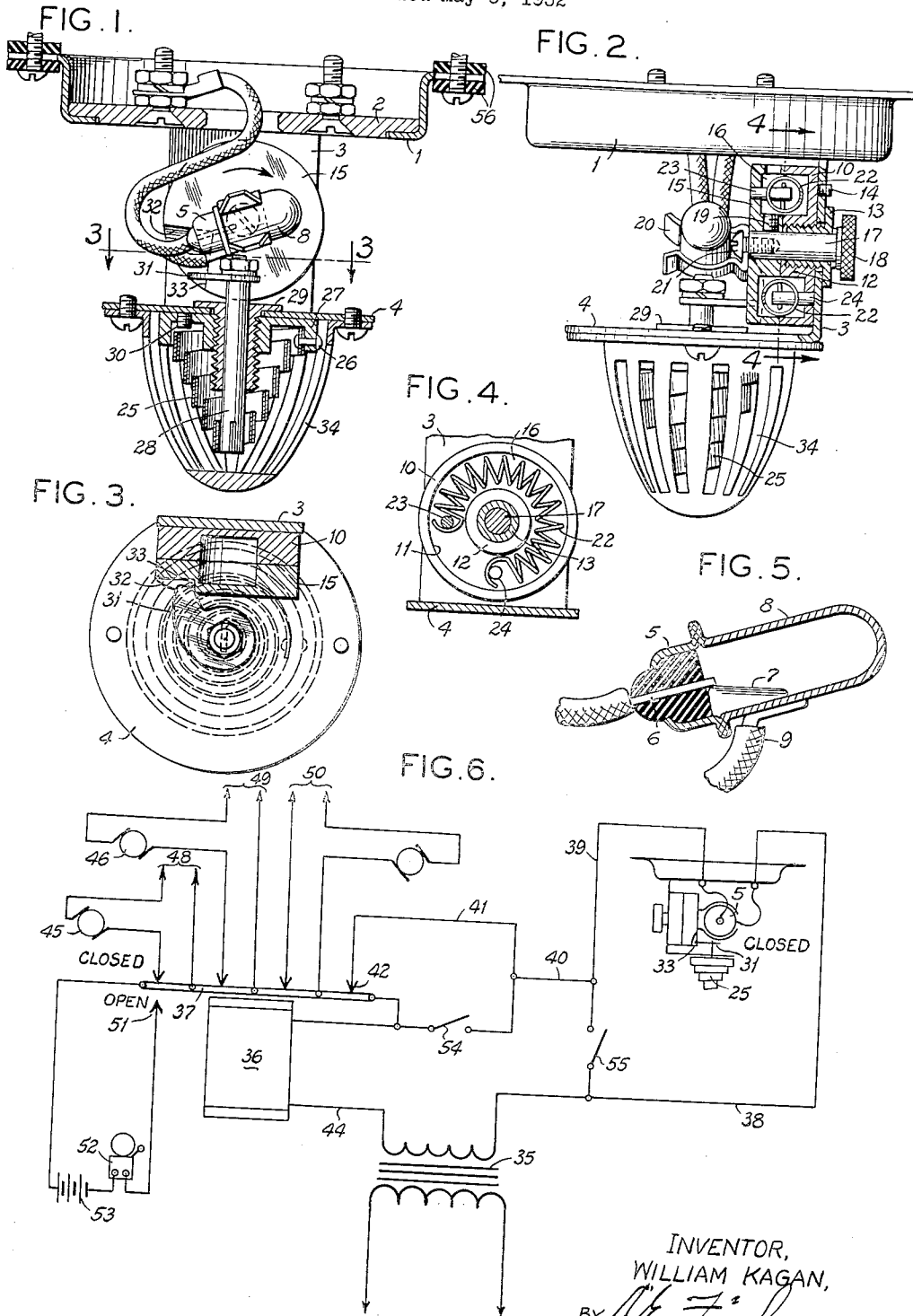


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FIRE AND EXPLOSION DETECTORS

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FIRE AND EXPLOSION DETECTORS

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This invention pertains to safety devices for shutting off electrically-operated service appliances such as furnaces, gas valves, air-conditioning systems, and the like in emergencies such as fires or explosions.

An object of this invention is to provide such a device which may be mounted adjacent a furnace or other appliance, which shall respond to excessively high temperature or to more or less violent shock to interrupt the electric supply circuit to such appliance to cause the same to shut down.

Another object is to provide such a device which, when it has functioned to open the electric supply circuit, will maintain that condition until it is manually reset, so as to afford opportunity for inspection of the appliances shut down and the region to be protected to make certain of the safety of restarting.

Generally stated, the device of the invention comprises a mercury switch connected in the energizing circuit of a drop-out relay controlling one or more supply circuits to the service appliances to be controlled. Said switch is mounted for rocking movement on a supporting frame which may be installed at such point as may be subject to excess temperature if an emergency, such as a fire or explosion, should occur. Said switch is spring biased for movement to its open-circuit position but is held in closed-circuit position by a thermostatic element exposed to the atmosphere of the region. Said element is set to release the switch at a predetermined temperature. Said switch may also be adjusted to a position such that its mercury globule just contacts the circuit terminals thereof, so that a violent shock, such as caused by an explosion, may move said globule to open the circuit momentarily, thereby causing the drop-out relay to open its circuits.

A preferred embodiment of this invention is illustrated in the accompanying drawing, in which:

Figure 1 is a vertical central section of a protective device embodying this invention,

Figure 2 is a side view of Fig. 1, with parts in section,

Figure 3 is a section on line 3—3 of Fig. 1,

Figure 4 is a section on line 4—4 of Fig. 2,

Figure 5 is an enlarged section of the mercury switch, and

Figure 6 is a diagram of electrical connections showing one arrangement of circuits in accordance with this invention.

Referring to the drawing, 1 designates an attachment ring which may be arranged for mounting on a standard outlet box or other support. Suitably fixed in said ring is an insulating disc 2, on which is mounted a supporting frame or bracket 3 having a horizontal member 4. A mercury switch 5 has a circuit terminal 6, and a mercury globule 7 contained in a metallic tube 8. The other circuit lead 9 is connected to the tube 8 so that said tube forms the second switch terminal.

A supporting bracket 10, of circular form has an annular groove 11 encircling a central hub 12. A bushing 13 passes through a perforation in the frame 3 and is thread-

ed into the hub 12 of the bracket 10, as shown in Fig. 2, thereby clamping the bracket 10 to the frame 3. If this clamping connection is loosened the bracket 10 may be adjusted angularly about the axis of the bushing 13 to any desired position and may then be reclamped. Such adjustment may be fixed by a set screw 14 threaded into the frame 3 and bearing against the bracket 10. A second bracket 15, similar in shape to the bracket 10, has an annular groove 16 matching the groove 11 when said two brackets are assembled facing each other as shown in Fig. 2, forming between them an annular housing. The bracket 15 is supported on a pivot shaft 17 journaled in the bore of the bushing 13 and provided with a manipulating head 18. The bracket 15 is secured to the shaft 17 by a set screw 19.

The switch 5 is mounted in a spring clip 20 which is fixed to the end of the pivot shaft 17 by a screw 21. Thus the bracket 15 provides a mounting bracket for the switch 5. Said switch may be set at any desired angle with respect to said bracket by loosening the set screw 19 and turning the bracket on the shaft 17. The mounting bracket 15 is biased with respect to the supporting bracket 10 by a coil spring 22 housed in the matching grooves 11 and 16 and extending annularly therealong as shown in Fig. 4. One end of this spring is connected to a pin 23 on the bracket 15 and the other end to a pin 24 on the bracket 10. The spring 22 tends to rotate the bracket 15, and the switch 5 thereon, in the clockwise direction as indicated by the arrow in Fig. 1. Rotation of the switch 5 in this direction will cause the globule 7 to move away from the terminal 6 and open the circuit.

Mounted on the part 4 of the supporting frame is a thermostat comprising a spirally formed bi-metallic element 25 secured at its outer end, as by a rivet 26, to a supporting bracket 27 and at its inner end to a pin 28. The bracket 27 is secured to the plate 4 by a bushing 29 passing through a perforation in the plate 4 and threaded into the hub of said bracket as shown in Fig. 1. Said bracket may be adjusted angularly on said bushing and fixed in adjustment by a set screw 30. The pin 28 traverses the bore of the bushing 29 and is equipped at its upper end with a laterally extending finger 31. The front face of the bracket 15 is formed with a depression 32 leaving a shoulder 33 which serves as a stop engageable by the finger 31 to hold the bracket 15 against the tension of the spring 22 with the switch 5 in closed-circuit position. A louvered cover or housing 34 may be provided to protect the element 25 while permitting access thereto by the surrounding atmosphere.

In use this device may be connected in control circuits as shown in Fig. 6. A transformer 35 supplies electrical energy at the desired voltage to a relay 36, the circuit passing through the switch 5. The relay 36 is of the drop-out type, that is, its contacts are opened by gravity or otherwise when its coil is deenergized. In Fig. 6, 37 represents, schematically, a contact bar or other element which is lifted by action of the relay when energized to close one or more contacts represented by the arrow points. The energizing circuit may be traced from the secondary coil of the transformer 35 via conductor 38 to the switch 5; thence via conductors 39, 40 and 41 to the contact 42; thence via the bar 37, conductor 43, relay 36 and conductor 44 back to the transformer 35. The other contacts engaging the bar 37 may control the circuits to the several service appliances indicated at 45, 46 and 47 connected through the relay contacts to supply circuits 48, 49 and 50 respectively. All of these may, however, be connected to the same supply circuit.

In operation, under normal conditions the switch 5 is closed to energize the relay 36, being held in closed position by the finger 31 engaging the stop 33. While the relay is energized it holds the bar 37 in position to close

all the circuits to the service appliances as well as the contact 42 which controls the relay itself. The thermostat is set as described so that at a predetermined temperature it will turn the finger 31 so as to release the stop 33 and the bracket 15. As shown in Fig. 3, this movement of the finger 31 is in the same general direction as that of the stop 33 as urged by the spring 22, but in a path which deviates from that of the stop to effect the release. Thus no appreciable extra load, such as friction between these parts, is imposed on the bimetallic element 25 during this movement. When this happens, the switch 5 opens and the relay 36 is de-energized, and the bar 37 drops, opening the circuits 48, 49 and 50 and shutting down the appliances 45, 46 and 47. At the same time the relay circuit is opened at the contact 42. Also, since the stop 33 has been moved past the finger 31, the switch 5 will remain open even if a drop in temperature should cause the thermostat to return to its normal condition. This provides opportunity for inspection of the premises before restarting the various appliances. An extra contact 51 may be arranged to be engaged by the bar 37 when it drops, to close an independent circuit to a suitable alarm device 52. Such circuit may have its own source of energy, represented by the battery 53 in Fig. 6.

In order to restore operation when the trouble has been cleared, the switch 5 is closed by manipulation of the head 18, at the same time re-engaging the finger 31 with the stop 33. Thereafter a switch 54, short-circuiting the contact 42, is closed to energize the relay 36 which thereupon lifts the bar 37 to close the other contacts and start the appliances 45, 46 and 47. The switch 54 should be a push button or other self-opening switch, so as to restore control of the relay to the contact 42. An emergency switch 55, short-circuiting the switch 5, is provided so that, in the event of trouble with the switch 5 or the thermostat, the appliances may be operated temporarily without them.

The arrangement of the switch 5 is such that it may be adjusted to afford protection against violent shocks due to explosions, tornadoes, or like causes. As shown in Fig. 5, the closed-circuit setting may be so adjusted, as by positioning the clip 20 with respect to the bracket 15, that the globule 7 makes just sufficient contact with the terminal 6 to carry the required current. Said globule, being freely mobile in the tube 8, will be displaced by a substantial shock, breaking contact with the terminal 6 and opening the energizing circuit of the relay 36. In order to avoid such action taking place as the result of mere vibration of the supporting structure, however, the attachment ring 1 may be mounted with pads 56, of vibration-absorbing material such as rubber, felt or the like, interposed between it and the supporting structure in any suitable manner.

It will be seen that this invention provides a simple and effective device for protecting premises and installations against hazards engendered by the operation of service appliances, such as furnaces, gas supply lines, air-conditioning systems and the like, in emergencies resulting from fires, explosions and other accidental occurrences. The device is responsive to high temperature and shock, one or both of which are usually present in such emergencies. Once shut down, the appliances are not restarted automatically upon return of conditions to normal, but must be restarted manually so that inspection may be made before resuming operation.

I claim:

1. In a device for the purpose set forth, an L-shaped supporting bracket having a vertical leg and a horizontal leg, a circular housing member resting against one face of said vertical leg and having a peripheral flange projecting away from the leg, said housing member having a centrally disposed internally threaded tubular boss, a vertical leg having an opening alined with said boss, a tubular bearing member extending through said opening

and screwed into said boss, said bearing member having a flanged head bearing against the other face of the vertical leg, a second housing member having a peripheral flange and a hollow boss engaging in alinement with the flange and boss of the first housing member and providing a circular channel between the flanges and bosses, a shaft extending through said bearing and the boss of the second member and having the latter fixed thereto, pins projecting into said channel from the housing members respectively, a coiled tension spring mounted in said channel and having its ends hooked on said pins and urging the second housing member to rotate on the first housing member, said housing members being angularly adjustable relatively to each other and to said supporting bracket, latch means engaging the second housing member to hold it releasably from rotation, and a mercury switch carried by said shaft.

2. In a device for the purpose set forth, an L-shaped supporting bracket having a vertical leg and a horizontal leg, a circular housing member resting against one face of said vertical leg and having a peripheral flange projecting away from the leg, said housing member having a centrally disposed internally threaded tubular boss, said vertical leg having an opening alined with said boss, a tubular bearing member extending through said opening and screwed into said boss, said bearing member having a flanged head bearing against the other face of the vertical leg, a second housing member having a peripheral flange and a hollow boss engaging in alinement with the flange and boss of the first housing member and providing a circular channel between the flanges and bosses, a shaft extending through said bearing and the boss of the second member and having the latter fixed thereto, pins projecting into said channel from the housing members respectively, a coiled tension spring mounted in said channel and having its ends hooked on said pins and urging the second housing member to rotate on the first housing member, latch means engaging the second housing member to hold it releasably from rotation, a mercury switch carried by said shaft, and thermostatic means effecting release of said latch means at a predetermined temperature.

3. In a safety switch of the character described, a support, a pair of similar housing brackets having matching circumferential grooves, said housing brackets being mounted face to face with each other so as to form together an annular housing, one of said brackets being adjustably fixed to said support, a shaft journaled on said support to pass coaxially through said fixed bracket, the other of said housing brackets being mounted on said shaft for rotation relatively to said fixed bracket, a coil spring housed in said annular housing and attached at each end to a different one of said brackets, a mercury switch mounted on said rotatable bracket, a stop on said last bracket, a latch engageable with said stop and mounted on said support for rotary movement on an axis transverse to that of said shaft to disengage said stop, and a thermostatic element connected to rotate said latch in accordance with changes of temperature.

4. In a safety switch of the character described, a support, a pair of similar housing brackets having matching circumferential grooves, said housing brackets being mounted face to face with each other so as to form together an annular housing, one of said brackets being adjustably fixed to said support, a shaft journaled on said support to pass coaxially through said fixed bracket, the other of said housing brackets being mounted on said shaft for rotation relatively to said fixed bracket, a coil spring housed in said annular housing and attached at each end to a different one of said brackets, a mercury switch mounted on said rotatable bracket, a stop on said last bracket, a latch engageable with said stop, and a thermostatic element connected to said latch and operating under rise of temperature to move the same in the same general direction as the movement of said stop

by the action of said spring but in a path deviating from
that of said stop so as to release the latter.

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