

Feb. 16, 1960

J. L. BONANNO
CIRCUIT BREAKER

2,925,482

Filed May 9, 1958

2 Sheets-Sheet 1

Fig. 1.

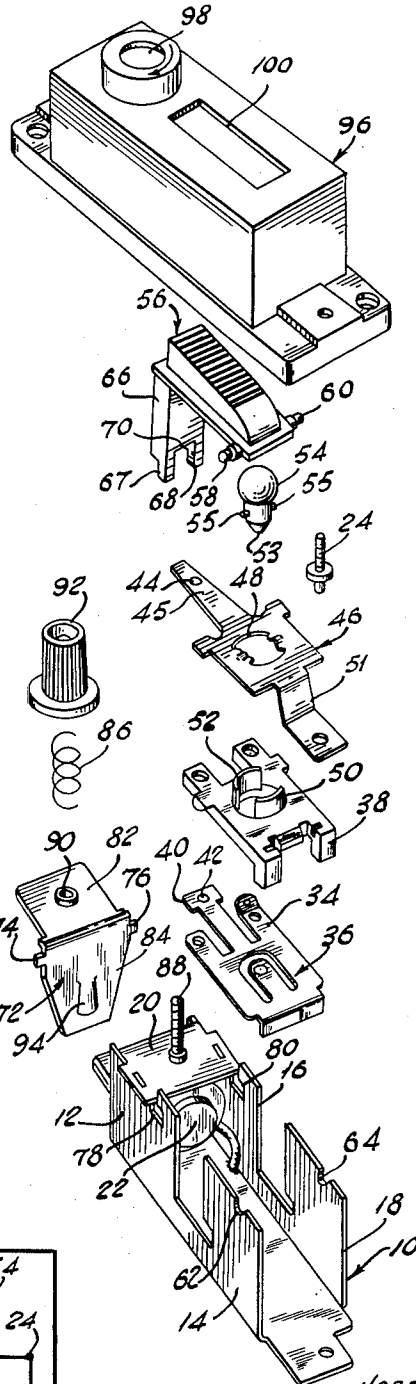
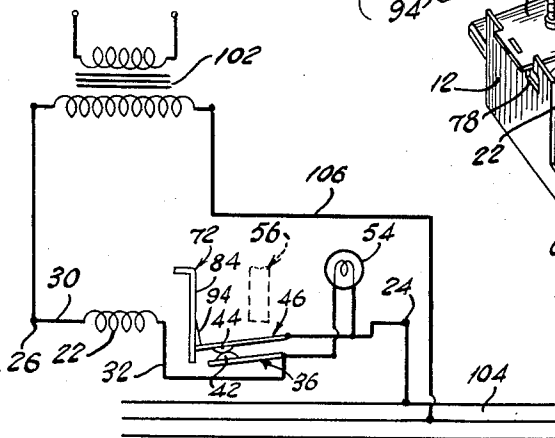


Fig. 5.



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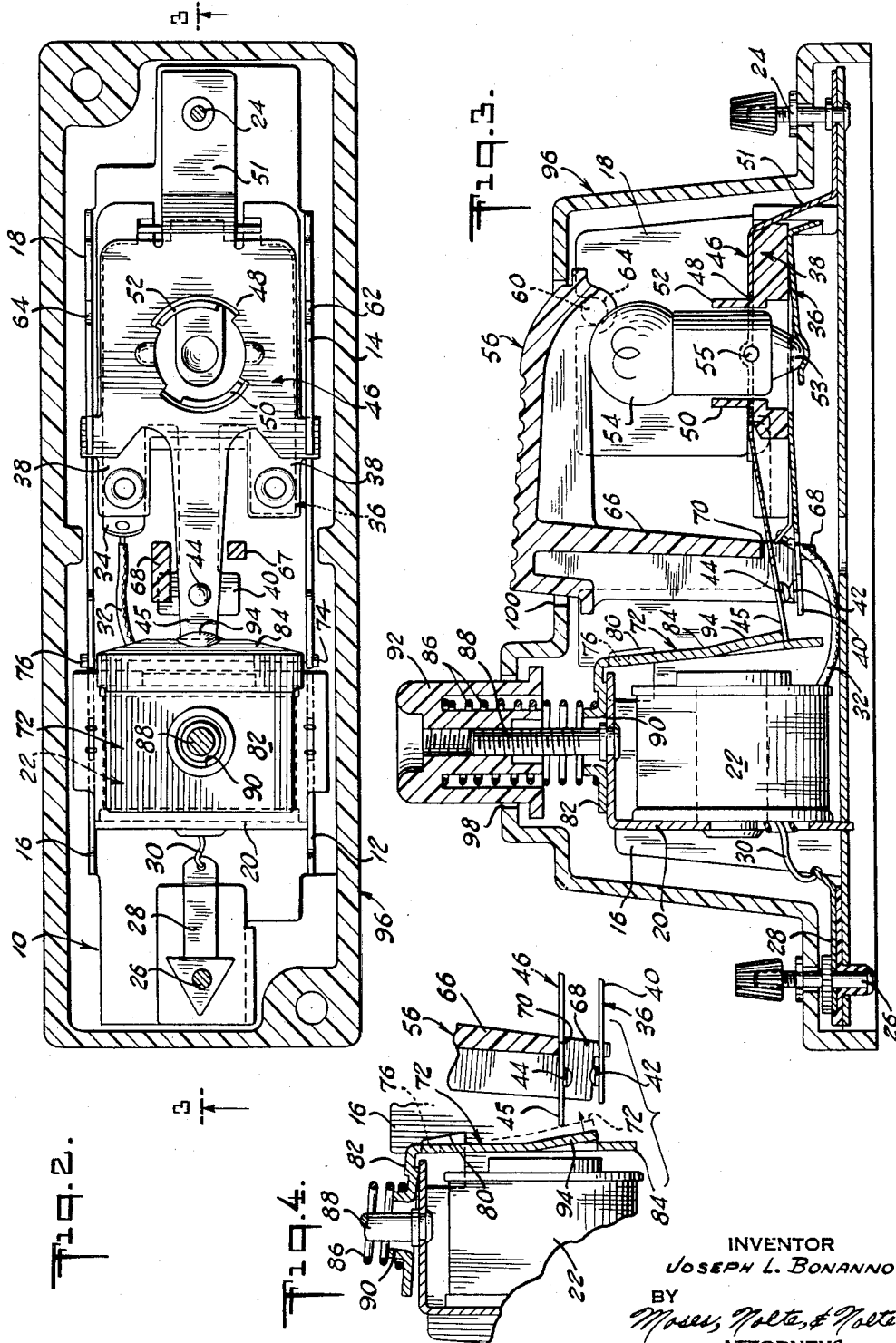
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CIRCUIT BREAKER

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10 Claims. (Cl. 200—95)

This invention relates in general to circuit breakers and in particular to a new and useful combination adjustable circuit breaker and short circuit indicating device.

The present invention is particularly directed, but not limited, to a circuit breaker for use with a toy railroad, and which is adjustable for operation over a small current range.

A feature of the invention is an arrangement which permits adjustment of the circuit-breaking current by varying the force acting on a solenoid actuable member. The amount of current passing through the solenoid coil must be an amount sufficient to overcome the force acting on the member in order to break the circuit. Such a construction has decided advantages over usual circuit breakers in that generation of heat due to current overload is not utilized to effect breaking of the circuit.

A feature of the invention is the simplicity of construction which permits inexpensive manufacture of the circuit breaker for use with toys such as model-railroads or the like.

The arrangement is such that when the circuit is broken due to current overload an indicator lamp is connected into the circuit and flashes a warning signal indicating the short.

Accordingly, it is an object of this invention to provide an improved circuit breaker.

A further object of the invention is to provide a circuit breaker including an adjustable spring loaded contact holding member, which is actuable by a solenoid receiving current of a predetermined amount, to open the contacts of a circuit.

A further object of the invention is to provide a circuit breaker which is simple in design, rugged in construction and economical to manufacture.

The various features of novelty which characterize the invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, its operating advantages and specific objects attained by its use, reference should be had to the accompanying drawings and descriptive matter in which there is illustrated and described a preferred embodiment of the invention.

In the drawings:

Fig. 1 is an exploded perspective view indicating the parts of a circuit breaker constructed in accordance with the invention;

Fig. 2 is a top plan view with portions in section and portions being removed for clarity;

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

Fig. 4 is a fragmentary section indicating the solenoid and circuit breaking actuating member in a circuit breaking position; and

Fig. 5 is a schematic electrical diagram of the circuit breaker and indicating connections to a coil of a transformer.

Referring to the drawings in particular, the invention as embodied therein includes a metallic base section gen-

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erally designated 10 having two sets of upstanding spaced side walls 12 and 14 and 16 and 18. An L-shaped member 20 is affixed to the side walls 12 and 16 and covers the top and the end of the two walls to form a compartment in which is positioned a solenoid 22. The solenoid 22 is secured to the portion of the L-shaped member 20 forming the end wall.

Mounted on each end of the base section 10 are upstanding stud members 24 and 26 which form terminal connections for electrically connecting the circuit breaker.

The stud 26 is secured to and makes contact with a metallic conductive plate 28 which has an upstanding portion secured to a wire conductor 30 which is electrically connected to the solenoid 22. Another terminal 32 of the solenoid 22 is connected to an extending side arm 34 of a contact button plate generally designated 36.

The contact button plate 36 is secured to the underside of an insulated body 38, made of plastic or similar material. A central arm 40 of the contact button plate 36 is provided with an upstanding contact button 42 which engages a similar button 44 on the bottom face of an arm 45 of an upper contact button plate generally designated 46, when the circuit breaker circuit is closed. The upper contact button plate 46 is provided with a central opening 48 precisely cut to fit over two upstanding separated annular portions 50 and 52 of the insulation member 38.

The upper contact button plate 46 is provided with a downwardly extending trailing portion 51 which is secured to the stud 24 to complete the electrical circuit.

A circuit breaking light bulb indicator 54 is positioned between the upstanding portions 50 and 52 in the recess 48. A bottom contact 53 electrically connects the contact button plate 36 and projecting side lugs 55 contact electrically, the upper contact button plate 46. A combination recess button and warning light indicating window generally designated 56 is provided with two laterally extending lugs 58 and 60 which normally rest on curved recesses 62 and 64 formed on the upstanding side walls 14 and 18. The opposite end of the button is provided with a depending portion 66 having two lower spaced legs 67 and 68 which rest on the central arm 40 of the contact button plate 36. A face 70 between the arms 67 and 68 rests on the arm 45 of the upper contact button plate 46.

In accordance with the invention a substantially L-shaped member generally designated 72 is provided with laterally extending lugs 74 and 76 which rest in notches 78 and 80 formed in the side plates 12 and 16. The L-shaped member includes a top plate 82 which rests against the top portion of the L-shaped member 20, and a vertical portion 84 which extends downwardly therefrom across the face of the solenoid 22. The L-shaped member 72 may pivot on its lugs 74 and 76 under the influence of an attractive force caused by the solenoid 22.

In accordance with the invention the force required to pivot the L-shaped member about its lugs 74 and 76, is adjustably predetermined by the amount of force which is preset on the member 82. This adjustment is made by varying the compressive force on a compression spring 86, which is positioned around an upstanding stud 88 secured to the top of the L-shaped member 20. The L-shaped member 72 is provided with a suitable opening 90 through which the stud 88 extends, and the spring 86 is positioned between a recess in a control knob nut 92 and the top face 82 of the L-shaped member 72. The control knob nut 92 is internally threaded and is adjustably positionable on the stud 88 to vary the compressive force of the spring 86. The amount of the compression spring force which the solenoid 22 must overcome, in order to attract the vertical face 84 of the

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L-shaped member 72, is proportional to the amount of current which passes through the solenoid. Hence, an adjustment of the force acting on the L-shaped member 72 is effective to adjust the current amount at which the L-shaped member will rotate.

The L-shaped member 72 is provided with an outwardly deformed portion 94 on its lower face, which overlies the arm 45 when the solenoid 22 is not exerting sufficient force on the L-shaped member to move the face 84 and the portion 94 backwardly off the contact arms. When the arm 45 is held by the deformed portion 94, the arms 40 and 45 are in a position in which the contact buttons 44 and 42 are in touching engagement and in a position closing the electrical circuit.

A substantially rectangular cover-housing generally designated 96 is provided with a circular opening 98 to which the control knob 92 extends and a rectangular opening 100 through which the recessed button and indicating window 56 is positioned.

In Fig. 5 there is illustrated schematically the electrical connection of the circuit breaker to a transformer 102 and tracks 104 of a toy railroad. Terminal 26 and hence one coil of the solenoid 22 is connected to one terminal of the transformer 102. The circuit breaker forms a series circuit including the solenoid 22, the closed contact buttons 42 and 44 and the terminal 24 which is connected to the track 104. A connection 106 between the other terminal of the transformer 102 and the central rail of the track 104 completes the connection.

A short circuit indicating light 54 is connected in a shunt circuit across the two contact plates 36 and 46. The lamp 54 is short circuited and hence not lighted when the contacts 42 and 44 are closed.

When the solenoid 22 receives an excessive amount of current, as, for example, when a short circuit develops on the track circuit 104, it will exert sufficient electromagnetic force to attract the vertical face 84 of the L-shaped member 72, and overcome the restraining force exerted by the predetermined setting on the spring 86, as influenced by the control knob 92. Movement of the vertical face 84 in the direction of the solenoid brings the outwardly deflected portion 94 off the end of the arm 45 of the upper contact plate 46. The upper contact plate arm 45 then springs upwardly out of contact with the plate 36. The circuit is then broken and current flow will be only through the high resistance circuit of the lamp 54. The circuit breaker thus protects the transformer 102 from excessive short-circuit currents which might destroy or damage the transformer and effectively cuts off the power to the tracks when a short circuit or derailment occurs.

The lamp will continue to glow and its light will be visible through the combination recessed button and window 56. The combination recessed button and window is preferably made of a red colored plastic to make the overload-condition warning clearly visible.

Once the overloaded condition is corrected, the circuit breaker is reset by depressing the button 56 to cause the contact buttons 42 and 44 to come together and the arm 43 to be positioned beneath the outwardly deflected portion 94 of the L-shaped member 72. The lamp 54 will then go out and the breaker will be in condition for further use for breaking of the circuit and lighting of the warning signal.

Thus, the invention provides an extremely attractive low-cost circuit breaking and indicating switch particularly adapted for use with model railroads and the like. The simple adjustment for the current overload at which the circuit breaker will trip makes it ideally suited for model railroad use. Connections are extremely simple and resetting is easily effected.

While a specific embodiment of the invention has been shown and described in detail to illustrate the application of the invention principles, it will be understood

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that the invention may be embodied otherwise without departing from such principles.

I claim:

1. A circuit breaker comprising a first contact member, a second contact member, a pivotally mounted substantially L-shaped member having one leg in holding engagement with said second contact member to hold the latter in engagement with the first contact member, loading means on the opposite leg of said L-shaped member to bias said member in holding engagement with said second contact member, and electromagnetic means arranged in proximity to said L-shaped member in a position to attract said one leg, said electromagnetic means being responsive upon excitation by a predetermined amount of electrical current to overcome said loading means and attract said member and move it out of engagement with said second contact member to effect parting of said first and second contact members.

2. A circuit breaker according to claim 1 wherein said loading means is adjustable.

3. A circuit breaker according to claim 1 wherein said loading means includes a control knob movable in a direction toward and away from a face of the opposite leg of said member, a compression spring held between the face of the opposite leg of said member and said control knob, and means to move said control knob whereby the compressive force of said spring acting on said member is varied.

4. A circuit breaker according to claim 1 including a relatively high resistance lamp connected across said first and second contacts whereby said lamp is lighted when said contacts are opened.

5. A circuit breaker comprising a base, a solenoid secured to said base, said base including two electrical terminal portions, one of which being electrically connected to a terminal of said solenoid, an insulated member mounted on said base, a lower contact plate secured to the lower face of said insulator, an upper contact plate secured to the upper face of said insulator and having a portion connecting the other of said terminal portions, a substantially L-shaped member pivotally mounted on said base and having a face in close proximity to said solenoid, said face including a portion in engagement with said upper contact plate to hold it in contact with the lower contact plate, and adjustable means to apply a force to the opposite face of said member.

6. A circuit breaker comprising a base, a solenoid secured to said base, said base including two electrical terminal portions, one of which is electrically connected to a terminal of said solenoid, an insulated member mounted on said base, a lower contact plate secured to the lower face of said insulator, an upper contact plate secured to the upper face of said insulator and having a portion connecting the other of said terminal portions, a substantially L-shaped member pivotally mounted on said base and having a face in close proximity to said solenoid, said face including a portion in engagement with said upper contact plate to hold it in contact with the lower contact plate, adjustable means to apply a force to the opposite face of said member, a reset button pivotally mounted on said base and having a depending portion resting on said upper contact plate, said button being movable about its pivoted portion to deflect said upper contact plate into contact with said lower contact plate.

7. A circuit breaker comprising a base, a solenoid secured to said base, said base including two electrical terminal portions, one of which is electrically connected to a terminal of said solenoid, an insulated member mounted on said base, a lower contact plate secured to the lower face of said insulator, an upper contact plate secured to the upper face of said insulator and having a portion connecting the other of said terminal portions, a substantially L-shaped member pivotally mounted on said

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base and having a face in close proximity to said solenoid, said face including a portion in engagement with said upper contact plate to hold it in contact with the lower contact plate, adjustable means to apply a force to the opposite face of said member, said member having a deformed portion extending outwardly from the face thereof in proximity to said solenoid and under the lower edge of which said upper contact plate is held.

8. A circuit breaker according to claim 5 including a high resistance lamp mounted on said base and having a terminal connected to said upper contact plate and another terminal connected to said lower contact plate.

9. A circuit breaker comprising a base, a solenoid secured to said base, said base including two electrical terminal portions, one of which is electrically connected to a terminal of said solenoid, an insulated member mounted on said base, a lower contact plate secured to the lower face of said insulator, an upper contact plate secured to the upper face of said insulator and having a portion connecting the other of said terminal portions, a substantially L-shaped member pivotally mounted on said base and having a face in close proximity to said solenoid, said face including a portion in engagement with said upper contact plate to hold it in contact with the lower contact plate, adjustable means to apply a force to the opposite face of said member, the opposite face of said L-shaped member from the face in close proximity to said solenoid having an opening therein, a stud mounted on said base and extending upwardly through said opening, a spring positioned on said stud, said stud being threaded, and an internally threaded control knob positioned on said stud and adjustable thereon to increase the compression of said spring against the face of said member.

10. A circuit breaker comprising a substantially channel-shaped base member, having upstanding side walls, a solenoid positioned between said side-walls at one end

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of said channel member, a stud plate connected to said side walls and positioned over said solenoid and including an upstanding stud centrally located thereon, a substantially L-shaped plate member including laterally extending lugs which are pivotally mounted on adjacent side walls and a top face having an opening therein in which said stud is positioned and a substantially vertical face extending downwardly from the pivotal location into proximity to said solenoid, a mounting base of insulating material positioned in said channel member between said walls adjacent said solenoid, a first contact member secured to the underside of said mounting base, a second resilient contact member secured to the top side and having a portion thereof held downwardly against said first contact member by a portion of said vertical face of said L-shaped member, a cover member extending over said channel-shaped member, a reset button pivotally mounted on said cover member and including a depending portion which spans said second contact member and is depressable thereagainst to position said second contact member in holding engagement with said vertical face of said L-shaped member for resetting purposes and means to bias the top face of said L-shaped member downwardly to hold said vertical face in holding engagement with said contact member whereby said vertical face is moved upon actuation of said solenoid away from holding engagement with said contact member to trip said circuit.

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