said casing for actuating the switch; the said casing including a plurality of separable sections and the motor comprising a bellows closed at its lower end and having its other end clamped between two adjacent sections of the casing so as to provide an expansion chamber between the bellows and one of said sections of the casing for containing a thermosensitive liquid adapted to vary the pressure in said expansion chamber in relation to temperature changes, means comprising a push rod connected to the closed lower end of the bellows for detachably connecting the said motor with a movable element of said switch, a flexible diaphragm between two adjacent sections of the casing and connected with said push rod so as to provide a dust-proof chamber for said switch, means associated with said expansion chamber for conducting heat thereto from a location remote from said chamber, and a metallic heat conductor extending from the pressure chamber casing to a heated zone remote from said motor, whereby the motor is made responsive to the temperature of said heated zone.

WILLIAM R. PETERSON.

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