Oct. 31, 1944. A. J. STOUGES 2,361,712

ELECTRIC SNAP SWITCH

Filed Dec. 26, 1942 2 Sheets-Sheet 1

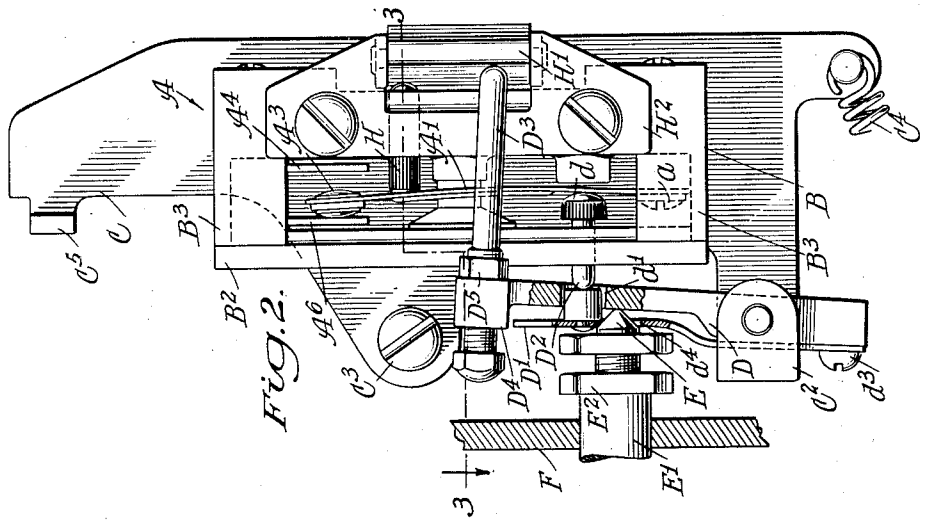


Fig. 2.

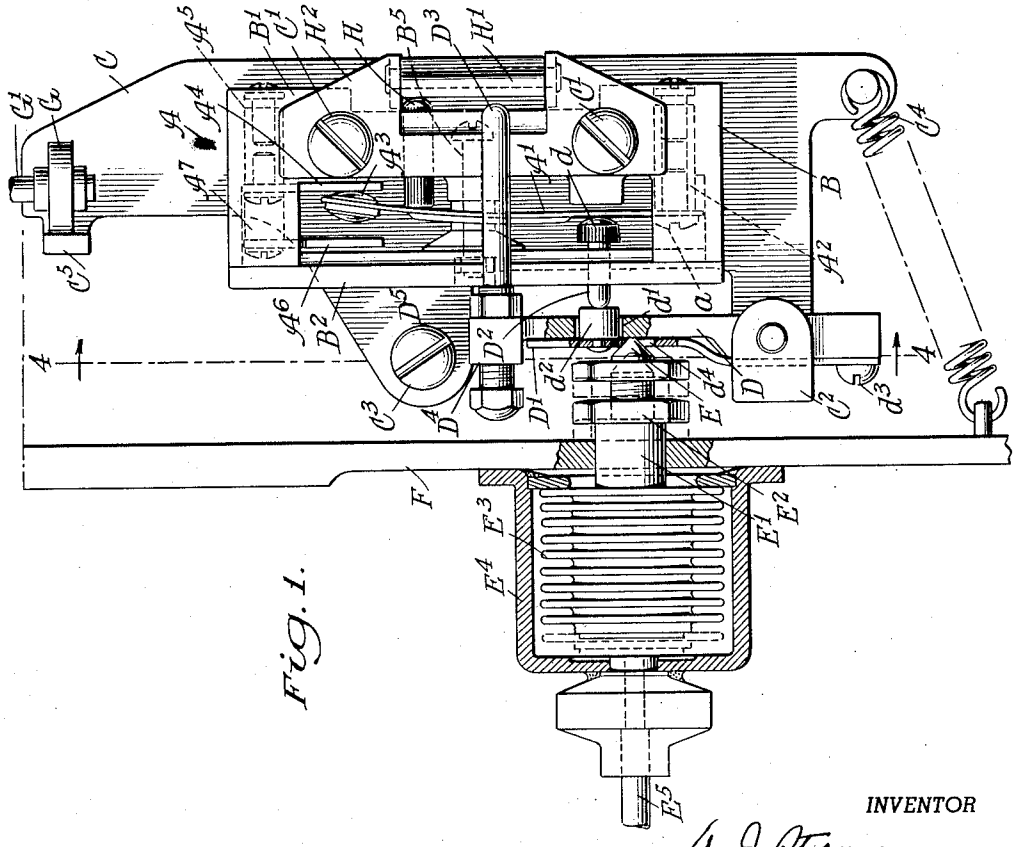


Fig. 1.

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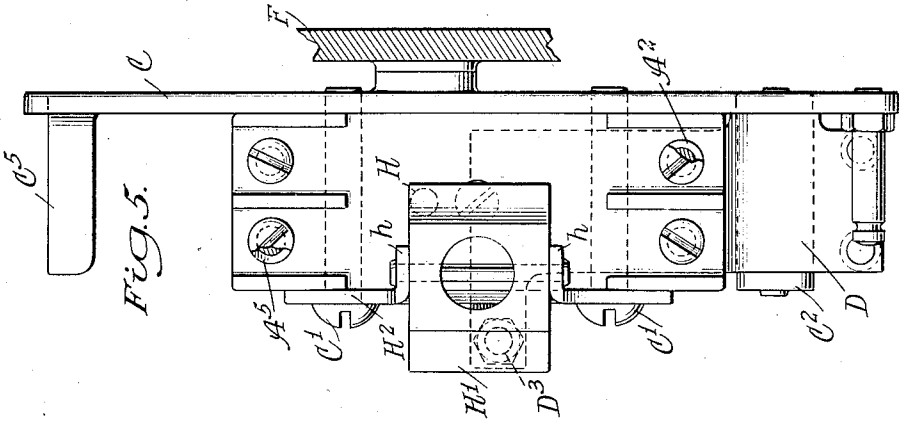


Fig. 5.

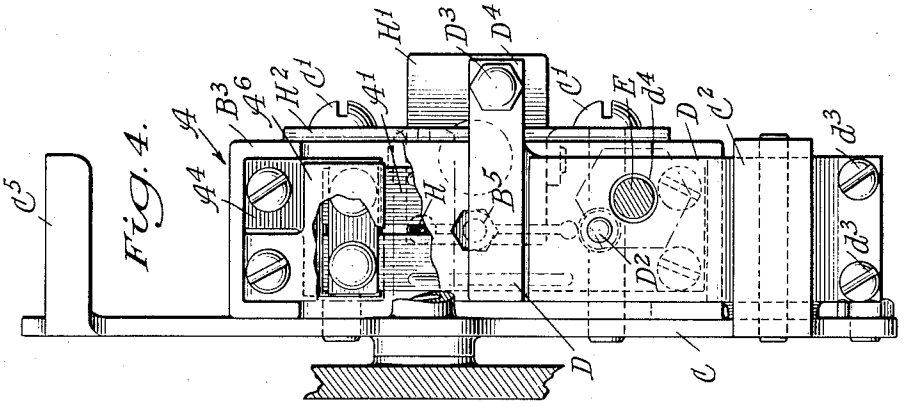


Fig. 4.

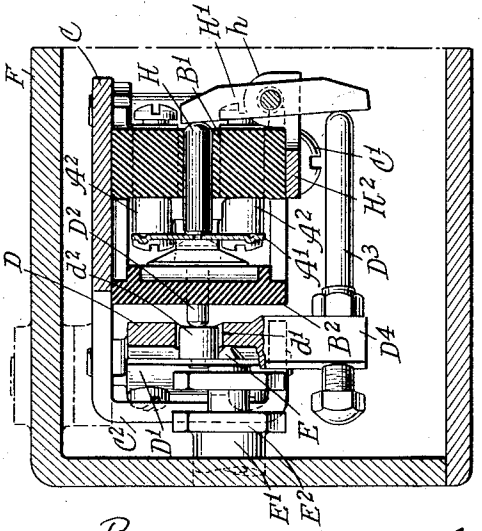


Fig. 3.

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ELECTRIC SNAP SWITCH

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Application December 26, 1942, Serial No. 470,254

8 Claims. (Cl. 200—83)

This invention relates to electrical switch mechanisms and particularly to that class of reclosing circuit breakers now extensively used for the automatic control of temperature in the metal pots of type casting machines, electrical refrigeration, etc. The switch elements of these circuit breakers are usually of the distortable or deformable type and are responsive to an actuating movement of small magnitude which may be produced by fluid expansion of a bellows or diaphragm, or by similar well known thermostatic devices.

In practice, and particularly in installations where the mechanism is subject to vibration, it has been found that as a result of chattering and arcing between contacts at the moment before the circuit is broken, they will frequently adhere or stick together so as to delay the normal action of the switch or prevent it from functioning altogether. Such conditions of course, unless quickly discovered and remedied, are likely to cause serious damage to the delicate parts involved as well as much loss of time and effort in replacements and repairs.

The present invention is intended to overcome these and other difficulties and contemplates a circuit breaker of the class mentioned equipped with automatic safety means adapted to insure breaking of the electrical circuit through the distortable switch element if the latter should fail to function in the proper manner. To this end, and in the preferred embodiment illustrated, the improved switch mechanism includes a thermostatically controlled actuator associated with the switch element and subsidiary means operable thereby to forcibly separate the circuit closing contacts under the abnormal conditions stated.

In the accompanying drawings, the invention has been shown merely in preferred form by way of example, and obviously many changes and variations may be made therein and in its mode of adaptation without departure from its spirit. It should therefore be understood that the invention is not limited to any specific form or embodiment except insofar as such limitations are specified in the claims.

Referring to the drawings:

Fig. 1 is a front elevation, partly in section, of the improved switch mechanism, showing the position of the parts just prior to the distortion of the switch element and the breaking of a circuit therethrough;

Fig. 2 is an elevation similar to Fig. 1 but showing the parts in a different position and the safety device functioning;

Fig. 3 is a horizontal section taken on the line 3—3 of Fig. 2;

Fig. 4 is a side elevation partly in section and taken on the line 4—4 of Fig. 1; and

Fig. 5 is a side elevation similar to Fig. 4 but looking in the opposite direction.

As shown in Figs. 1 and 2, the circuit breaker A, which is intended in the present application to control the temperature of the molten metal used in a typographical casting machine, includes a snap-action switch element A^1 arranged in a Bakelite housing B and secured at its lower end by screws *a* to a pair of terminal bushings A^2 mounted in the housing B. At its upper or free end, the switch element A^1 is provided with the usual "movable" contacts A^3 which are held resiliently engaged with a stationary contact plate A^4 of a single terminal bushing A^5 so as to normally close an electrical circuit through the switch. However, when pressure is applied in a certain restricted area of the element A^1, distortion of the same will be effected and the contacts A^3 will be snapped out of engagement with the plate A^4 against an opposed stop plate A^6 to open or break the circuit. When the switch element is relieved of such pressure, it will automatically resume its original shape and the contacts A^3 will snap back into engagement with the plate A^4 to reclose the circuit. The stop plate A^6 is secured to a terminal bushing A^7 which in the present embodiment is dead, although in other applications of the switch, where the applied pressure acts to close instead of open the circuit, the plate A^6 will be used as the stationary contact and the opposing plate A^4 as the stop.

The switch housing B (Figs. 1, 2 and 4) is secured to a supporting bracket C by a pair of clamping screws C^1 and comprises, generally, a base or body portion B^1 and a cover B^2, the latter being supported upon recessed end posts B^3 of the body portion and arranged in spaced relation therewith to permit access to the parts as the occasion demands. The edges of the cover B^3 are undercut or grooved to fit the end posts, and a single centrally located tie bolt B^5 is employed to hold the two sections of the housing together.

The pressure necessary to effect the distortion of the switch element A^1 is imparted thereto from an actuator D through the medium of a yieldable flat spring member D^1 and a plunger D^2 mounted transversely in the cover of the casing B and formed with an insulated head *d* arranged to engage the switch in the vicinity of the terminal bushings A^2. The actuator D is pivotally mounted near its lower end in an offset portion

C^2 of the bracket C and is controlled by mechanism, presently to be described, which is responsive to temperature changes of the molten type metal in the pot. At its upper end, the actuator, for reasons later to be pointed out, is equipped with an elongated push rod or pin D^3, and below the pin it is formed with a clearance aperture d^1 for a stud d^2 projecting laterally from the spring member D^1 and aligned with the stem of the plunger D^2. The spring member D^1 is fastened by screws d^3 to the actuator D and, adjacent the stud d^2, is itself apertured at d^4 to permit the so-called "expansion" point E of the thermostatic mechanism to directly engage the actuator.

To locate the expansion point A in proper spaced relation with the actuator, it is adjustably mounted in a plunger rod E^1, being threaded into one end of said said rod and located in its adjusted position by a lock nut E^2. At its opposite end, the plunger rod is fastened to a bellows E^3 arranged in a fixed gas-tight chamber E^4 secured to one of the side walls of the usual control or terminal box F. The bellows E^3 is responsive to the expansion of a volatile fluid contained in a bulb (not shown) which is immersed in the molten type metal and connected with the chamber E^4 by appropriate tubing E^5. When the temperature of the metal rises to a predetermined maximum, the bellows E^3 will be collapsed and, through the connections just described, the actuator D will be swung toward the switch housing B to the position shown in Fig. 1. As a result, the stud d^2 of the spring member D^1 will be carried into engagement with the plunger D^2 to effect the distortion of the switch element A^1 and open the circuit therethrough. Conversely, as the temperature falls the bellows will be extended, the actuator will be relieved of the pressure applied thereto by the expansion point E, and the switch element will be permitted to resume its normal shape and reclose the circuit.

It will be observed (see Fig. 1) that the supporting bracket C is pivotally mounted at C^3 in the control box F and is sustained in a vertical position against the influence of a pull spring C^4 by an edge cam or eccentric G arranged to engage a finger C^5 projecting forwardly from the bracket C near the upper end thereof. The eccentric G is fastened to a vertically disposed stub shaft G^1 and is capable of rotary adjustment, when desired, by means conveniently located outside the control box F and operable to change the angular position of the bracket C in order to vary the distance between the actuator and pressure point E. In this way, the operation of the switch element A^1 may be timed to control the temperature according to the particular kind of type metal employed.

As previously stated, the switch element A^1 at times fails to function properly; and, to avoid the danger that would likely result, the circuit breaker A is equipped with a subsidiary safety attachment which is controlled by the actuator through the push rod D^3 and which is adapted to insure breaking of the electrical circuit before the metal temperature and pressure within the expansion bulb and bellows can rise above a predetermined safe limit. This attachment, in the preferred embodiment illustrated, comprises merely an insulated plunger H, arranged to engage the switch element at a point adjacent the contacts A^3, and a rocking lever H^1 for operating the plunger. The lever H^1 (Figs. 1 and 3) is pivotally mounted in a stationary bracket H^2 and disposed outside the housing B with one arm thereof opposed to the free end of the push rod D^3; whereas, the plunger H is mounted transversely in the base portion B^1 of the housing and is directly opposed to the other arm of the lever H^1. The bracket H^2 is formed with spaced apart offset ears *h* (Fig. 5) to accommodate the fulcrum pin of the lever and is held securely in place against the front face of the housing B by the two clamping screws C^1 that fasten the housing to the supporting bracket C. Ordinarily, i. e. when the circuit is broken through the distortion of the switch element by the spring member D^1, the plunger H and the lever H^1 are idle, the free end of the push rod D^3 at such times stopping just short of its engagement with the lever as shown in Fig. 1. However, if for any reason the circuit closing contacts should stick together and prevent the normal operation of the switch element, the spring member D^1 of the actuator D is adapted to yield and permit the latter to continue its movement toward the housing B under the influence of the pressure behind it, to the position shown in Fig. 2. As a result, the lever H^1 will be actuated by the push rod D^3 and, through the plunger H, forcibly disengage the contacts A^3 from the stationary contact plate A^4. As soon as the circuit is broken, the switch element A^1, due to the influence of the spring member D^1 upon the plunger D^2, will snap against the stop plate A^6 and may thereafter continue to function properly without attention and in the manner required. It is important, of course, in order to prevent an excessive rise in temperature before the circuit is broken by the plunger H, that the operation of the rocking lever H^1 be effected as quickly as possible. Consequently, the push rod D^3, as best shown in Figs. 1, 3 and 4, is threaded into a forward extension D^4 of the actuator D so as to be capable of endwise adjustment and is provided with a lock nut D^5 for locating it at the proper distance from the lever H^1.

Occasionally the switch element, through constant usage over a period of time, may consistently fail to respond to the operation of the plunger D^2 and in such instances the safety device just described would function solely to maintain metal at a temperature level slightly above normal until it is convenient to make the repairs or replacements indicated.

From the foregoing description, the construction and operation of the parts should be clear. However, it may here be added that the invention is not limited to the specific embodiment illustrated and that many changes therein will readily suggest themselves to those skilled in the art, which will still be composed within its scope. For example, it is conceivable that the circuit breaker A may be enlarged slightly to include two distortable switch elements arranged in series, one operable under normal conditions by the yieldable member D^1 in precisely the same way as the switch element A^1, and the other operable under the abnormal conditions mentioned, by the actuator D through means corresponding with the plunger H and lever H^1. In short, the invention is not limited to any particular form or embodiment except insofar as such limitations are specified in the following claims.

Having thus described my invention, what I claim is:

1. An electrical switch mechanism including, in combination, a distortable switch element, means for effecting the distortion of said element, an actuator responsive to applied pressure,

a yieldable member independent of the switch element and carried by the actuator for effecting the distortion of the switch element to break the circuit, and subsidiary safety means controlled by the actuator for automatically breaking the circuit upon the yielding of said member if the switch element should fail to function.

2. A combination according to claim 1 including means capable of adjustment to regulate the time of breaking the circuit by the safety means.

3. A combination according to claim 1 wherein the safety means includes a plunger operable to forcibly separate the circuit closing contacts, a rocking lever for operating the plunger, and an adjustable pin carried by the actuator for operating the rocking lever.

4. An electrical switch mechanism including, in combination, a distortable switch element, a housing therefor, an actuator responsive to applied pressure, a yieldable member carried by the actuator for effecting the distortion of the switch element to break the circuit, and a safety attachment for breaking the circuit automatically upon the yielding of said member if the switch element should fail to function, said attachment including a plunger mounted in the switch housing and operable to forcibly separate the circuit closing contacts, a rocking lever arranged adjacent the housing in operative relation with the plunger, and means carried by the actuator for operating the rocking lever.

5. A combination according to claim 4, wherein the means for operating the rocking lever includes a pin adjustably mounted in the actuator so as to regulate the time of breaking the circuit by the plunger.

6. An electrical switch mechanism including, in combination, a distortable switch element, an actuator responsive to applied pressure for effecting the distortion of the switch element to break the circuit, said actuator carrying a member independent of the switch element and through which the circuit breaking movement of the actuator is transmitted to the switch element, said member being unyielding in relation to the actuator under normal conditions but arranged to yield in relation thereto under abnormal conditions, and subsidiary safety means controlled by the yielding of said motion transmitting member and acting positively upon the switch element to break the circuit.

7. An electrical switch mechanism including, in combination, a distortable switch element, an actuator responsive to applied pressure for effecting the distortion of the switch element to break the circuit, said actuator carrying a member independent of the switch element and through which the circuit breaking movement of the actuator is transmitted to the switch element, said member being unyielding in relation to the actuator under normal conditions but arranged to yield in relation thereto under abnormal conditions, and subsidiary safety means operated by the actuator upon the yielding of said motion transmitting member and comprising an independent motion transmitting connection with the switch element to break the circuit.

8. An electrical switch mechanism including, in combination, a distortable switch element, an actuator responsive to applied pressure for effecting the distortion of the switch element to break the circuit, said actuator carrying a member independent of the switch element and through which the circuit breaking movement of the actuator is transmitted to the switch element, said member being unyielding in relation to the actuator under normal conditions but arranged to yield in relation thereto under abnormal conditions, and subsidiary safety means operated by the actuator upon the yielding of said motion transmitting member and comprising an independent motion transmitting connection with the switch element to break the circuit, said subsidiary means being normally idle and brought into operation only upon the yielding of the yieldable member carried by the actuator.

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