March 31, 1964 A. BODENSCHATZ 3,127,488

CURRENT LIMITING CIRCUIT BREAKER HAVING BOTH CONTACTS MOVABLE

Filed July 18, 1960 2 Sheets-Sheet 1

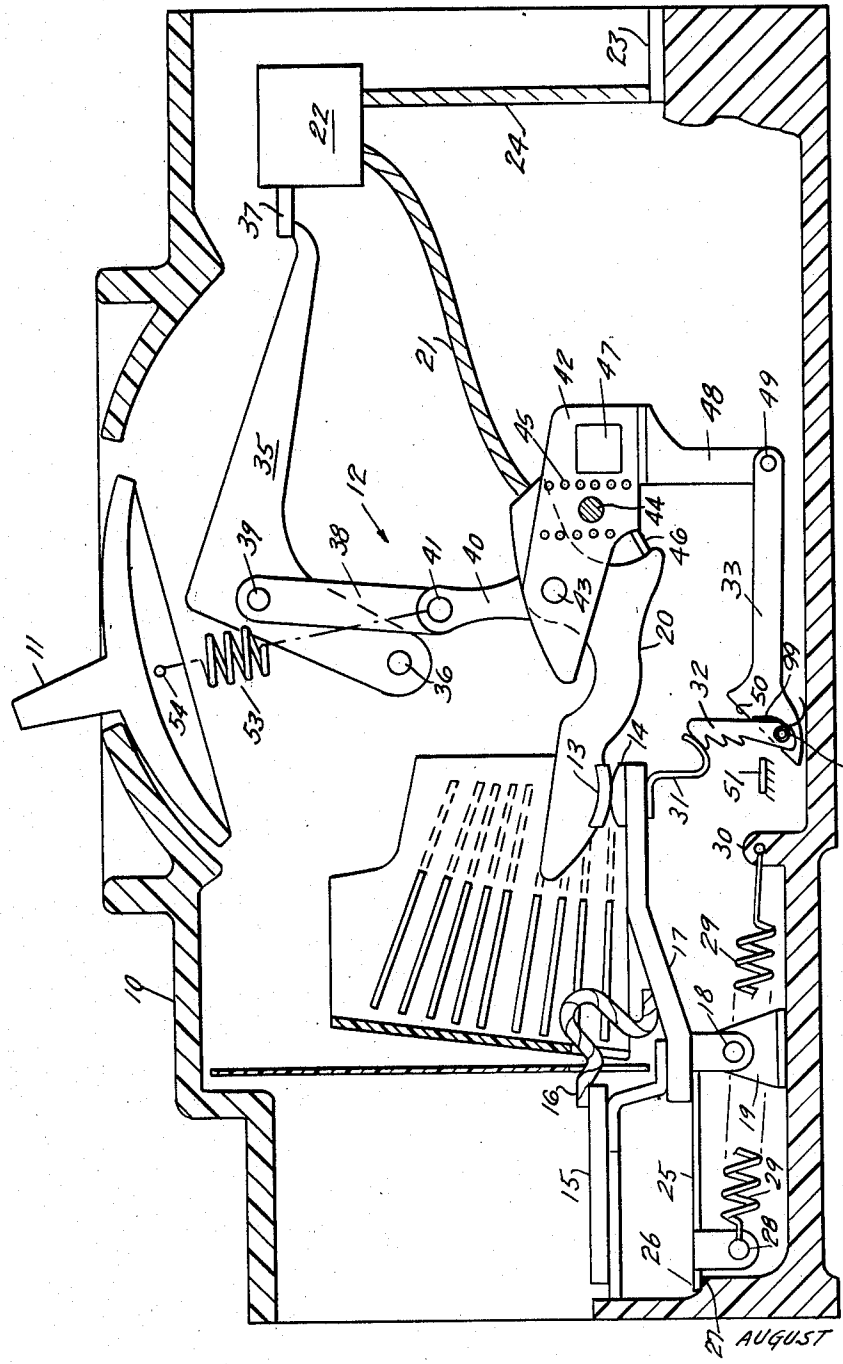


FIG. 1

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FIG. 2.

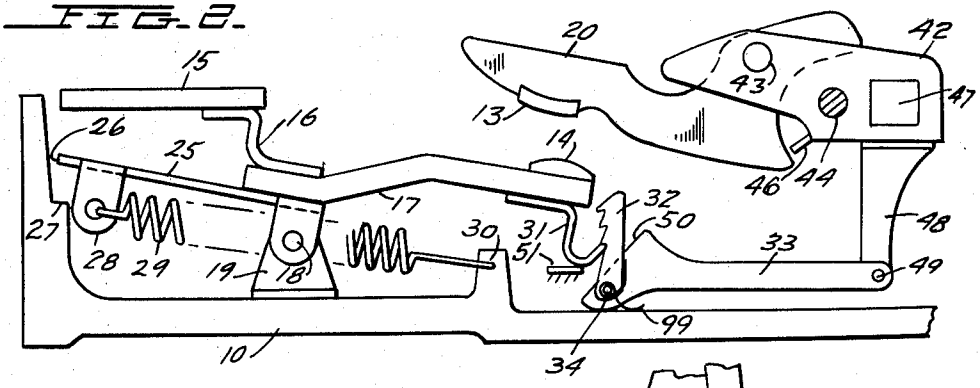


FIG. 3.

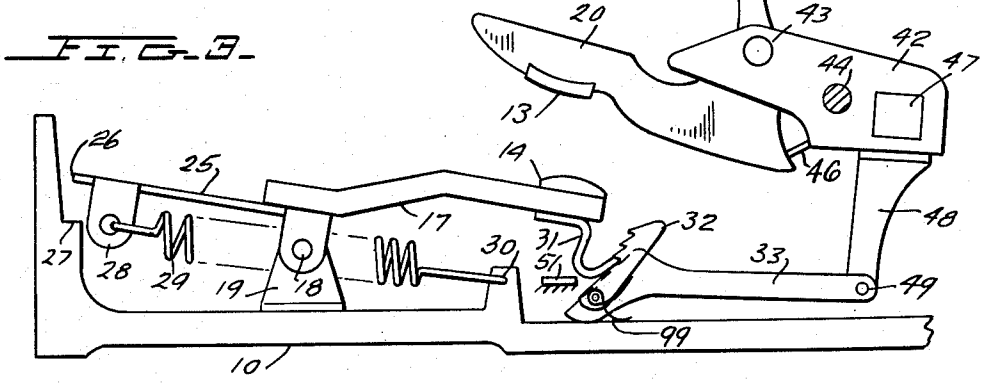
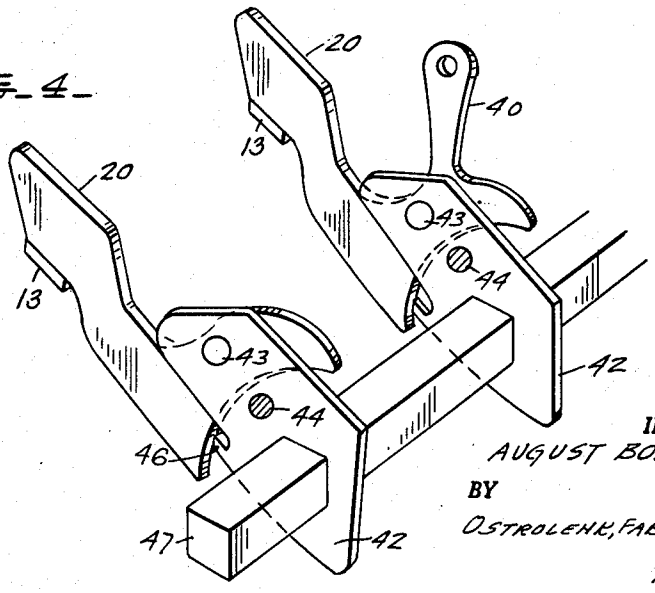


FIG. 4.



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3,127,488

CURRENT LIMITING CIRCUIT BREAKER HAVING BOTH CONTACTS MOVABLE

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7 Claims. (Cl. 200—166)

This invention relates to current limiting circuit breakers, and more particularly relates to a current limiting circuit breaker wherein the normal stationary contact is rendered semi-stationary with respect to a standard-type of movable contact, and is moved to a disengaged position by blow-off forces prior to the time that the operating mechanism of the circuit breaker will operate so that current limiting action is achieved.

Current limiting circuit breakers have been described in copending applications Serial No. 806,041, filed April 13, 1959, entitled "Current Limiting Circuit Breaker," inventor, August Bodenschatz, and Serial No. 770,321, filed October 29, 1958, now issued as U.S. Patent 3,012,118 on December 5, 1962, entitled "Current Limiting Circuit Breaker," inventor, William Harold Edmunds, each of which are assigned to the assignee of the present invention. Each of those applications set forth the concept of rendering a circuit breaker current limiting by causing an initial opening action of the contacts under high fault conditions. Thus, in each case, the movable contact is operable through mechanism auxiliary to the main operating mechanism so that the movable contact may be initially moved to a disengaged position and thereafter retained in that disengaged position until the normal operating mechanism "catches up" to the movable contact to retain it in its open position.

The concept of initially moving the movable contact requires that a relatively high inertia body be quickly moved where the body is necessarily constructed primarily to serve other purposes than being initially moved to a disengaged position for current limiting action. The stationary contact with which the movable contact operates, however, has only a contacting function, and its minimum mass is limited solely by the current which the contact must carry.

The essence of the present invention is to cause this relatively low mass stationary contact structure to be semi-stationary whereby the semi-stationary contact performs the initial function of moving to a disengaged position responsive to exceedingly high fault conditions to cause initial current limiting action prior to the time that the movable contact is moved by its operating mechanism.

Accordingly, a low inertia mass may be moved which lends itself to flexibility in design and permits the retention of standard operating mechanisms for the movable contact. Furthermore, standard component parts may be used for the main portion of the circuit breaker.

In a preferred embodiment of the invention, the semi-stationary contact is moved against a biasing spring which retains the contact in its engaging position under normal conditions and can, if desired, supply contact pressure for the circuit breaker. The semi-stationary contact is so disposed in the current conducting circuit that under fault currents of a predetermined magnitude, the blow-off force will exceed the biasing force of the above noted spring so that the contact is moved downwardly and is retained in its downward position as by a latch means. When the operating mechanism which controls the movement of the movable contact operates at a later time to move the movable contact to a fully disengaged position, the movement of the operating mechanism may operate to defeat the aforementioned latch, whereby the semi-stationary contact can be returned to its normal contacting position so that the circuit breaker is prepared for the next circuit closing operation.

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Accordingly, a primary object of this invention is to provide a novel current limiting circuit breaker.

A further object of this invention is to provide a novel current limiting circuit breaker which can utilize many standard circuit breaker components.

A further object of this invention is to provide a novel current limiting circuit breaker which has a semi-stationary contact which is moved to a contact disengaged position with respect to a movable contact responsive to fault currents which exceed a predetermined magnitude.

These and other objects of this invention will become apparent from the following description when taken in connection with the drawings, in which:

FIGURE 1 shows a side cross-sectional view of a current limiting circuit breaker constructed in accordance with the present invention.

FIGURE 2 shows a portion of the operating mechanism of the circuit breaker of FIGURE 1 immediately after a fault current beyond some predetermined magnitude is passed through the circuit breaker.

FIGURE 3 is similar to FIGURE 2 and illustrates the position of the operating mechanism components when the operating mechanism has caused the movable contact to operate and immediately prior to release of the latch for retaining the semi-stationary contact in its disengaged position.

FIGURE 4 is a perspective view of a portion of the operating mechanism of FIGURE 1 for a multi-pole circuit breaker.

Referring now to FIGURE 1, the concept of the novel invention which is to render the stationary contact semi-stationary may be applied to any standard type of circuit breaker device. Thus, in FIGURE 1 a standard molded case circuit breaker having a molded case 10 is provided with a manual operating handle 11 which is movable within the housing 10, and drives an operating mechanism 12 which controls the position of movable contact 13 with respect to a cooperating contact 14 which will be seen hereinafter to be semi-stationary.

The current path through the circuit breaker includes a first terminal member 15 which may be of any standard construction, and can receive any desired type of lug to which electrical connection may be made. Terminal number 15 is connected to a flexible braid 16 which is secured to a semi-stationary contact carrier 17 which is pivotally mounted at pivot 18 to ear 19 secured to the bottom of casing 10. The semi-stationary contact 14 is then rigidly electrically and mechanically secured to arm 17 and cooperates with movable contact 13 which is carried by movable contact arm 20.

The right-hand side of movable contact arm 20 is then connected to a flexible braid 21 which has its other end connected to a trip unit 22 which may be of any standard type for circuit breakers such as the type shown in U.S. Patent No. 2,932,706 issued April 12, 1960 to August Bodenschatz, entitled "Hold-Open and Anti-Rebound Latch," assigned to the assignee of the present invention. The electrical current then passes through trip unit 22 and is connected to a second terminal 23 by flexible conductor 24 where terminal 23 may again be of any standard type and can have lug means secured thereto.

As previously indicated, the semi-stationary contact arm 17 is pivotally mounted on ear 19. A rearward extending member 25 is rigidly secured to arm 17, and its left-hand portion 26 seats on a cooperating portion 27 of molded housing 18 to limit the counterclockwise rotation of semi-stationary contact arm 17. An ear 28 of member 25 then receives a spring 29 which has its other end secured to protrusion 30 of housing 10.

When semi-stationary contact 17 and its contact 14 are in an engaged position, as shown in FIGURE 1, the axis of spring 19 will be below pivot 18 so that member 25 is biased toward stop 27. When, however, the semi-stationary contact arm 17 rotates so that ear 28 moves upwardly and the axis of spring 29 moves toward pivot 28, it will be apparent that the biasing force of spring 29 will rapidly drop off.

The right-hand end of semi-stationary contact arm 17 has a hook-type member 31 rigidly secured thereto which is movable with respect to a ratchet 32 carried by lever 33 which will be described more fully hereinafter. The ratchet 32 has a normal position which is that shown in FIGURE 1, and it is biased to this position by biasing means, in the form of torsion spring 99 which biases ratchet 32 counterclockwise about its pivot 34 against a stop. Spring 99 is mounted to pivot 34 with one end bearing against ratchet 32 and the other end bearing against the bottom wall of casing 10. Thus, ratchet 32 may be rotated in a clockwise direction against its bias when hook 32 moves downwardly due to a clockwise rotation of arm 17 so that the end of hook 31 will be latched by either one of the teeth of ratchet 32 to retain arm 17 in this clockwise position.

The operating mechanism for controlling the position of contact 20 is of the standard type, and includes a cradle 35 which is pivoted at fixed pivot 36 and has its right-hand end latched against counterclockwise rotation by latch means 37 which is controlled by trip unit 22. Thus, when trip unit 22 is energized as by a predetermined type of overload current, latch 37 will be withdrawn to permit rotation of cradle 35 in a counterclockwise direction for a limited motion.

A link 38 then has its upper end pivotally connected to cradle 35 by pivot 39, and its lower end is pivotally connected to upwardly extending portion 40 of movable contact arm 20 by pivot 41.

Movable contact arm 20, as shown in FIGURE 4, is pivoted to a movable contact arm carrier 42 at pivot 43 for each phase where contact arm carrier 42 is pivotally supported at fixed pivot 44. A biasing spring 45 (FIGURE 1) is then supported in such a manner as to exert a bias between members 20 and 42 to cause a rotation of contact arm 20 about pivot 43 in a counterclockwise direction so as to achieve contact pressure when the contacts are in an engaged position. The degree of counterclockwise motion between members 20 and 42 is limited by projecting stop member 46 carried by member 42.

The right-hand end of movable contact carrier 42 then receives a common shaft 47 which, as is seen in FIGURE 4, is common to each of the phases of the circuit breaker. Thus, there will be simultaneous movement of the movable contacts of all phases.

The lower portion of contact arm carrier 42 then has a projecting link 48 rigidly secured thereto which is pivotally connected to lever 33 at pivot 49. The left-hand end of lever 33 is rounded, as shown in FIGURE 1, and rides along the bottom of housing 10. The left-hand end of lever 33 is further provided with a cam surface 50 which is movable into engagement with the bottom of hook 31 to defeat its connection to ratchet 32. A stationary tripper member 51 which may be carried as an integral part of housing 10 is then positioned to receive ratchet 32 and rotate it clockwise when lever 33 moves to the left.

A toggle spring 53 is secured at one end 54 to handle 11 and at its other end to pivot 41.

For manual operation to move the contact arm 20 to a disengaged position from the engaged position shown in FIGURE 1, handle 11 is moved to the right whereby the axis of spring 53 passes pivot 39 so that the spring 53 can collapse to rotate contact arm 20 and contact arm carrier 42 about pivot 44.

During overload conditions, a predetermined electrical overload will cause trip unit 22 to operate latch 37 so that cradle 35 may rotate in a counterclockwise direction about pivot 36. This will move pivot 39 to the left of the axis of spring 53 so that spring 53 may collapse to cause motion of contact arm 20 to its disengaged position. Reset means (not shown) are then provided to permit resetting of cradle 35 after such an automatic operation.

During low overload conditions, there will be some blow-off force between contact arm 17 and contact arm 20. This blow-off force, however, is not sufficient to overcome the biasing action of spring 29 which retains contact arm 17 in its stationary contact engaged position. When, however, a severe overload condition occurs, the current through the blow-off path will become sufficient to overcome the biasing action of spring 29. That is to say, spring 29 is calibrated to permit motion of contact arm 27 under predetermined fault current conditions.

Once such fault conditions occur, and before trip unit 22 can respond, the contact arm will rotate in a clockwise direction to bring stationary contact 14 to its disengaged position. This operation is seen in FIGURE 2 where the semi-stationary contact 17 has moved to its disengaged position prior to the time that the movable contact arm 20 has been moved toward a disengaged position. This extremely rapid initial motion of the semi-stationary contact arm 17 which is made to have as small an inertia as possible causes a strong current limiting action on the fault current flowing through the circuit breaker prior to the time that the fault can be cleared by the normal action of the short circuit responsive elements in trip unit 22 and the movable contact operating mechanism.

Once the relatively slow operating mechanism is released by trip unit 22 which causes latch 37 to retract to release cradle 35, the contact arm 20 and contact arm carrier 42 rotate clockwise to move movable contact 13 to its disengaged position. At the same time, lever 33 is moved to the left, as shown in FIGURE 3 whereby ratchet 32 engages stationary tripper member 51 so that ratchet 32 is moved clockwise about its pivot 34 to defeat the engagement between hook 31 and the ratchet teeth or ratchet 32. At the same time, cam surface 50 engages the bottom of hook 31, as shown in FIGURE 3, to move it upwardly so that contact arm 17 is moved over the dead center position so that spring 29 can return contact arm 17 to its normal position shown in FIGURE 1.

Although I have described preferred embodiments of my novel invention, many variations and modifications will now be obvious to those skilled in the art, and I prefer, therefore, to be limited not by the specific disclosure herein, but only by the appended claims.

I claim:

1. A current limiting circuit breaker; said current limiting circuit breaker comprising a movable contact and a semi-stationary contact; first means for moving said semi-stationary contact between an engaging position and a disengaging position; second means for moving said movable contact between an engaged and disengaged position with respect to said semi-stationary contact when said semi-stationary contact is in its said engaging position; said first means including fault responsive operating means for said semi-stationary contact; said fault responsive means operatively associated with said semi-stationary contact to move said semi-stationary contact from its

said engaging position to its said disengaging position responsive to fault currents through said circuit breaker of a predetermined nature; said fault responsive operating means operable to move said semi-stationary contact to its said disengaging position while said movable contact is in its said engaged position; and latch means for latching said semi-stationary contact in its said disengaging position.

2. A current limiting circuit breaker; said current limiting circuit breaker comprising a movable contact and a semi-stationary contact; first means for moving said semi-stationary contact between an engaging position and a disengaging position; second means for moving said movable contact between an engaged and disengaged position with respect to said semi-stationary contact when said semi-stationary contact is in its said engaging position; said first means including fault responsive operating means for said semi-stationary contact; said second means including additional fault responsive operating means for automatically operating said movable contact from said engaged to said disengaged position upon the occurrence of predetermined overload conditions; said fault responsive means operatively associated with said semi-stationary contact to move said semi-stationary contact from its said engaging position to its said disengaging position responsive to fault currents through said circuit breaker of a predetermined nature; said fault responsive operating means operable to move said semi-stationary contact to its said disengaging position while said movable contact is in its said engaged position; said first mentioned fault responsive operating means including a magnetic blow-off path actuated by the current flow through said current limiting circuit breaker and calibrating means for restraining movement of said semi-stationary contact until the occurrence of a predetermined blow-off force.

3. A current limiting circuit breaker; said current limiting circuit breaker comprising a movable contact and a semi-stationary contact; first means for moving said semi-stationary contact between an engaging position and a disengaging position– second means for moving said movable contact between an engaged and disengaged position with respect to said semi-stationary contact when said semi-stationary contact is in its said engaging position; said first means including fault responsive operating means for said semi-stationary contact; said fault responsive means operatively associated with said semi-stationary contact to move said semi-stationary contact from its said engaging position to its said disengaging position responsive to fault currents through said circuit breaker of a predetermined nature; said fault responsive operating means operable to move said semi-stationary contact to its said disengaging position while said movable contact is in its said engaged position; and latch means for latching said semi-stationary contact in its said disengaging position; said fault responsive operating means including a magnetic blow-off path actuated by the current flow through said current limiting circuit breaker.

4. A current limiting circuit breaker; said current limiting circuit breaker comprising a movable contact and a semi-stationary contact; first means for moving said semi-stationary contact between an engaging position and a disengaging position; second means for moving said movable contact between an engaged and disengaged position with respect to said semi-stationary contact when said semi-stationary contact is in its said engaging position; said first means including fault responsive operating means for said semi-stationary contact; said fault responsive means operatively associated with said semi-stationary contact to move said semi-stationary contact from its said engaging position to its said disengaging position responsive to fault currents through said circuit breaker of a predetermined nature; said fault responsive operating means operable to move said semi-stationary contact to its said disengaging position while said movable contact is in its said engaged position; said fault responsive operating means including a magnetic blow-off path actuated by the current flow through said current limiting circuit breaker; latch means for latching said semi-stationary contact in its said disengaging position; and means associated with said movable contact for defeating said latch means when said movable contact moves to its said disengaged position.

5. A circuit breaker; said circuit breaker comprising a first and second cooperable contact; an operating mechanism for said first of said cooperable contacts for controlling the motion of said first of said cooperable contacts between an engaged and disengaged position with respect to said second contact, and a trip means for automatically controlling said operating mechanism to move said first of said cooperable contacts to its said disengaged position responsive to predetermined fault conditions; said second contact being semi-stationary; calibrated biasing means urging said semi-stationary contact toward said engaging position when said contacts are in engagement; means for operating said semi-stationary second contact against the force of said biasing means to a disengaged position with respect to said movable first contact while said movable first contact is in said engaged position; said last mentioned means including means operatively responsive to blow-off forces created by fault currents of a predetermined nature for moving said second semi-stationary contact before said operating mechanism becomes operable to operate said movable first contact.

6. A circuit breaker; said circuit breaker comprising a first and second cooperable contact; an operating mechanism for said first of said cooperable contacts for controlling the motion of said first of said cooperable contacts between an engaged and disengaged position with respect to said second contact, and a trip means for automatically controlling said operating mechanism to move said first of said cooperable contacts to its said disengaged position responsive to predetermined fault conditions; said second contact being semi-stationary; means for operating said semi-stationary second contact to a disengaged position with respect to said movable first contact while said movable first contact is in said engaged position; said last mentioned means including means operatively responsive to blow-off forces created by fault currents of a predetermined nature for moving said second semi-stationary contact before said operating mechanism becomes operable to operate said movable first contact; and latch means; said latch means being operable to latch said semi-stationary second contact in its said disengaged position when moved thereto.

7. A circuit breaker; said circuit breaker comprising a first and second cooperable contact; an operating mechanism for said first of said cooperable contacts for controlling the motion of said first of said cooperable contacts between an engaged and disengaged position with respect to said second contact, and a trip means for automatically controlling said operating mechanism to move said first of said cooperable contacts to its said disengaged position responsive to predetermined fault conditions; said second contact being semi-stationary; means for operating said semi-stationary second contact to a disengaged position with respect to said movable first contact while said movable first contact is in said engaged position; said last mentioned means including means operatively responsive to blow-off forces created by fault currents of a predetermined nature for moving said second semi-stationary contact before said operating mechanism becomes operable to operate said movable first contact; and latch means; said latch means being operable to latch said semi-stationary second contact in its said disengaged position when moved thereto; a latch defeater means; said latch defeater means being operatively connected to

said movable first contact and being operable to defeat said latch means when said movable first contact moves to its said disengaged position.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,127,488 March 31, 1964

August Bodenschatz

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 1, line 23, for "December 5, 1962" read -- December 5, 1961 --.

Signed and sealed this 19th day of April 1966.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents

UNITED STATES PATENT OFFICE

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