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N. L. CASE ET AL

2,293,382

THERMAL TYPE OVERLOAD CIRCUIT BREAKER

Filed June 26, 1940

Fig. 1

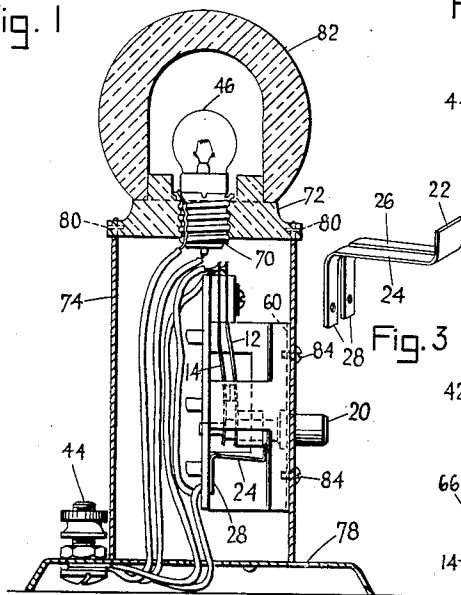


Fig. 2

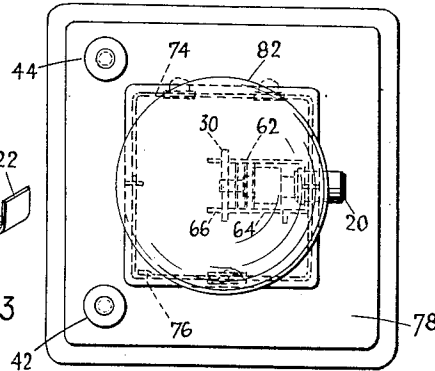


Fig. 3

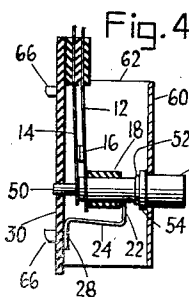


Fig. 4

Fig. 5

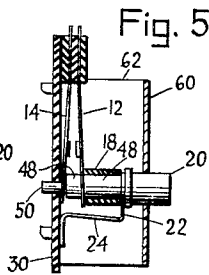


Fig. 6

Fig. 7

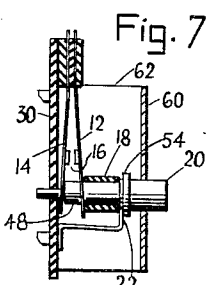


Fig. 8

Fig. 9

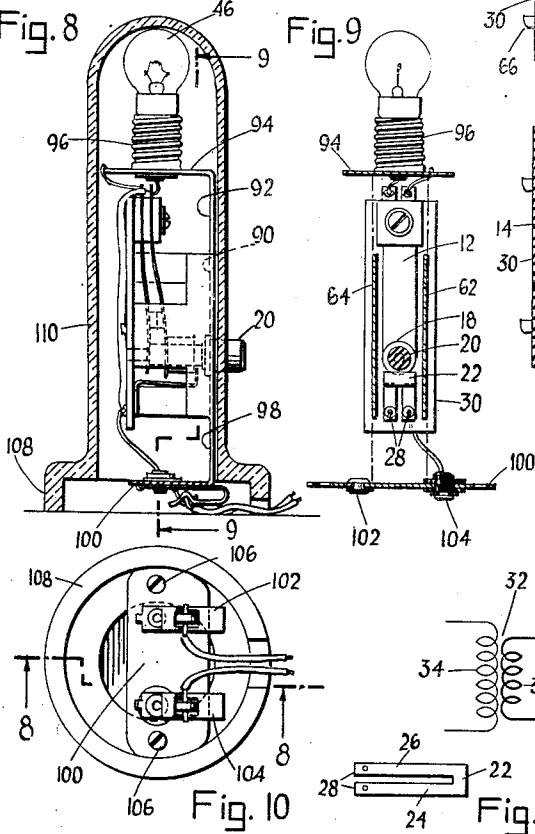
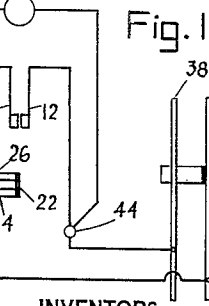


Fig. 10

Fig. 11



UNITED STATES PATENT OFFICE

2,293,382

THERMAL TYPE OVERLOAD CIRCUIT
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Application June 26, 1940, Serial No. 342,460

7 Claims. (Cl. 200-116)

This invention relates to overload circuit breakers, particularly for toys such as toy railroads.

The primary object of the present invention is to generally improve overload circuit breakers, particularly low voltage circuit breakers for electrically-operated toys such as toy railroads. A more particular object is to provide such a device which may also be used as a manually-operated circuit breaker, this being desirable for signalling or remote control purposes. Still another object is to so arrange the restoring button or control as to make it impossible to hold the circuit closed manually after it has been opened by a short circuit or similar overload.

Other objects of the invention are to provide a circuit breaker which is simple in construction, dependable in operation, compact in dimension, and low in manufacturing cost. A still further object of the invention is to so arrange the parts of the circuit breaker that they may be housed in the relatively slender upright part of a support for a lamp or like signal showing when the circuit breaker has opened.

To the accomplishment of the foregoing and other objects which will hereinafter appear, our invention consists in the circuit breaker elements and their relation one to the other as hereinafter are more particularly described in the specification and sought to be defined in the claims. The specification is accompanied by a drawing, in which:

Fig. 1 is a section taken in elevation through an overload circuit breaker embodying features of the invention;

Fig. 2 is a plan view thereof;

Fig. 3 is a perspective view showing the configuration of the thermostatic element;

Fig. 4 is a section through the circuit breaker with the contacts in closed condition;

Fig. 5 illustrates the operation of the push button as a manual circuit breaker;

Fig. 6 illustrates the relative location of the parts following a short circuit or overload;

Fig. 7 shows how the parts may be restored to working position, without manually closing the circuit;

Fig. 8 is a section taken in elevation through a modified form of the invention, and is taken approximately in the plane of the line 8-8 of Fig. 10;

Fig. 9 is a section through the mechanism taken in the plane of the line 8-8 of Fig. 8;

Fig. 10 is a bottom plan view of the modification;

Fig. 11 is a wiring diagram for the circuit breaker; and

Fig. 12 is explanatory of a detail.

Referring to the drawing, and more particularly to Fig. 4, the circuit breaker comprises insulatedly mounted front and back spring contacts 12 and 14 which are normally closed at 16, as is indicated in the drawing. The front contact 12 is so shaped that it normally tends to spring toward the right or away from the contact 14 to the open circuit position shown in Fig. 6. However, it is normally held in the closed contact position by a sleeve 18 slidable on a pusher 20, the sleeve 18 being held in the left-hand position shown in Fig. 4 by a detent 22. Detent 22 forms a part of the thermostatic element of the circuit breaker. Its configuration will be clear from inspection of Fig. 3 in which it will be seen that the thermostatic element comprises spaced legs 24 and 26 integrally connected at one end by the detent ledge 22. A generally U-shaped piece, having the configuration shown in Fig. 12, is stamped or punched from a sheet of laminated or thermostatic metal. The U-shaped piece is then bent at both ends to the shape shown in Fig. 3, the upwardly bent closed end 22 acting as the detent ledge, and the downwardly bent parts 28 acting as a convenient means for attachment to a suitable support such as the insulation wall 30 in Fig. 4.

The detent normally assumes the upward position shown in Fig. 4, and thereby holds the sleeve 18 in the left-hand position shown, and so keeps the front contact 12 closed against the rear contact 14.

The laminations of different metals in the thermostatic element are such that overheating tends to cause the same to bend downwardly from the position shown in Fig. 4 to the position shown in Fig. 6. This releases the sleeve 18, whereupon the front contact 12 springs away from the rear contact 14, thus opening the circuit to be protected.

The thermostat and the contacts are preferably connected in series with one another and with the circuit to be protected. Thus, referring to Fig. 11, the step-down transformer 32 may be a typical toy transformer having its primary 34 connected to a household wiring outlet, and having its secondary 36 connected to the service rails 38 and third rail 40 of a toy railroad. The thermostatic detent 22, 24, 26 is connected in series with the contacts 12, 14 and both are arranged in series with the transformer circuit, as is clearly shown in the wiring diagram. Ter-

minals 42 and 44 are preferably provided for convenience, and a lamp 46 is preferably connected across terminals 42 and 44 or in parallel with the circuit breaker mechanism. In the event of an overload or short circuit, the current flowing through the thermostatic element becomes excessive and heats the same, whereupon the contacts 12, 14 are permitted to open. The lamp 46, which is normally extinguished because of the low voltage across the circuit breaker mechanism, is lighted when the circuit breaker opens, thus warning of the condition to be corrected.

Reverting now to Fig. 6, the opening of the circuit permits the thermostat to cool, and it thereupon moves upwardly from the solid line position 22 to the broken line position 22' where it rests against the sleeve 18. To close the circuit breaker, it is merely necessary to depress the pusher or button 20, this having a diameter somewhat greater than the inside diameter of sleeve 18, and so moving the sleeve relative to detent 22 until the latter moves upwardly at the end of the sleeve, as is shown in Fig. 7.

In order to prevent the button 20 from being used to manually hold the circuit closed despite the existence of a short circuit, with possible burning out of the transformer or other hazard, the pusher is preferably arranged to move the rear contact 14 away from the front contact 12. For this purpose a part 48 of the pusher is arranged to bear against the rear contact 14 without, however, affecting the position of the front contact 12. Thus, when the button 20 is pushed in, the parts assume the relation shown in Fig. 7, for while the button moves the sleeve 18 and the front contact 12 toward the left so as to make it possible for detent 22 to engage and hold the sleeve 18, the pusher also pushes the rear contact 14 toward the left, thus keeping the contacts open at 16. The circuit is closed when the button 20 is released, for then the rear contact moves to the right and the parts assume the relation shown in Fig. 4. Note, however, that at this time the button has been released and, therefore, if the short circuit still exists the thermostat will again quickly heat and so release the front contact as is shown in Fig. 6.

With the construction shown the button 20 may be used as a manual means to momentarily break the circuit. This is useful in connection with certain types of toy trains which are arranged to reverse or to perform some other operation under remote control. Referring to Fig. 5 the parts are there shown in the same relation as in Fig. 4, except that the button 20 has been depressed. This causes the part 48 of the pusher to move the rear contact 14 away from the front contact 12, thereby opening the circuit, there being no change in the positions of the sleeve 18 and the detent 22.

While not essential, it is convenient to make the pusher 20 in the form of a stepped cylinder made of insulated material. The endmost part 50 of smallest diameter is slidable in a hole in insulation back plate 30. The part 50 is preferably slidable through a hole in the lower end of contact 14. The part 48 is of larger diameter than the hole and, therefore, controls the position of contact 14. This part, however, passes through a larger hole in the lower end of contact 12, and does not control the position of contact 12. That is controlled instead by the sleeve 18 which is slidable on the part 48 of the pusher. The next step on the pusher is the part 52 (Fig. 4) which is somewhat larger than the inside

diameter of sleeve 18, yet substantially smaller than the outside diameter of the sleeve. It is larger than the inside diameter in order to move the sleeve when the button is pushed, but it is smaller than the outside diameter in order to permit the detent 22 to engage the end of the sleeve when the button is pushed inwardly as shown in Fig. 7. This part 52 may have the same diameter as the button 20, and in such case a collar 54 of still larger diameter is preferably provided to limit outward movement of the button as shown in Figs. 4 and 6.

The button is slidable in a hole through a metal wall 60. This is the end or connecting wall of a piece of sheet metal bent to U-shape, one of the sides of the U being shown at 62, and both sides being shown at 62, 64 in Fig. 2. The metal piece is secured to an insulation base 30 by suitable tongue and slot connections 66.

Referring now to Figs. 1 and 2 of the drawing, the lamp 46 is received in a socket 70 carried on a top 72 which may be made of a suitable plastic. Top 72 closes the upper end of a hollow sheet metal support 74 which is preferably made by bending a single piece of heavy gauge sheet metal to form four side walls connected at a suitable seam 76 (Fig. 2). These are carried on an upwardly dished sheet metal base 78 which in turn carries the binding posts 42 and 44. One of these may be grounded to the metal, but the other must be insulated. The upright support 74 is secured to base 78 by suitable tongue and slot connections, the tongues being bent beneath the base. The top 72 is secured to the walls 74 by tongue and slot connections but, in this case, it is preferable to secure the tongues in the plastic by pins 80 (Fig. 1) instead of by bending the tongues. Lamp 46 is enclosed by a suitable globe 82 which may, if desired, be made of a translucent plastic.

The circuit breaker unit is secured within the upright housing 74, as by means of screws 84 which pass through one wall of the housing and which are threadedly received in the front wall 60 of the sheet metal frame. Connections to the thermostat are made at the legs 28, while connections to the switch contacts 12 and 14 are made at their upper ends.

A modified housing for the invention is shown in Figs. 8, 9, and 10. In this arrangement the entire housing is made of a single piece of plastic. The mechanical construction of the circuit breaker is exactly the same as previously described. However, the sheet metal front wall 90, corresponding to the front wall 60 in Figs. 4-7, is extended both upwardly and downwardly. The upwardly extending part 92 is bent to horizontal position at 94 and forms a support for lamp socket 96. The downwardly extending part 98 is bent to horizontal position at 100, and has mounted thereon suitable terminals such as the Fahnestock clips 102 and 104 (Fig. 10). One of these, in this case the clip 102, is secured directly on and grounded to the metal, while the other, in this case the clip 104, is insulatedly mounted. Screws 106 may be used to secure the plate 100 in the base part 108 of the housing 110. The upper plate 94 is suitably dimensioned to prevent side to side movement. The button 20 projects through a hole in the casing 110, and the latter is, of course, preferably made of a translucent plastic. It may, for example, be colored red, in which case it will glow with a red lumination when the lamp 46 is lighted, thus warning that the circuit breaker is open.

It is believed that the construction and operation, as well as the many advantages of our improved thermal type circuit breaker will be apparent from the foregoing detailed description thereof. It will also be apparent that while we have shown and described the invention in several preferred forms, many changes and modifications may be made in the structures disclosed without departing from the spirit of the invention as sought to be defined in the following claims.

We claim:

1. An overload circuit breaker comprising a pair of spring contacts tending to open, a pusher extending transversely of said contacts and having a part adapted to bear against and push the further contact away from the nearer contact, thereby opening the circuit whenever the pusher is pressed, a step slidable on said pusher, said step bearing against and being adapted to control the position of the nearer contact, means in said pusher for engaging and moving the step, a thermostat detent to normally hold the step in such position as to keep the contacts closed, means connecting said thermostat and said contacts in series with each other and with the line to be protected, the direction of movement of said thermostat being such that when overloaded and heated it bends away from the step and so permits opening of the contacts, the depression of said pusher restoring the step to proper position to again be engaged by the detent but at the same time moving the rear contact so that it is impossible to hold the contacts closed by means of the push-button, the slidable relation between the slidable step and the pusher affording outward movement of the pusher and the rear contact after the slidable step has been engaged by the detent.

2. An overload circuit breaker comprising a pair of collaterally arranged spring contacts tending to open, a pusher extending transversely of said contacts and having an exposed end acting as a push-button, said pusher having a part adapted to bear against and push the further contact away from the nearer contact, thereby opening the circuit whenever the push-button is pressed, a sleeve surrounding and slidable on said pusher, said sleeve bearing against and being adapted to control the position of the nearer contact, means on said pusher for engaging and moving the sleeve, a detent to normally hold the sleeve in such position as to keep the contacts closed, said detent being a thermostat cut to U-shaped configuration and disposed generally transversely of the contacts with the closed end of the U bent transversely of the legs to form a detent ledge for engaging the aforesaid sleeve and holding the contacts closed, means connecting said thermostat and said contacts in series with each other and with the line to be protected, the direction of movement of said thermostat being such that when overloaded and heated it bends away from the sleeve and so permits opening of the contacts, the depression of said button restoring the sleeve to proper position to again be engaged by the detent ledge, but at the same time moving the rear contact, whereby it is impossible to hold the contacts closed by means of the push-button, the slidable relation between the sleeve and the pusher affording outward movement of the pusher and the rear contact after the sleeve has been engaged by the detent.

3. An overload circuit breaker, particularly for

toy railways, said circuit breaker comprising a pair of spring contacts tending to open, a pusher extending transversely of said contacts and having an exposed end acting as a push-button, said pusher being cylindrical and stepped in diameter, a small-diameter inner end passing through the further contact and through a guide wall whereby an intermediate-diameter portion is adapted to bear against and push the further contact away from the nearer contact, thereby opening the circuit whenever the push-button is pressed, said intermediate-diameter portion passing through the nearer contact, a sleeve surrounding and axially slidable on said intermediate-diameter portion, said sleeve bearing against and being adapted to control the position of the nearer contact, a large-diameter portion on said pusher for engaging and moving the sleeve, a thermostat detent to normally hold the sleeve in such position as to keep the contacts closed, means connecting said thermostat and said contacts in series with each other and with the line to be protected, the direction of movement of said thermostat being such that when overloaded and heated it bends away from the sleeve and so permits opening of the contacts, the depression of said button restoring the sleeve to proper position to again be engaged by the detent, but at the same time moving the rear contact, whereby it is impossible to hold the contacts closed by means of the push-button, the slidable relation between the sleeve and the pusher affording outward movement of the pusher and the rear contact after the sleeve has been engaged by the detent.

4. An overload circuit breaker comprising a frame having spaced front and back walls, front and back spring contacts mounted in said frame and extending in the direction of said front and back walls, said contacts normally tending to separate, an insulation pusher rod extending transversely of said contacts through said front and back walls, said pusher rod having a small-diameter inner end portion passing through said back contact and said back wall, a medium-diameter intermediate portion passing through said front contact and abutting said back contact, a sleeve slidable on said intermediate portion and abutting said front contact, the next forward portion of said pusher rod being of large diameter and the forward end of said pusher rod projecting through the front wall of the frame and acting as a push-button for said pusher rod, and a thermostatically controlled detent for engaging said sleeve to normally hold the contacts closed, the steps of said pusher rod being so related that depression of the push-button moves the back contact away from the front contact at the same time that it moves the sleeve into position for engagement by the detent.

5. An overload circuit breaker comprising a frame having spaced front and back walls, front and back spring contacts mounted in said frame and extending in the direction of said front and back walls, said contacts normally tending to separate, an insulation pusher rod extending transversely of said contacts through said front and back walls, said pusher rod having a small-diameter inner end portion passing through said back contact and said back wall, a medium-diameter intermediate portion passing through said front contact and abutting said back contact, a sleeve slidable on said intermediate portion and abutting said front contact, the next forward portion of said pusher rod being of large diameter and the forward end of said pusher rod

projecting through the front wall of the frame and acting as a push-button for said pusher rod, a detent for engaging said sleeve to normally hold the contacts closed, said detent being a thermostat made of relatively high-resistance sheet metal cut to U-shaped configuration and disposed transversely of the contacts in the direction of the pusher rod, the closed end of the U-shaped thermostat being bent transversely of the legs to form a detent ledge for engaging the sleeve, the steps of said pusher rod being so related that depression of the push-button moves the back contact away from the front contact at the same time that it moves the sleeve into position for engagement by the detent.

6. An overload circuit breaker comprising a frame having spaced front and back walls, front and back spring contacts mounted in said frame and extending in the direction of said front and back walls, said contacts normally tending to separate, an insulation pusher rod extending transversely of said contacts through said front and back walls, said pusher rod having a small-diameter inner end portion passing through said back contact and said back wall, a medium-diameter intermediate portion passing through said front contact and abutting said back contact, a sleeve slidable on said intermediate portion and abutting said front contact, a larger-diameter step ahead of the sleeve, said step having a diameter larger than the inside of the sleeve in order to prevent forward movement of the sleeve, but smaller than the outside of the sleeve so that the forward end of the sleeve may be used for engagement by a detent, the forward end of said pusher rod projecting through the front wall of the frame and acting as a push-button or said pusher rod, and a thermostatically controlled detent for engaging said sleeve to normally hold the contacts closed, the steps of said pusher rod being so related that depression of the

push-button moves the back contact away from the front contact at the same time that it moves the sleeve into position for engagement by the detent.

7. An overload circuit breaker comprising a frame having spaced front and back walls, front and back spring contacts mounted in said frame and extending in the direction of said front and back walls, said contacts normally tending to separate, an insulation pusher rod extending transversely of said contacts through said front and back walls, said pusher rod having a small-diameter inner end portion passing through said back contact and said back wall, a medium-diameter intermediate portion passing through said front contact and abutting said back contact, a sleeve slidable on said intermediate portion and abutting said front contact, a larger-diameter step ahead of the sleeve, said step having a diameter larger than the inside diameter of the sleeve in order to prevent forward movement of the sleeve, but smaller than the outside of the sleeve so that the forward end of the sleeve may be used for engagement by a detent, a stop portion of still larger diameter, the forward end of said pusher rod being smaller in diameter than the stop portion and projecting through a mating hole in the front wall of the frame and acting as a push-button for said pusher rod, the aforesaid stop portion limiting outward movement of the pusher rod, and a thermostatically controlled detent for engaging said sleeve to normally hold the contacts closed, the steps of said pusher rod being so related that depression of the push-button moves the back contact away from the front contact at the same time that it moves the sleeve into position for engagement by the detent.

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