Oct. 7, 1941. J. RUSSELL 2,257,816

HIGH PRESSURE SWITCH

Filed Feb. 7, 1940 2 Sheets-Sheet 1

Fig 1

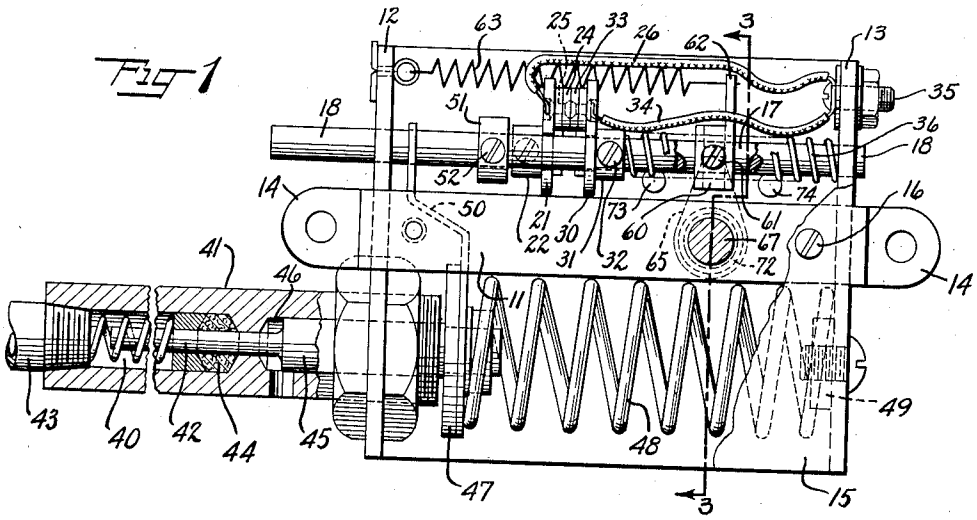
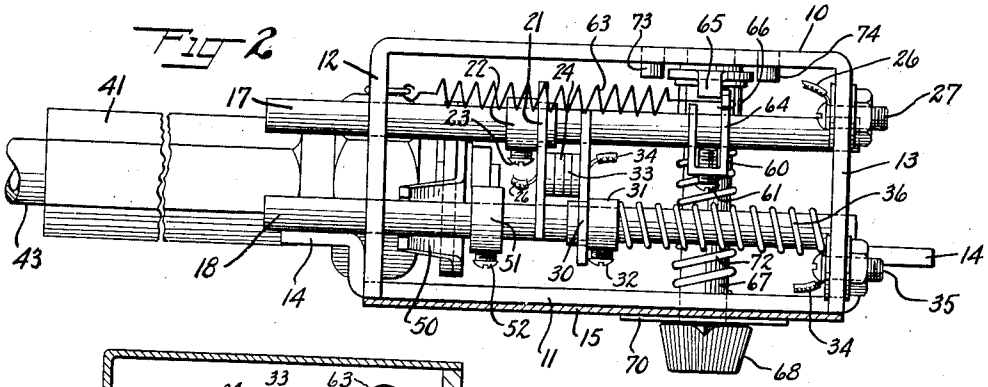


Fig 2



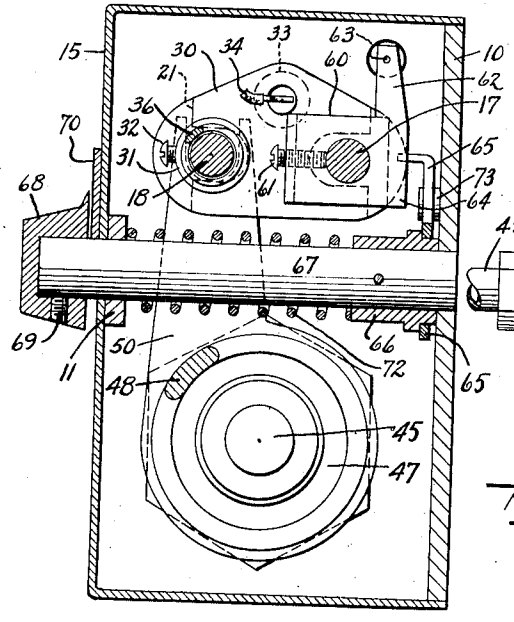


Fig 4

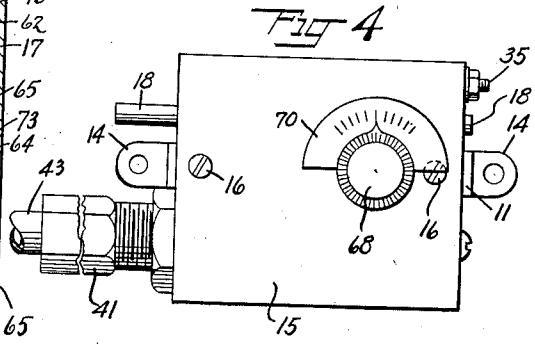


Fig 3

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HIGH PRESSURE SWITCH

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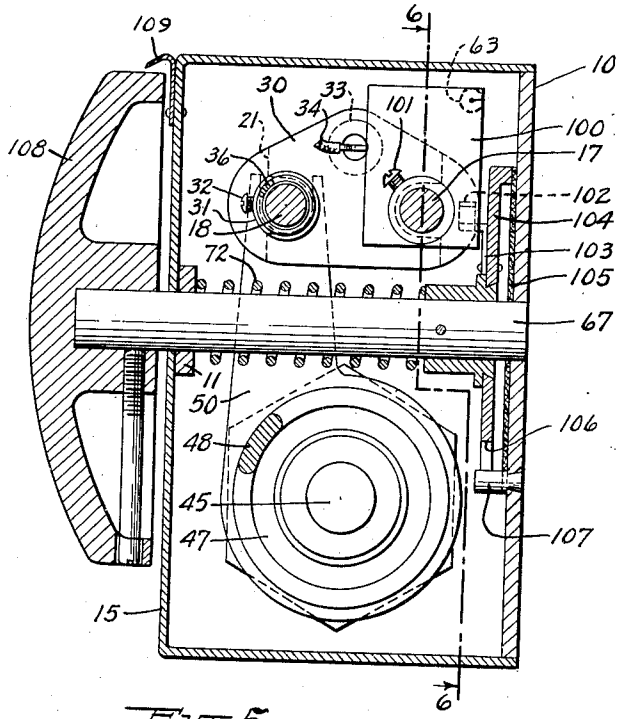


Fig 5

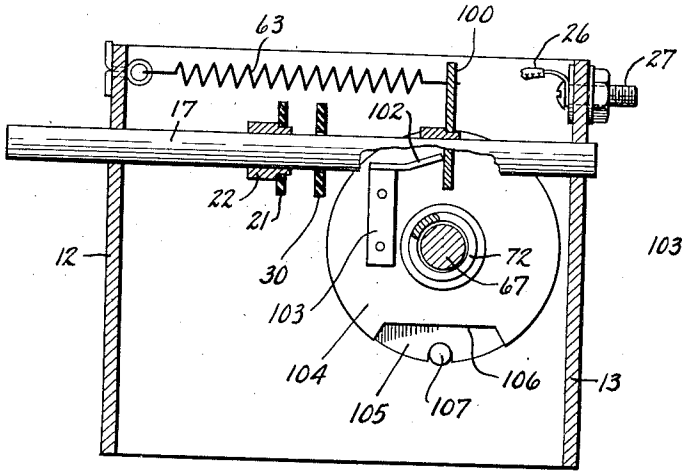


Fig 6

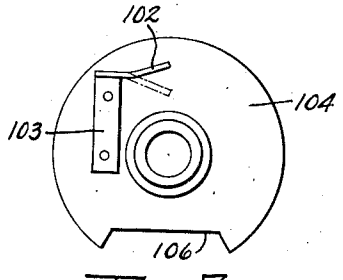


Fig 7

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UNITED STATES PATENT OFFICE

2,257,816

HIGH PRESSURE SWITCH

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Application February 7, 1940, Serial No. 317,673

6 Claims. (Cl. 200—82)

The present invention relates to new and useful improvements in pressure operated switches.

Objects and advantages of the invention will be set forth in part hereinafter and in part will be obvious herefrom, or may be learned by practice with the invention, the same being realized and attained by means of the instrumentalities and combinations pointed out in the appended claims.

The invention consists in the novel parts, constructions, arrangements, combinations and improvements herein shown and described.

The accompanying drawings, referred to herein and constituting a part hereof, illustrate one embodiment of the invention, and together with the description, serve to explain the principles of the invention.

Of the drawings:

Figure 1 is a front elevation partly in section and with the cover partly broken away;

Figure 2 is a plan view partly in section;

Figure 3 is a vertical section taken on the line 3—3 of Figure 1;

Figure 4 is a front elevation on a smaller scale than Fig. 1 and showing the pressure setting dial;

Figure 5 is a vertical section similar to Figure 3 but showing a modification;

Figure 6 is a vertical section taken on the line 6—6 of Figure 5; and

Figure 7 is a front elevation of detail of construction.

Referring now in detail to the drawings there is illustratively shown a channel shaped housing 10 having end flanges or walls 12, 13 and adapted to support within and upon it the operable parts of a switch for operation at extremely high pressures. A strap-like member 11 is secured, as by welding, in recesses formed in the front edges of the walls 12 and 13 and is provided with outwardly projecting, apertured ears 14 by means of which the device may be mounted upon apparatus with which it may be associated. A cover plate 15, also channel shaped, may be provided to completely enclose the mechanism contained within the housing 10 and may be secured in position by screws 16 which are threaded into the strap member 11.

Slidably mounted in the end walls 12, 13 of the housing 10 near the upper edges thereof and in parallel spaced relation to each other are a pair of contact bearing slide rods 17, 18, each of these rods carrying similarly constructed contact plates so positioned upon the rods that their contact buttons are in opposed relation to each other.

As embodied, the contact plate 21, carried by the slide rod 17, may be generally oval in shape and consist of insulating material such as Bakelite, hard rubber, fiber or similar substance. A hub 22, secured in an aperture near one end of the oval contact plate 21, serves as means for adjustably mounting the contact plate upon the rod 17 and a set screw 23 permits the fixing of the plate in any desired position. The end of the contact plate 21 opposite the hub 22 may be forked so as to span the rod 18 and be guided thereby to maintain its proper alinement. The upper central portion of the contact plate is provided with a metallic contact button 24, which may be secured to the plate by a rivet 25, and to one end of this rivet may be attached, as by soldering, one end of a flexible and insulated lead wire 26 the other end of which may be secured to a terminal post 27 mounted in but insulated from the end wall 13 of the housing 10.

A second contact plate 30, similar to plate 21, is adjustably mounted on the slide rod 18 by means of its hub 31 and set screw 32, and its metallic contact button 33 is connected by a lead wire 34 to a terminal post 35 mounted in but insulated from the end wall 13 of the housing 10 conveniently near the terminal post 27. The contact plate 30 and its contact button 33 is maintained in operative alinement with plate 21 and button 24 by being forked at one end so as to span and be guided by the rod 17.

For maintaining the two contact buttons 24, 33 in electrical contact with each other, except under conditions to be described later, there is provided a compression spring 36 mounted upon the slide rod 18 between the end wall 13 and the hub 31 of contact plate 30 so as to always urge the plate 30 towards the contact plate 21. Thus, the electrical switch formed by the two contact buttons 24, 33 remains normally closed to form a complete circuit from terminal post 27 to terminal post 35 until such time as slide rod 18 may be moved to the right (Fig. 2) to break such circuit.

Means for breaking the electrical circuit through the contact buttons 24, 33 by utilization of high fluid pressure are provided and as embodied consist of a pressure chamber 40, formed in the outer end of a block 41 mounted in the end wall 12 of the housing 10, and a pressure actuated plunger 42 slidably mounted within the block 41 and projecting into the chamber 40. A pipe 43 connects the chamber 40 to any source of extremely high fluid pressure it may be desired to utilize for the purpose of actuating the switch and

a spring-pressed packing gland 44 serves to seal the opposite end of the chamber 40, through which the plunger 42 projects, against leakage. The inner end 45 of the plunger 42 is enlarged and slidably supported in a bore 46, formed in the inner end of the block 41, from which it projects into the interior of the housing 10. A spring seat 47 is fixed upon the end of the enlarged portion 45 of plunger 42 so as to form an abutment for one end of a compression spring 48 the other end of which abuts and is affixed to the end wall 13, as by a screw held clip 49. The spring 48 forms the reactance for the fluid pressure to be utilized for opening the switch as this pressure is applied to the end of plunger 42 in pressure chamber 40, and the pressures used may vary from a few thousand to ten, fifteen or more thousand pounds per square inch.

Means for transmitting the movement of the plunger 42, as pressure is applied thereto, to the slide rod 18 and thus break the contact between the two contact buttons 24, 33, are provided. As embodied they comprise an upwardly extending, offset arm 50, the upper end of which is forked so as to embrace the slide rod 18 near its journal in the end wall 12, and a collar 51 slidably mounted upon the rod 18 and adapted to be fixed at any predetermined position in the path of movement of the arm 50 by a set screw 52. Thus it will be seen that as fluid pressure is admitted into chamber 40 in excess of the strength of the spring 48, the plunger 42 will move to the right (Fig. 1) and eventually bring the arm 50 into contact with the collar 51 on slide rod 18. Continued movement of the plunger 42 thereby moves with it the slide rod 18, compressing the spring 36 on said rod and moving the contact button 33 away from contact button 24, thus breaking the electrical circuit. As pressure decreases in the chamber 40, the reactance spring 48 moves the arm 50 and plunger 42 to the left and spring 36 causes slide rod 18 and contact button 33 to follow this movement until the two contact buttons again meet to complete the electrical circuit. Further decrease of pressure merely moves the arm 50 away from collar 51 until reactance spring 48 reaches zero compression.

Means are incorporated within the device whereby an operator may, conveniently and from the outside of the device, predetermine the relation between the actuating fluid pressure and the point at which this pressure will break the electrical circuit. As embodied, there is provided on the slide rod 17 a U-shaped stop clamp 60 having a set screw 61 to fix its position on the rod 17 and an upstanding finger 62 to which one end of a tension spring 63 is secured. The other end of the spring 63 is fixed to the wall 12 of the housing 10 and the spring lies parallel to the rod 17. One arm 64 of the stop clamp 60 is longer than the other and lies in the path of a detent finger 65 which is rigidly attached to a collar 66 pinned to a shaft 67. The shaft 67 is journalled in the rear wall of the housing 10 and projects forwardly through a journal in the strap 11 and cover 15. A dial knob 68 having the usual pointer thereon is secured to the end of shaft 67 by a set screw 69 and a calibrated dial 70 may be affixed on the cover 15 in cooperative relation to the dial knob 68. The calibrations on the dial 70 may be in any desired units of pressure within the range of pressures for which the device is to be used.

Frictional means are provided for maintaining the shaft 67 and detent finger 65 in whichever position the operator may select and as embodied comprise a reasonably strong compression spring 72 encircling the shaft 67 and abutting the rear face of the strap 11 and the forward face of the collar 66 thus forcing the rear face of the collar 66 into strong frictional engagement with the rear wall of the housing 10. Limiting stops 73, 74, set into the rear wall of the housing 10 in the path of movement of the detent 65 serve to prevent rotating the pressure selecting shaft 67 beyond its effective range of movement. It will thus be seen that the stop clamp 60 on the slide rod 17 is always held against the detent 65 by the spring 63, and the position of the contact buttons 24, 33 relative to the pressure actuated arm 50 is determined by the position of the detent 65 as set by the dial knob 68, this setting being variable at the will of the operator to whichever pressure he may select within the range of the device.

Thus a clockwise rotation of dial knob 68 will move the contact buttons to the right (Fig. 2) and increase the distance between the pressure actuated arm 50 and the collar 51 carried on the slide rod 18, necessitating a greater fluid pressure to break contact between buttons 24 and 33. A counter-clockwise rotation of knob 68 so sets the contact buttons as to require less pressure to break their contact.

Referring now to Figs. 5, 6 and 7, there is shown a modified form of means whereby the circuit breaking positions of the contact buttons 24, 33 relative to the pressure actuated arm 50 may be varied within a limited pressure range, and simple, adjustable means associated therewith whereby the said pressure range of the switch may also be maintained for example, from a range of four to fifteen thousand pounds per square inch regardless of minor irregularities in the strength of the main spring 48. The mechanism by which the pressure range may be maintained utilizes the same limited rotation of a dial knob for all strengths of springs within the manufacturing tolerances of the spring thereby insuring accuracy of the pressure range of the switch and making the graduations on the knob equally accurate.

However, the range may also be varied with any spring so as to vary the working range of the switch, thereby enabling it to operate at four to twelve thousand or from four to twenty thousand pounds per square inch, for example. Thus, on the dial knob the center mark may represent a circuit breaking pressure of 12,500 pounds in a pressure range of 10 to 15 thousand pounds per square inch, but the same mark in a pressure range of 10 to 30 thousand pounds represents a circuit breaking pressure of 20,000 pounds.

As embodied, in the modification, there is provided on the slide rod 17 a rectangular stop plate 100 to which is secured one end of the tension spring 63. A set screw 101, provided in the hub of stop plate 100, serves to adjustably position the plate on the rod 17. One side of the stop plate 100 lies in the path of a detent finger 102 whose base 103 is attached to a friction disc 104 which is pinned or otherwise secured on the dial knob shaft 67 adjacent the rear wall of the housing 10, but spaced therefrom by a friction washer 105. A notch 106, provided in the periphery of the disc 104, cooperates with a stop pin 107 to limit the rotation of the disc, the limits of this rotation representing the high or low pressure in the pressure range at which the switch may be set to break

the circuit. The friction necessary to maintain the disc 104 in its set position is provided by the compression spring 72, previously described. A dial knob 108 is secured on the outer end of shaft 60 and provided with graduations (not shown) on a portion of its periphery and adapted to be read against a pointer 109 attached to the cover 15 at a convenient spot.

It will thus be seen that a partial rotation of the dial knob 108 will cause the detent 102 to act upon stop plate 100 and move it to the right or left, as the case may be, to vary the position of the contact buttons 24, 33, relative to pressure actuated arm 50.

It is desirable that the pressure range of the device may be altered without changing the limit of rotation provided for the dial knob 108 by the pin 107 and for this purpose the detent 102 may be made of a material, such as soft iron or steel, adapted to be bent toward or away from the center of rotation of the disc 104. By this expedient it will be noted that the same limited rotation of disc 104 produces lineal movements of the stop plate 100 which may be greater or less as the detent 102 is further from or nearer the center of disc rotation. Thus, if detent 102 is bent toward the disc center, as shown in dot and dash lines in Fig. 7, a rotation of the disc 104 through its limit of motion will produce a smaller circumferential movement of the detent tip than the same rotation of the disc will produce if the detent is bent to its outermost position, as indicated in solid lines in Figure 7.

When the device is connected in a fluid pressure system, such as a high pressure lubricating grease dispensing apparatus, in which the pressure is created by an electric motor controlled by the switch contained within the device, it will be seen that, when the pressure reaches a pre-selected point the electrical circuit to the motor is broken and the motor stops after the exhaustion of its momentum has created a slight increase of pressure over that required to break the circuit. After this slight excess pressure has been used in the ordinary course of operation the drop in pressure in the chamber 40 permits the switch to close and thus again start the motor to supply more pressure. The device thus operates to provide a constant supply of grease under a pre-selected pressure and to maintain this pressure within narrow limits. It also permits by means of its convenient dial knob 68 and direct reading dial 70 a quick and easy method of changing, during operation, the pressure at which the device will operate.

The invention in its broader aspects is not limited to the specific mechanisms shown and described but departures may be made therefrom within the scope of the accompanying claims without departing from the principles of the invention and without sacrificing its chief advantages.

What I claim is:

1. A pressure operated switch for extremely high pressure operation including in combination a high pressure piston, a spring opposing movement of the piston, a pair of relatively movable contacts, a pair of rods carrying the contacts, a casing in which the rods are individually slidable, spring means for relatively moving the contacts and means interconnecting the piston with one of the rods, and means for variably positioning the other rod and its contact to vary the pressure required for operation of the switch.

2. A pressure operated switch for extremely high pressure operation including in combination a high pressure piston, a spring opposing movement of the piston, a pair of relatively movable contacts, a pair of relatively movable rods on which the contacts are individually mounted, a spring moving the contacts relatively towards each other, a frictionally held arm for variably positioning and holding one rod and its contact, and a stop carried by the other rod and engageable with a loosely fitted member moved by the piston for moving the rod and its contact when a predetermined pressure is exerted on the piston.

3. A pressure operated switch for extremely high pressure operation including in combination a casing, a high pressure piston supported at one end of the casing, a spring compressed between the piston and the other end of the casing, a pair of parallel rods supported by the casing and slidable therein, coacting contacts carried by the rods and closed by relative movement of the rods, a dial frictionally held against rotation, an arm connected to the dial for moving one of the rods and its contact to vary the pressure at which the switch is actuated, a spring for relatively moving the rods and a lost motion connection between the piston and the other rod for actuating the switch by excessive pressure on the piston.

4. A pressure operated switch for extremely high pressure operation including in combination a casing, a high pressure piston supported at one end of the casing, a spring compressed between the piston and the other end of the casing, a pair of parallel rods supported by the casing, a pair of relatively movable contacts carried by the rods, frictionally held movable means for moving one of the contacts to vary the pressure at which the switch opens, a spring for moving the other contact to closing position and an arm having lost motion relative to the spring-moved contact and moved by the piston on excessive pressure for moving the contacts relatively apart.

5. In a high pressure switch a high pressure piston to be operated by fluid pressure, a spring compressed by the piston, a pair of relatively movable contacts, one of which is moved by the piston, a rotary adjusting member, a plate carried by and moving the other contact and adjacent to the axis of the rotary member, and a radially movable finger on the rotary member engageable with the plate to vary the normal position of the second contact.

6. A pressure operated switch for extremely high pressure operation including in combination a high pressure piston, a spring opposing movement of the piston, a pair of relatively movable contacts, a pair of rods carrying the contacts, a casing in which the rods are individually slidable, spring means for relatively moving the contacts and means interconnecting the piston with one of the rods, means for variably positioning the other rod and its contact to vary the pressure required for operation of the switch, and means for varying the relation of the last means and the other rod to vary the normal setting of the switch.

JOHN RUSSELL.