

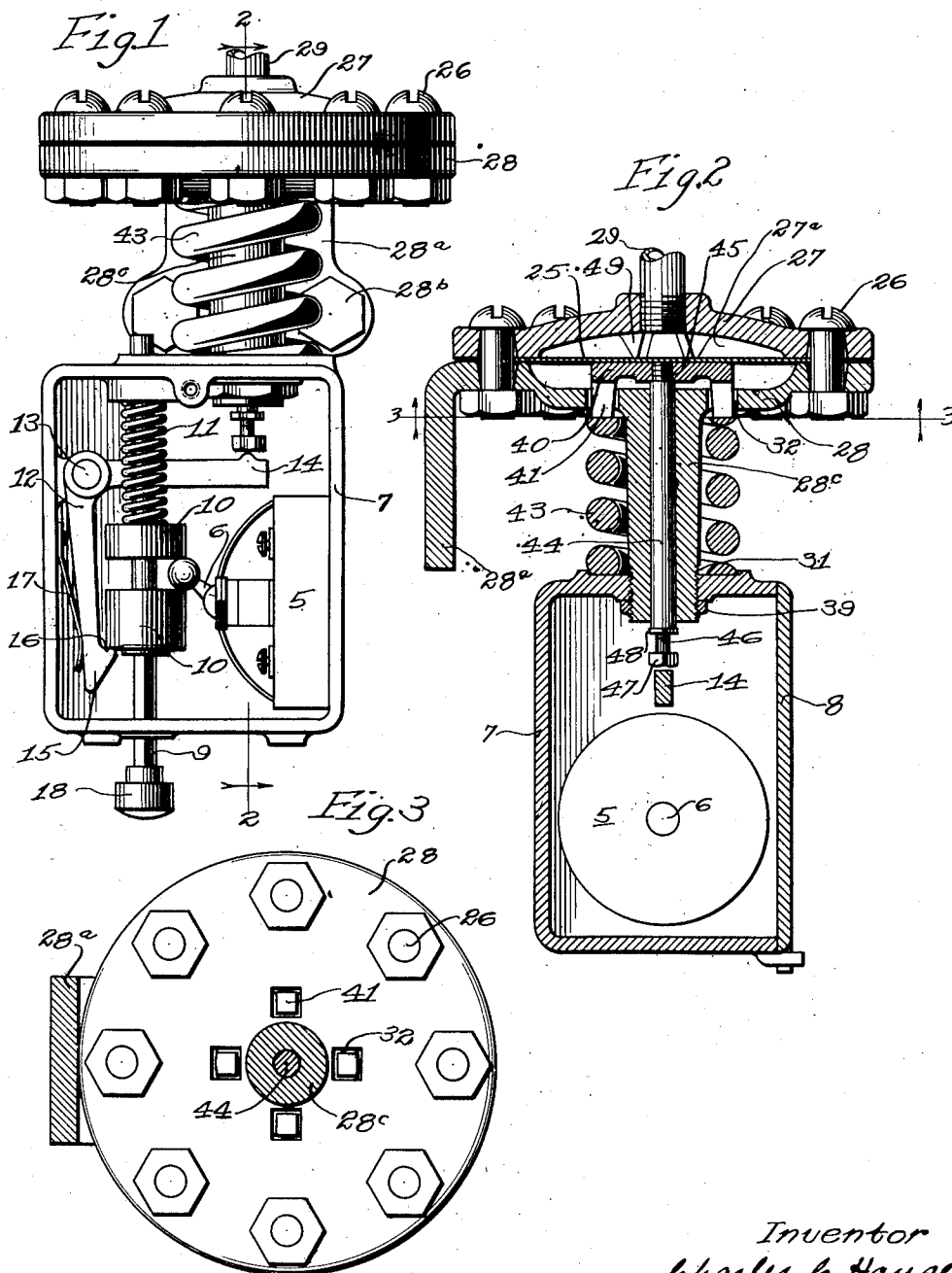
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FLUID PRESSURE OPERATED ELECTRIC SWITCH

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UNITED STATES PATENT OFFICE.

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FLUID-PRESSURE-OPERATED ELECTRIC SWITCH.

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The invention relates to devices actuated by fluid under pressure for operating switches for controlling electrical circuits.

The object of the invention is to provide a device for this purpose which is simple in construction and can be readily installed and adjusted to cause the switch to be actuated in response to different predetermined pressures.

The invention consists in the several novel features hereinafter set forth and more particularly defined by the claims at the conclusion hereof.

In the drawing: Fig. 1 is a front elevation of a device embodying the invention, the cover plate of the switch-box being removed for illustrative purposes. Fig. 2 is a section taken on line 2—2 of Fig. 1. Fig. 3 is a section taken on line 3—3 of Fig. 2.

The invention is exemplified in a device for controlling an electric switch 5 which may be connected to any circuit, such as a controlling, operating or alarm circuit in a refrigerating system, as well understood in the art, the switch being provided with a pivoted arm or lever 6 of usual construction for controlling the switch contacts. The device comprises a suitable box or casing 7, in which the switch is mounted and which is provided with a removable cover 8 to provide access to the contents of the box; a stem 9 which is mounted to slide vertically in casing 7 and is provided with shoulders or abutments 10 between which the knob on the pivoted switch-operating lever 6 is confined, so that when the stem is shifted in either direction, the switch lever 6 will be correspondingly shifted; a spring 11 coiled around the upper end of stem 9 and applied between the box and one of the shoulders 10 to operate the stem and switch lever in one direction; a bell-crank lever 12, which is pivoted in the box at 13 and comprises an arm 14 which is adapted to be shifted in one direction by the actuator and an arm 15 which is provided with a hook 16 to engage the lower end of the lower abutment 10 and lock the stem in one of its alternate positions, and a leaf spring 17 applied to normally hold the hook 16 in operative relation to the lower abutment 10. The lower portion of the stem 9 is polygonal and extends through a correspondingly shaped opening in the bottom of the box to hold the stem against rotation and a finger-piece 18 is fixed to the lower end of the rod outside of the box 7 so that the stem may be manually retracted and reset into position to

hold the switch lever 6 in one of its alternate positions.

The actuator for operating the switch comprises a flexible metal diaphragm 25, the margin of which is clamped by bolts 26 in a casing formed of a chambered head 27 and a supporting head or member 28. A pipe 29, connected to a refrigerating or other line, delivers fluid, such as ammonia under pressure, into the diaphragm chamber 27, one side of which is formed by the diaphragm 25 to shift the switch responsively to predetermined pressure variations of the ammonia or fluid in said line. The supporting head 28 of the actuator is provided with a lug 28^a so that it may be secured and supported by bolts 28^b at any desired point. The supporting head 28 of the actuator is provided with an integral sleeve 28^c which has its lower end provided with an exterior thread 31. The top of case 7 is threaded to receive thread 31 on sleeve 28^c and a nut 39 is adapted to lock case 7 to the actuator casing. Sleeve 28^c serves as a rigid connection between the actuator casing and the box or casing for the switch.

An abutment on a plate 40 engages the exposed face of diaphragm 25 and is provided with lugs 41 which extend through openings 32 in head 28. A coil spring 43 is interposed between the top of the switch-casing 7 and lugs 41 to retract the diaphragm and a stem 44, which is screw-threaded at 45 to abutment 40, and extends downwardly through sleeve 28^c to operate the switch-controlling lever 12. An adjustable tappet for engaging arm 14 of said lever consists of a screw 46 threaded into the end of stem 44 with a head 47 which is secured in assigned position in said stem by a lock-nut 48. Lugs 49 are formed in head 7 to limit the inward movement of the diaphragm by spring 43.

In operation, the switch, under normal working conditions, will be held in the position shown in Fig. 1 and the diaphragm 25 will be normally held against lugs 49 by the force of spring 43 applied through abutment 40, which is separate from but bears against the diaphragm for this purpose. The invention is adapted to control a switch for breaking and operating circuits and closing an alarm circuit whenever fluid under pressure connected to the actuator becomes excessive or abnormal and, therefore, normally, the lever 12, 14 is set to hold switch-operating stem 9 in position to cause the working cir-

cuited to be operative, the hook 16 being held under the lower abutment 10 which will be pressed against the hook by spring 11. When the pressure in the refrigerant or other line connected to the diaphragm casing, by pipe 29 rises to or above the predetermined point, it will operate the diaphragm against the force of spring 43 to shift abutment 40 and stem 44 to cause tappet screw 46 to engage arm 14 and trip the bell-crank lever to release stem 9, whereupon spring 11 will shift the stem and the switch lever 6 to produce the desired circuit conditions through switch 5. When the pressure subsides and the system has been otherwise restored to normal conditions, the operator will push knob 18 to shift the switch-lever 6 to restore normal circuit conditions and to reset the lower abutment 10, so it will be held by hook 15.

The invention exemplifies a construction in which the diaphragm casing is connected to the switch-casing by a sleeve through which the stem of the actuator slides; which can be easily and quickly assembled at the factory and in which the force of the actuator spring is applied to the abutment through the supporting member of the diaphragm. The screw-threaded connection between the sleeve and the switch-casing makes it possible to readily adjust the force of spring 43 to regulate the operation of the actuator for different pressures by mere rotation of the switch casing relatively to the sleeve. The construction is one which can be produced at a low cost and by which the switch and actuator are securely connected for correct operation. The tappet-screw in the actuator stem may be used for final adjustments desired after installation.

The invention is not to be understood as restricted to the details set forth, since these may be modified within the scope of the appended claims, without departing from the spirit and scope of the invention.

Having thus described the invention, what I claim as new and desire to secure by Letters Patent, is:

1. The combination of a switch, a housing in which the switch is disposed and by which the latter is supported, a fluid pressure operated actuator comprising a diaphragm and a casing, a sleeve on the actuator casing, a stem operable by the diaphragm and slidable in said sleeve, a spring outside of the actuator for retracting said stem, said spring extending around the sleeve and abutting against the switch-housing, and adjustable connection

between the sleeve and said housing whereby the latter may be moved longitudinally with respect to the sleeve to vary the tension of the spring, and means in the housing operable by the stem for controlling the switch.

2. The combination of a switch, a housing in which the switch is disposed and by which the latter is supported, a fluid pressure operated actuator comprising a diaphragm and a casing, a sleeve on the actuator casing, a stem operable by the diaphragm and slidable in said sleeve, a spring outside of the actuator for retracting said stem, said spring extending around said sleeve and abutting against the switch-housing, a screw-thread connection between the sleeve and said housing whereby the tension of the spring may be varied by rotation of the housing relatively to the sleeve, and means in the housing operable by the stem for controlling the switch.

3. The combination of a switch comprising a pivotally mounted switch lever, a switch housing, a fluid-pressure operated actuator comprising a diaphragm and a casing, a sleeve between the actuator casing and the housing, a stem operated by the diaphragm and slidable in said sleeve, a shaft slidably mounted in said switch-housing, an abutment fixed to the shaft and provided with a socket in which the free end of the switch lever is confined, means for securing the shaft in a position to maintain the switch lever in one of its alternative positions, said stem being operable by movement thereof to release the securing means, and spring-means for shifting the shaft upon release of said means.

4. The combination of a switch comprising a switch lever, a switch housing, a fluid pressure operated actuator comprising a diaphragm and a casing, a sleeve between the actuator casing and the housing, a stem operated by said diaphragm and slidable in said sleeve, and means in said switch-housing for controlling the switch comprising a slidably mounted shaft provided with an abutment having means in which the end of the switch lever is confined, a bell crank lever comprising a pair of arms, one of which is arranged to engage the stem and the other of which is provided with a hook for engagement with the abutment, and spring means for shifting the shaft when the hook on the bell crank is disengaged from the abutment.

Signed at Chicago, Illinois, this 30th day of August, 1923.

CHARLES C. HANSEN.