

July 10, 1934.

H. D. DORFMAN

1,966,286

CIRCUIT BREAKER

Original Filed Sept. 6, 1930

Fig. 1.

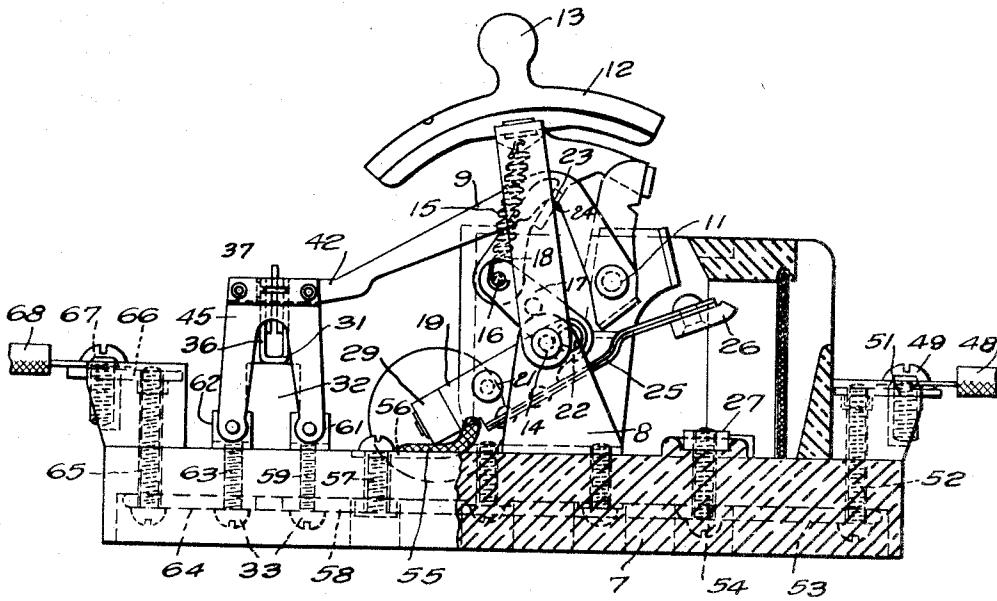


Fig. 2.

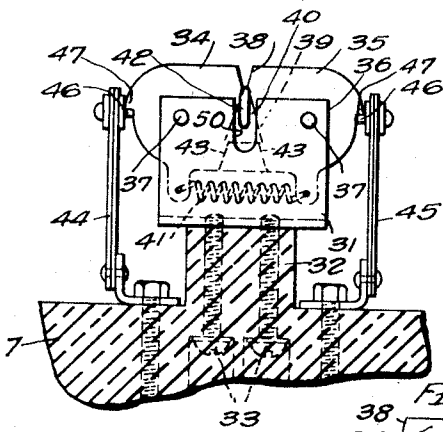


Fig. 3.

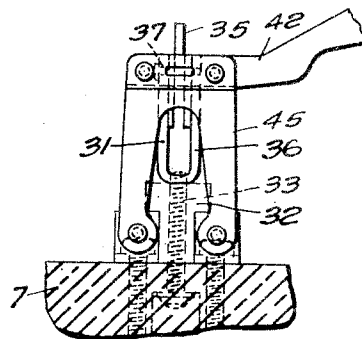
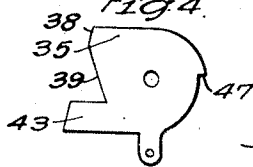


Fig. 4.



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1,966,286

CIRCUIT BREAKER

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Westinghouse Electric & Manufacturing Com-
pany, a corporation of Pennsylvania

Application September 6, 1930, Serial No. 480,096
Renewed September 16, 1933

21 Claims. (Cl. 200—116)

My invention relates to circuit breakers and particularly to circuit breakers to be mounted in sheet-metal enclosures for controlling lighting and motor circuits.

5 An object of my invention is to provide a multi-pole circuit breaker wherein a current-responsive trip mechanism is associated with at least two of the poles of the circuit, and wherein the trip mechanism releasably retains a single latch element 10 of the circuit breaker in closed position, thereby rendering the circuit breaker responsive to current conditions in either of the two poles of the circuit.

15 A further object of my invention is to provide a simple current-responsive tripping element that may be applied to multiple circuit breakers of standard construction, and which may be detachably mounted upon the circuit breaker base, in order to permit of interchange of current-responsive elements having different operating characteristics.

20 A further object of my invention is to provide a trip mechanism for a circuit breaker wherein a plurality of cooperating cam elements serve to jointly and releasably retain the circuit breaker from being tripped to open position, and wherein the cam members are retained in latching position by separate independently operable current-responsive elements.

25 A further object of my invention is to provide a trip mechanism for a circuit breaker that comprises a minimum number of parts which are assembled in compact relation.

30 These and other objects, that will be made apparent throughout the further description of my invention, are attained by means of the circuit-breaker apparatus hereinafter described, and illustrated in the accompanying drawing, wherein

35 Figure 1 is an elevational view, partially in section, of a circuit breaker embodying features of my invention;

40 Fig. 2 is an enlarged front elevational view of the current-responsive trip mechanism shown in Fig. 1;

45 Fig. 3 is an enlarged end elevation of the trip mechanism shown in Fig. 2, and

Fig. 4 is a side elevational view of a cam.

Referring to the drawing, the circuit breaker comprises an insulating base 7 upon which is 50 mounted a sheet-metal-frame structure 8 to support the circuit-breaker unit which is similar in construction to that minutely described in Patent No. 1,794,901 of Oliver S. Jennings assigned to the assignee of this application.

55 Briefly, the circuit breaker unit comprises the

frame 8 upon which a cradle 9 is pivoted for rotation about the pivot pin 11. An operating arm 12, having a handle 13, is pivoted for rotation about the pivot pin 14, and a pair of tension springs 15 are attached, at their outer ends, to 60 the arm 12 and, at their inner ends, to the knee pivot 16 of a pair of toggle links 17 and 18 which serve to operate a pivoted switch arm 19 that is mounted to oscillate about a pivot shaft 21 mounted on the frame 8, the link 17 being pivoted to 65 the arm 19 by the pivot shaft 22, and the toggle link 18 being pivotally connected to the cradle 9 at the point 23 in the apex of a notch 24 of V-shape in the cradle 9.

70 The contact arm 19 carries a flexible leaf spring 25, upon the free end of which is mounted a movable contact 26 that is adapted to engage a stationary contact 27.

75 The cradle 9 is releasably retained in the closed position shown in Fig. 1 by means of a latch arm that will be hereinafter described. The circuit-breaker apparatus may be designated as of the tumbler type wherein an overcenter spring serves to move the contact to open and to closed positions. As shown in Fig. 1, the contact 26 is in 80 open position and is moved to closed position with a snap action when the operating handle 13 has been moved clockwise a sufficient distance to move the outer ends of the springs 15 past a center line traversing the pivot shaft 16 and the point 23 re- 85 ferred to above. When this movement of the operating handle 13 has been accomplished, the springs 15 will snap the lower pivot shaft 16 toward the right and straighten the toggle links 17 and 18 for forcing the contact 26 into the closed 90 position.

95 When it is desired to move the switch to open position manually, the operating handle 13 is moved to the left or in a counter-clockwise direction, and, when the springs 15 again pass over the above-mentioned center line, the toggle will be broken with a snap action and cause the contact 26 to quickly separate from the contact 27.

100 In the event of an overload or a short-circuit condition, the latch arm is released, in a manner to be hereinafter described, and the springs 15, which are in an extended stressed condition when the circuit breaker contact is closed, cause the cradle 9 to turn in the clockwise direction, which 105 movement causes breaking of the toggle and the subsequent rapid separation of the contact 26 from the contact 27.

110 This form of circuit-breaker apparatus is completely described in the above-mentioned patent, and it is believed that no further explanation of

the construction and operation of the circuit breaker is necessary for the purpose of this application, which is concerned more with the particular form of current-responsive releasing apparatus suitable for a multi-pole circuit breaker.

However, it is to be understood that the present form of circuit breaker, as disclosed in Fig. 1, is of the two-pole type in which the operating mechanism above described is employed for operating two contact arms 19 that are connected at their inner ends by means of an insulating cross bar 29.

Referring particularly to Figs. 2 and 3, the current-responsive tripping or releasing device comprises a metal frame 31 of U-shape that is secured upon an insulating standard 32 that is integral with the insulating base 7, by means of screws 33. A pair of rotatable cams 34 and 35 are mounted between the side flanges 36 of the frame 31 for rotation about pivot pins 37, the adjacent faces of the cams being provided with two flat angularly disposed portions 38 and 39, as indicated in Fig. 4.

The cams 34 and 35 are normally biased in a counter-clockwise and clockwise direction, respectively, by a helical spring 41 that serves to normally, yieldingly retain the cams in their open, latch-receiving position.

The cradle 9 of the circuit breaker is provided with a latch arm 42 that is moved into the space between the cam faces when the circuit breaker is moved to closed or operative position wherein the cradle occupies its reset position shown in Fig. 1, the inner edge of the latch arm 42 being adapted to engage overlapping resetting arms 43 on the cams 34 and 35, which move the cams against the tension of the spring 41 into the locking positions, as indicated in Fig. 2, where they are releasably retained by bimetal elements 44 and 45, respectively, that are of the usual U-shape construction well known in the art. The movable outer ends of the bimetal elements 44 and 45 are provided with insulated latch clips 46 that engage shoulders 47 on the cams 34 and 35.

It will be noted that the space 40 between the closest cam surfaces of the cams, when the cams are in locking positions, is of less width than the thickness of the latch arm 42, and, consequently, the latch arm is retained in closed position so long as the cams are prevented from rotating in opposite directions. However, should either one of the cams be released by the outward movement of either of the bimetal elements 44 and 45, the spring 41 immediately causes rotation of the cam, which results in widening of the space between the cam faces and consequent release of the latch arm 42 which is of such yielding construction that it may be deflected laterally a sufficient distance to clear the cam that remains stationary.

It will be understood that the bimetal element is connected in series with its respective contact arm and is heated by current flowing in the circuit controlled by the contact arm 19 and is, therefore, responsive to current conditions in that circuit. In the event of an overload or short-circuit condition, the bimetal element deflects laterally and releases its respective cam, thus causing opening movement of the circuit breaker in a well known manner.

Resetting movement of the circuit breaker causes resetting of the cam, and it will be noted that the flanges 36 of the frame 31 are provided with aligned notches 50 of U-shape, which permit of sufficient inward movement of the latch arm 42 to accomplish resetting of the cams in the position shown in Fig. 2.

By reference to Fig. 1, it will be seen that the bimetal elements 44 and 45 are connected in series with the contacts 26 and 27, the circuit being as follows: the live feed conductor 48 is attached to the terminal 49, and current passes from the terminal 49, through conductor strap 51, screw 52, conductor strap 53, screw 54, contact 27, movable contact 26, flexible spring contact arm 25, flexible conductor 55, terminal 56, screw 57, conductor strap 58, screw 59, terminal 61, one of the bimetal elements 44 and 45, element terminal 62, screw 63, conductor strap 64, screw 65, conductor strap 66 and terminal screw 67, to load conductor 68.

I have thus provided a simple, inexpensive and compact form of current-responsive trip mechanism for a multi-pole circuit breaker that may be readily applied to circuit breakers of standard construction, and I have provided a trip-mechanism construction wherein the operating characteristics of the circuit breaker with which it is associated may be varied by interchanging current-responsive units having different operating characteristics.

While I have illustrated but one embodiment of my invention, it will be apparent to those skilled in the art that various changes, modifications, substitutions, additions and omissions may be made in the apparatus illustrated without departing from the spirit and scope of my invention, as set forth in the appended claims.

I claim as my invention:

1. A trip device for a circuit breaker comprising a pair of independently operable members that, when in predetermined relative positions, jointly and releasably retain an element which when released causes movement of the circuit breaker to open position, means whereby said members are moved to said positions when the circuit breaker is moved to closed position, and independent current-responsive means for releasably retaining the said members in retaining position.

2. A trip device for a circuit breaker comprising a pair of independently movable cam members that, when in predetermined relative positions, jointly and releasably retain an element which when released causes movement of the circuit breaker to open position, means on the cams whereby the cams are moved by the circuit breaker to the said positions when the latter is moved to the reset or closed position, and independently operable current-responsive means for releasably retaining the cams in the said positions.

3. A trip device for a circuit breaker comprising a pair of independently movable cam members that, when in predetermined relative positions, jointly and releasably retain an element which when released causes movement of the circuit breaker to open position, means on the cams whereby the cams are moved by the circuit breaker to the said positions when the latter is moved to the reset or closed position, means for biasing the cams out of the said predetermined positions toward releasing position, and independently operable current-responsive means for releasably retaining the cams in the said predetermined positions.

4. A trip device for a circuit breaker having a latch arm, said trip device comprising a pair of independently movable cams pivotally mounted upon separate substantially parallel axes and having their peripheral cam faces adjacent to one another, and between which the

- latch arm moves when the circuit breaker is moved to the reset or closed position, the said cam faces having cooperating portions which, when in predetermined relation, jointly prevent release of the latch arm and which are moved to releasing position by the latch arm when rotation of the cams is permitted, and independently operable current-responsive means for releasably preventing rotation of the cams.
5. A trip device for a multi-pole circuit breaker including means for retaining the contacts of all of the poles of the circuit breaker from being tripped to open position, said retaining means being releasable for causing the opening of said contacts, a separate current responsive device for each of a plurality of poles of said circuit breaker, an independently operable trip member for each of said current responsive devices and operable thereby to tripping position in response to a predetermined current flow in said device, the movement of any one of said trip members causing the release of said retaining means to open the contacts of the circuit breaker, and means actuated by movement of the circuit breaker for resetting all of said trip members to non-tripping position.
6. A trip device for a multi-pole circuit breaker including a releasable latch arm upon movement of which the contacts of the several poles of the circuit breaker are moved to open position, a separate independently operable trip member for each of a plurality of poles of the circuit breaker normally biased toward tripping position and any one of which when released causes the release of said latch arm, a separate independently operable current responsive trip element associated with each of said two or more poles of the circuit breaker for releasably retaining said trip members in non-tripping position, and means for returning the trip members to their non-tripping position before the contacts are reclosed after being tripped.
7. In a multi-pole circuit breaker an operating member for opening and closing the contacts of all the poles of said circuit breaker, means for opening said contacts irrespective of the position of said operating member and retaining means for holding said contacts closed when said operating member is in closed position, a separate current responsive element for each of a plurality of poles of the circuit breaker, a separate pivoted trip member biased to tripping position and held in non-tripping position by each of said current responsive elements, the movement of any one of said trip members causing the release of said retaining means to open the contacts of the circuit breaker and means actuated by movement of said operating member for retaining each of said trip members to non-tripping position where it is held by said current responsive elements.
8. A trip device for a multi-pole circuit breaker including a latch arm which when released causes movement of the contacts of the several poles of the circuit breaker to open position, a separate independently operable trip member for each of a plurality of poles of the circuit breaker and any one of which when actuated causes the release of said latch arm, a separate independently operable current responsive trip element associated with each of said two or more poles of the circuit breaker for causing the actuation of said trip members to tripping position, and means actuated by movement of said latch arm to latched position for returning the trip members to their non-tripping position.
9. In a multi-pole circuit interrupter, contact members for each pole thereof, a member movable to cause the opening of all of said contact members, means for causing movement of said movable member including a separate current responsive device for each of a plurality of poles of the circuit interrupter, a plurality of trip members each controlled by one of said current responsive devices and movable to tripped position irrespective of the current through any other of said current responsive devices and said movement to tripped position of any one of said trip members causing movement of said movable member to open all of said contact members, and means actuated by movement of the circuit interrupter for resetting any of said trip members that have moved to tripped position.
10. In a multi-pole circuit interrupter, contact members for each pole thereof, a member movable to cause the opening of all of said contact members, a spring biasing said member to cause said movement, a plurality of trip members jointly holding said movable member against the bias of said spring, a plurality of current responsive elements electrically connected in different poles of the circuit interrupter, means biasing said trip members into engagement with said current responsive elements, and each of said trip members being releasable to cause release of said movable member upon movement of its current responsive element independently of movement of any other of said current responsive elements.
11. In a multi-pole circuit interrupter, contact members for each pole thereof, a member movable to cause the opening of all of said contact members, a spring biasing said member to cause said movement, a plurality of trip members jointly holding said movable member against the bias of said spring, a plurality of current responsive elements electrically connected in different poles of the circuit interrupter, a single spring biasing said trip members into engagement with said current responsive elements, and each of said trip members being releasable to cause release of said movable member upon movement of its current responsive element independently of movement of any other of said current responsive elements and means for moving said movable member upon actuation of the circuit interrupter after being tripped, said movement of the movable member returning said trip members into engagement with said current responsive elements.
12. In a circuit interrupter, a contact member movable to open and close the circuit, a pivoted operating member for normally moving said contact member to open and close the circuit, a spring having its line of action movable across the pivot of said operating member for actuating it with a snap action to both open and closed positions, a handle for actuating said spring, means for causing the opening of said contact member in response to predetermined conditions including a trip member, a second spring biasing said trip member to tripped position, the strain of said second spring remaining substantially constant during movement of said handle when normally moving said contact member to open and close the circuit, a current responsive element releasably preventing movement of said trip member by said second spring to tripped position, and said trip member when released moving under action of said second spring and thereby causing movement of said pivoted operating member to cause

opening movement of said contact member irrespective of the position of said handle.

13. In a circuit interrupter, a contact member movable to open and close the circuit, a pivoted operating member for normally moving said contact member to open and close the circuit, a spring having its line of action movable across the pivot of said operating member for actuating it with a snap action to both open and closed positions, a handle movable between an "on" and an "off" position for actuating said spring, means for causing the opening of said contact member in response to predetermined conditions including a trip member, a second spring biasing said trip member to tripped position, a current responsive element releasably preventing movement of said trip member to tripped position, and said trip member when released moving under action of said second spring and thereby causing movement of said pivoted operating member to cause opening movement of said contact member irrespective of the position of said handle, and rigid means for transmitting motion of said handle member to said trip member to positively reset it and stress said second spring upon movement of said handle toward "off" position after the circuit interrupter has been tripped.

14. In a multi-pole circuit breaker, a contact member for each of a plurality of said poles, said contact members being movable between an open and a closed position, spring means, an actuating member movable for actuating a plurality of said contact members, said actuating member stressing said spring means during a portion of its movement and thereafter causing said spring means to move a plurality of said contact members to closed position with a snap action, tripping means for causing opening of a plurality of said contact members, a second spring means for biasing said tripping means to tripped position, current responsive means releasably retaining said tripping means against movement, said current responsive means being responsive to predetermined conditions in a plurality of said poles and causing movement of said tripping means by said second spring means for causing movement of a plurality of said contact members to open position upon the occurrence of said predetermined conditions in one pole.

15. In a multi-pole circuit breaker, a contact member for each of a plurality of said poles, said contact members being movable between an open and a closed position, spring means, an actuating member movable for actuating a plurality of said contact members, said actuating member stressing said spring means during a portion of its movement and thereafter causing said spring means to move a plurality of said contact members to closed position with a snap action, tripping means for causing opening of a plurality of said contact members, a second spring means for biasing said tripping means to tripped position, current responsive means releasably retaining said tripping means against movement, said current responsive means being responsive to predetermined conditions in a plurality of said poles and causing movement of said tripping means by said second spring means for causing movement of a plurality of said contact members to open position upon the occurrence of said predetermined conditions in one pole, and said tripping means causing opening of said contact member irrespective of the position in which said actuating member may be held, and said actuating member being connected to reset said tripping

means and to re-stress said second spring means upon movement of the actuating member after said tripping means has caused opening of the contact members.

16. In a multi-pole circuit interrupter, a contact member for each of a plurality of poles thereof, a member movable to cause opening of a plurality of said contact members, a spring for biasing said member to cause said movement, a plurality of trip members each supplying one component of a force holding said movable member against the bias of said spring and the removal of the component of said force supplied by any one of said trip members causing movement of said member to cause opening of said contact members, and a current responsive element for each of a plurality of said poles and each of said current responsive elements causing removal of the component of force exerted by one of said trip members upon the occurrence of predetermined conditions in one pole of the circuit interrupter.

17. In a multi-pole circuit interrupter, a contact member for each of a plurality of poles thereof, a member movable to cause opening of a plurality of said contact members, a spring for biasing said member to cause said movement, a plurality of trip members each supplying one component of a force holding said movable member against the bias of said spring and the removal of the component of said force supplied by any one of said trip members causing movement of said member to cause opening of said contact members, means for biasing said trip members to move to a position where said components of force are removed, and a current responsive element for each of said trip members for controlling their movement by said biasing means.

18. In a circuit interrupter, a contact member movable to open and close the circuit, a pivoted operating member for normally moving said contact member to open and close the circuit, a spring having its line of action movable across the pivot of said operating member for actuating it with a snap-action to both open and closed positions, a handle movable between an "on" and an "off" position for actuating said spring, means for causing the opening of said contact member in response to predetermined conditions including a trip member, a second spring biasing said trip member to tripped position, the strain of said second spring remaining substantially constant during movement of said handle when normally moving said contact member to open and close the circuit, a current responsive element releasably preventing movement of said trip member by said second spring to tripped position, said trip member when released moving under action of said second spring and causing movement of said pivoted operating member to cause opening movement of said contact member irrespective of the position of said handle, and rigid means for transmitting motion of said handle member to said trip member to reset it and stress said second spring upon movement of said handle toward "off" position after the circuit interrupter has been tripped.

19. In a multi-pole circuit breaker, a contact member for each of a plurality of said poles, said contact members being movable between an open and a closed position, spring means, an actuating member movable for actuating a plurality of said contact members, said actuating member stressing said spring means during a portion of its

movement and thereafter causing said spring means to move a plurality of said contact members to closed position with a snap action, tripping means for causing opening of a plurality of said contact members, a second spring means for biasing said tripping means to tripped position, the strain of said second spring remaining substantially constant during movement of said actuating member when normally moving said plurality of contact members to open and closed positions, current responsive means releasably retaining said tripping means against movement by said second spring, said current responsive means being responsive to predetermined conditions in a plurality of said poles and causing movement of said tripping means by said second spring means for causing movement of a plurality of said contact members to open position upon the occurrence of said predetermined conditions in one pole.

20. In a multi-pole circuit breaker, a contact member for each of a plurality of said poles, said contact members being movable between an open and a closed position, spring means, an actuating member movable for actuating a plurality of said contact members, said actuating member stressing said spring means during a portion of its movement and thereafter causing said spring means to move a plurality of said contact members to closed position with a snap action, tripping means for causing opening of a plurality of said contact members, a second spring means for biasing said tripping means to tripped position, current responsive means releasably retaining said tripping means against movement, said current responsive means being responsive to predetermined conditions in a plurality of said poles and causing movement of said tripping means by said second spring means for causing movement of a plurality of said contact members to open position upon the occurrence of said predetermined conditions in one pole, and said tripping means causing opening of said contact

member irrespective of the position in which said actuating member may be held, and rigid means for transmitting motion of said actuating member to reset said tripping means and to re-stress said second spring means upon movement of the actuating member after said tripping means has caused opening of the contact members.

21. In a multi-pole circuit breaker, a contact member for each of a plurality of said poles, said contact members being movable between an open and a closed position, spring means, an actuating member movable for actuating a plurality of said contact members, said actuating member stressing said spring means during a portion of its movement and thereafter causing said spring means to move a plurality of said contact members to closed position with a snap action, tripping means for causing opening of a plurality of said contact members, a second spring means for biasing said tripping means to tripped position, the strain of said second spring remaining substantially constant during movement of said actuating member when normally moving said plurality of contact members to open and closed positions, current responsive means releasably retaining said tripping means against movement by said second spring, said current responsive means being responsive to predetermined conditions in a plurality of said poles and causing movement of said tripping means by said second spring means for causing movement of a plurality of said contact members to open position upon the occurrence of said predetermined conditions in one pole, and said tripping means causing opening of said contact member irrespective of the position in which said actuating member may be held, and rigid means for transmitting motion of said actuating member to reset said tripping means and to re-stress said second spring means upon movement of the actuating member after said tripping means has caused opening of the contact members.

HILLER D. DORFMAN.

CERTIFICATE OF CORRECTION.

Patent No. 1,966,286.

July 10, 1934.

HILLER D. DORFMAN.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 3, line 58-59, claim 7, for "retaining" read returning; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 11th day of September, A. D. 1934.

(Seal)

Leslie Frazer
Acting Commissioner of Patents.

DISCLAIMER

1,966,286.—*Hiller D. Dorfman*, Mansfield, Ohio. **CIRCUIT BREAKER**. Patent dated July 10, 1934. Disclaimer filed March 20, 1941, by the assignee, *Westinghouse Electric & Manufacturing Company*.

Hereby enters this disclaimer to claims 5, 6, and 9 of the patent.
[*Official Gazette April 8, 1941.*]