Sept. 10, 1968 C. D. VYSKOCIL ET AL 3,401,363

MULTIPOLE CIRCUIT BREAKER WITH TRIP INDICATOR

Filed Nov. 10, 1966 3 Sheets-Sheet 1

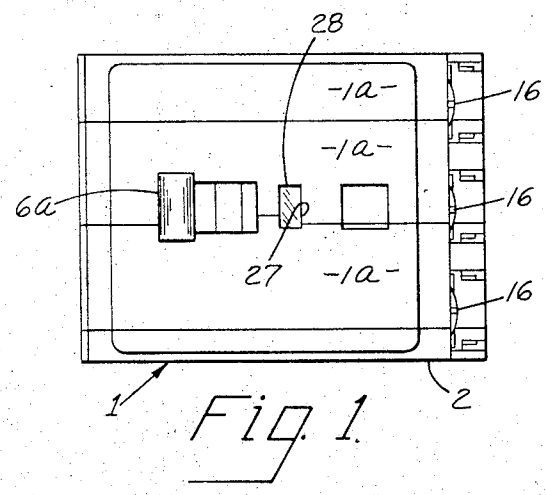


Fig. 1.

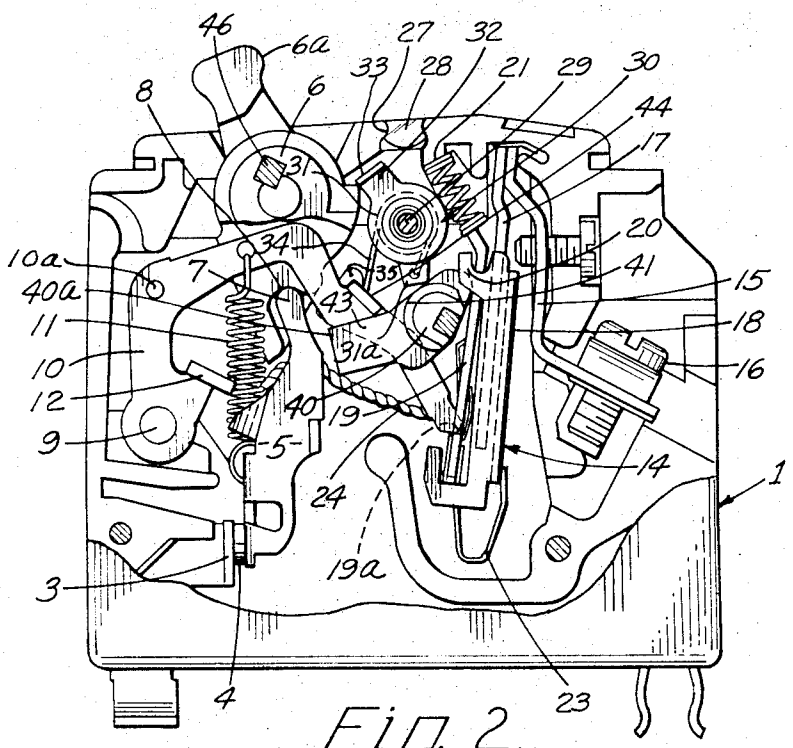


Fig. 2.

INVENTOR.
Charles D. Vyskocil &
BY Robert W. Dunham,
John A. Lennard,
his ATTORNEY.

MULTIPOLE CIRCUIT BREAKER WITH TRIP INDICATOR

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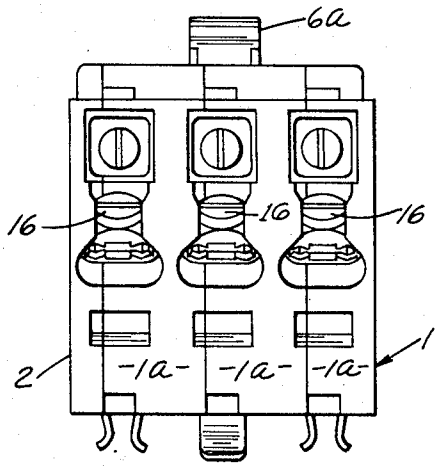


Fig. 3.

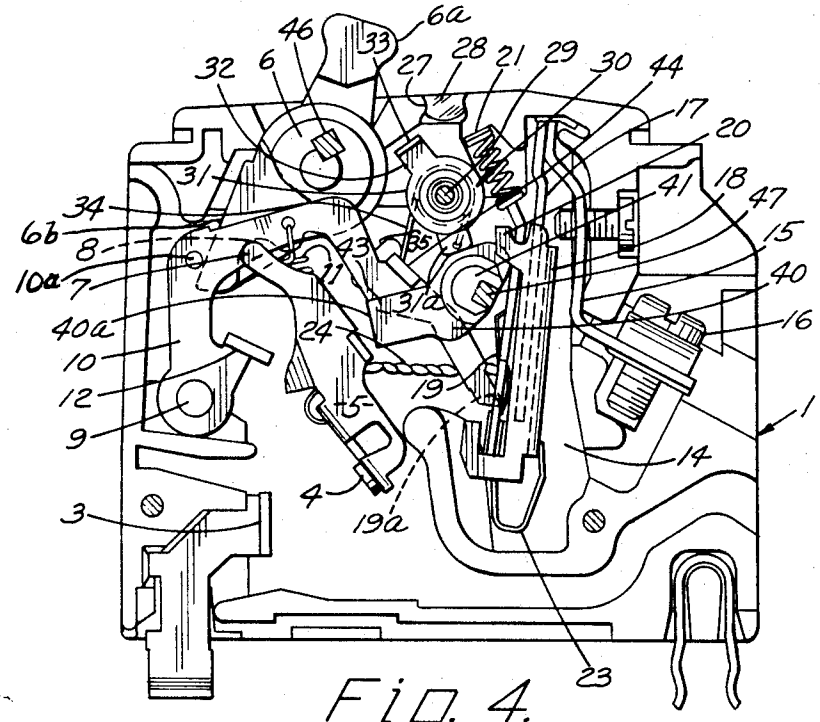


Fig. 4.

INVENTOR.
Charles D. Vyskocil &
Robert W. Dunbane,
BY
John A. Leonard,
their ATTORNEY.

Sept. 10, 1968 C. D. VYSKOCIL ET AL 3,401,363

MULTIPOLE CIRCUIT BREAKER WITH TRIP INDICATOR

Filed Nov. 10, 1966 3 Sheets-Sheet 3

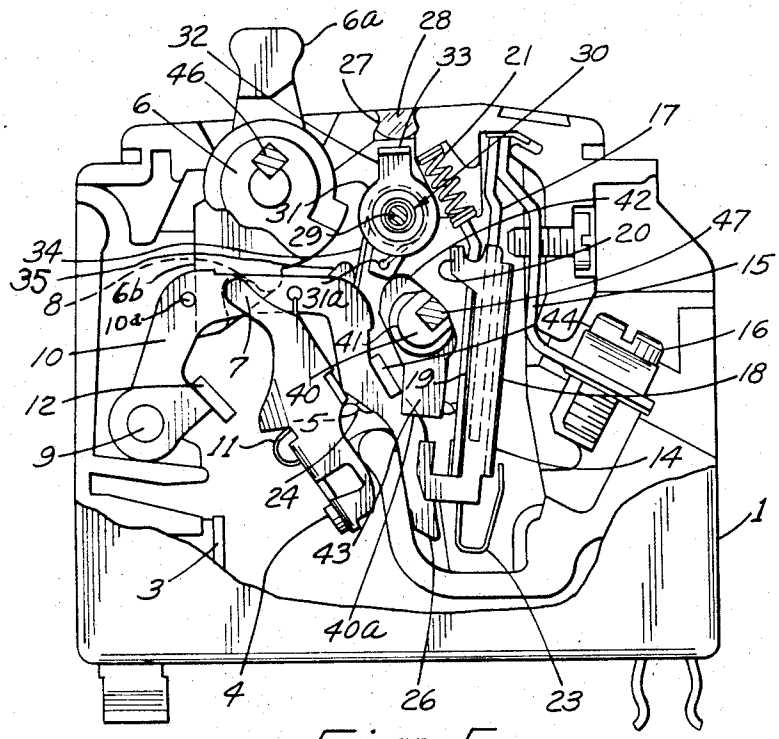


Fig. 5

INVENTOR.
Charles D. Vyskocil &
BY Robert W. Dunham,
Johnston Howard,
Their ATTORNEY.

United States Patent Office 3,401,363 Patented Sept. 10, 1968

3,401,363

MULTIPOLE CIRCUIT BREAKER WITH TRIP INDICATOR

Charles D. Vyskocil and Robert W. Dunham, Cedar Rapids, Iowa, assignors to Square D Company, Park Ridge, Ill., a corporation of Michigan

Filed Nov. 10, 1966, Ser. No. 593,518
3 Claims. (Cl. 335—17)

This invention relates to a multipole circuit breaker having a trip indicator which is common to a plurality of sets of contacts of the breaker, and their respective trip mechanisms, and which indicates the tripped condition of the breaker when any one or more of the mechanisms is tripped.

Particularly, this invention relates to a multipole circuit breaker having a plurality of separate individually operable sets of contacts, each having its own separate individually operable trip mechanism, and a common trip indicator which is biased toward nonindicating untripped position by a spring and is arranged to be driven positively by a trip bar common to all of the trip mechanisms. The trip bar is drivable by each mechanism so that when any one of the trip mechanisms is tripped, the indicator is driven by the bar to a position indicating the tripped condition of the breaker.

More particularly, the invention relates to a multipole breaker wherein, whether the circiut breaker is turned ON or OFF, if all of the trip mechanisms are in untripped condition, a visual indicator or flag, common to all of the sets of contacts, is displaced by its biasing spring from a window in the housing of the breaker to a nonindicating position. However, upon tripping of any one of the trip mechanisms of the breaker, whether due to a moderate and long sustained overload or sudden severe overload or fault, or for any reason, a rotatable trip bar, common to the trip levers of the individual mechanisms, is positively driven by whichever trip lever is tripped, as such lever moves to fully tripped position so as to drive the common indicator against the force of its biasing spring, to a trip indicating position in which the flag becomes visible through the window.

The arrangement of the indicator is such that, as in prior breakers, after the trip levers are set in untripped position, all sets of contacts of the breaker may be turned ON and OFF by a common manual operator or handle without rotation of the trip bar, and, therefore, without movement of the indicator out of its nonindicating position.

For the purposes of illustration, the trip indicator is shown as incorporated in a multipole breaker such as disclosed generally in U.S. Letters Patent No. 2,889,428 of Kingdon, et al., issued June 2, 1959, and employing the general type of individual trip mechanism fully described in Letters Patent No. 2,902,560 of Stanback et al., issued Sept. 1, 1959. The use of the present invention with other types of breakers employing trip levers will be readily apparent from the illustrative example.

Furthermore, it is known in the art, as evidenced by Green Patent No. 2,222,312, issued Nov. 19, 1940, to provide an indicating flag biased toward the nonindicating position by a torsion spring and the like, and driven against the force of the spring by a contact arm into an indicating position when the circuit breaker is tripped. In the breaker of Green the indicator or flog is not caused to move by manual operation of the circuit breaker to ON and OFF positions when the breaker is untripped.

In Platz Patent No. 2,905,795, issued Sept. 22, 1959, a signal drum or flag is provided which indicates ON, OFF, OVERLOAD, TRIP, or SHORT CIRCUIT, by means of a drum biased by a torsion spring toward

the OFF indicating position. Upon manual closure of the circuit breaker the drum is rotated to ON indicating position against the bias of the torsion spring by an extension on the contact arm. Upon tripping, the drum is released and the spring revolves to the appropriate one of the other positions, depending upon whether the magnetic trip responded to a short circuit or a bimetal responded to an overload. The drum, therefore, though operated in direct response to the trip mechanism generally, is not operated directly in response to the trip lever. The drum operates manually in response to movement of the contact arm.

The above patents evidence that it is known heretofore (a) to operate an indicator of a circuit breaker by the usual bimetal of the trip mechanism, by magnetic trip, by the manual operator, or by the contact arm, and (b) to spring bias the indicator toward either nonindicating or tripped indicating position.

However, it is new, and it is a principal feature of the present invention, to arrange a multipole circuit breaker of the type having a plurality of sets of contacts, each with its own tripping mechanism, so that upon the tripping of the trip lever of any one of the trip mechanisms, a common tie or trip cross bar is driven by the trip lever and, in turn, positively drives to an indicating position an indicator which normally is biased toward nonindicating possition by a spring.

Specifically it is new to provide a flag indicator which is pivoted for rocking in the housing of this multipole breaker in a position so as to move into and out of indicating position with respect to a window in the housing, which is biased by a spring to nonindicating position, and which is drivingly connected to all of the trip levers of the trip mechanisms of the sets of contacts of the breaker, by a common rotatable trip or cross bar in a manner such that movement of the levers to untripped position permits the flag to be moved out of indicating position, by its spring, and movement of any one or more of the levers to tripped position, rotates the trip bar and thereby causes it to rock the flag into indicating position against the force of the biasing spring.

Various advantages of the invention will become apparent from the illustrative example wherein reference is made to the drawings, in which:

FIG. 1 is a top plan view of a multipole breaker and flag indicator embodying the principles of the present invention;

FIG. 2 is an enlarged front elevation of the breaker illustrated in FIG. 1, with the forward breaker unit and front cover removed and part of the housing and operator being broken away for clearness in illustration, and showing the breaker parts and indicator in their relative positions when the breaker is in ON and untripped;

FIG. 3 is a right end elevation of the breaker illustrated in FIG. 1;

FIG. 4 is a view similar to FIG. 2 showing the relation of the indicator and parts of the breaker when the breaker is OFF and untripped; and

FIG. 5 is a fragmentary view similar to FIG. 2 showing the relation between the indicator and certain parts of the breaker when the breaker is tripped.

Referring to the drawings, since the breaker itself is essentially the one described in detail in Kingdon, et al., U.S. Patent No. 2,889,428, it is described herein only briefly.

The breaker comprises a housing **1** formed of a plurality of separate units **1***a* of molded insulating material, detachably secured together in face to face relation in a row, one end of the row being closed by a detachable cover **2**. The units **1***a* generally are identical except that the one at the opposite end of the row has a finished

outer face and the central unit 1*a* and a portion of the unit 1*a* to which the cover is secured each has an opening for the handle 6*a* and has the window 27, later to be described. Mounted in the housing units, respectively, are sets of stationary contacts 3, and complementary sets of movable contacts 4 which are mounted on carriers 5, respectively.

Pivotally mounted in the housing 1 is a manual operator 6, having an external operating handle 6*a* common to all of the sets of contacts and having a reset shoulder 6*b*. Since the sets of contacts and their trip mechanisms are substantially identical, only one set and its tripping mechanism are described herein in detail. Referring to the unit shown in FIG. 2, the upper end of the carrier 5 is provided with fingers 7 of which the upper ends engage in slots 8 in the manual operator 6 in rocking relation so that the carrier 5 can be rocked clockwise and counterclockwise about its upper ends.

Also pivotally mounted in the housing 1 for rocking about a pivot 9 parallel to that of the operator 6 is a trip lever 10 having a reset pin 10*a* for cooperation with the shoulder 6*b*, as is later described herein. The lever 10 is connected by a spring 11 to carrier 5. The spring 11 urges the carrier 5 upwardly so as to seat and hold the upper ends of the fingers 7 in rocking contact with the walls of the slots 8. The spring 11 also acts to rock the trip lever clockwise about its pivot 9 when the trip lever is released by the trip mechanism of the breaker. The trip lever 10 has an actuating portion 12 which, when the trip lever is released and swings clockwise, engages a shoulder on the carrier 5 and drives the carrier 5 counterclockwise about the upper ends of the fingers 7 to open contact position.

The spring 11 has a dead center position and is arranged so that it biases the carrier 5 to contact making position when the lever 10 is untripped. When the lever 10 is tripped, it swings clockwise and carries the upper end of the spring 11 past a dead center position, whereupon the spring 11 moves the carrier 5 to fully open position while at the same time still maintaining a downward force on the trip lever 10 urging it to rotate in the clockwise direction.

In order to latch the trip lever in the untripped position, a trip mechanism 14 is provided. The trip mechanism 14 comprises a bimetal assembly comprising a conducting strap 15 connected to a terminal 16, and a bimetal member 17 fixedly connected at its upper end to the strap and extending downwardly therefrom. A magnetic yoke member 18 is connected to the lower end of the bimetal 17. A movable magnetic armature member 19 is pivotally cradled near its upper end in arms 20 on the yoke member 18 and is held by an armature spring 21 for yieldably resisted swinging movement relative to the yoke member 18. To the lower end of the magnetic armature is secured a U-shape ambient temperature responsive bimetal member 23. A flexible conductor 24, which may have a loop portion wound about a part of the magnetic yoke, is connected at one of its ends to the bimetal member 17 and at the other of its ends to the movable contact 4.

Thus, upon a moderate sustained overload, the bimetallic member 17 operates to cause the magnetic yoke to swing counterclockwise, swinging with it the magnetic armature 19. On the other hand, a sudden undue surge in current causes the armature 19 to swing counterclockwise. In either event, the swinging action releases the trip lever 10.

In order to hold the trip lever 10 in untripped position, the trip lever is provided at its outer end with a finger portion 26 (FIG. 5) which, at its lower edge, engages an upwardly facing latching shoulder 19*a* disposed in a notch in the armature 19 when the trip mechanism is in latching position, thereby preventing swinging of the trip lever 10 clockwise out of its untripped position. Upon movement of the armature 19 counterclockwise, the finger 26 is released and the spring 11 becomes operative to swing the trip lever 10 clockwise.

The trip structure thus far described is that fully disclosed in the above Patent No. 2,889,428.

As mentioned, in accordance with the present invention, the tripped condition of the breaker is to be indicated. For this purpose a window 27 is provided in the top wall of the housing 1 adjacent to the manual operator. A suitable viewing lens 28 is mounted within the window. In the housing 1 adjacent to the window is a suitable pivot 29 on which is pivotally mounted an indicator 30. The indicator 30 comprises a body or rocker 31 which may be of sheet metal or molded composition. The rocker 31 has a finger 32 extending radially therefrom partway of its length with its outer end bent over to extend axially and provide an indicator or flag 33. The outer face of the flag 33 faces the lens and preferably is coated with red fluorescent paint. At the opposite side of the pivotal axis, rocker 31 is provided with a fin 31*a* having an aperture therein through which one end of a torsion spring 34 is received for connecting the spring to the rocker. The opposite end of the spring 34 abuts a suitable shoulder 35 in the housing 1. The spring 34 biases the flag 33 to nonindicating position wherein the flag is not visible through the lens 28.

It is desirable that when the trip lever 10 is in the untripped position as illustrated in FIG. 2, the flag 33 be retained in the nonindicating position out of alignment with the window 27. Accordingly the torsion spring 34 is connected to the rocker fin 31*a* so as to bias the rocker counterclockwise and thus dispose the flag 33 out of alignment with the window. On the other hand, it is desirable that when the trip lever is tripped for any reason, that the flag 33 be moved positively into indicating position in alignment with the window. Since one indicator 30 is common to all of the sets of complementary contacts and their trip mechanisms, the indicator must be moved to the trip indicating position when any one or more of the trip mechanisms releases its associated lever 10. As is usual in multipole breakers, to ensure simultaneous opening of all contacts upon release of any one of the trip levers 10, a common trip bar 40 is used. In the present breaker, the trip bar also operates the indicator.

The trip bar 40 comprises a plurality of bar elements 40*a*, each of which is connected to an associated lever 10. As best illustrated in FIG. 2, each trip bar element 40*a* has hub portions 41 at its opposite sides by which the element is supported in its associated housing unit 1*a* for rocking about an exis parallel to the pivotal axis 9 of its associated trip lever 10. The trip bar element in the unit 1*a* in which the indicator 30 is mounted has a cam portion 42 which is positioned so as to engage the fin 31*a* of the rocker 31 and rotate the rocker against the force of its torsion spring 34 clockwise to dispose the flag 33 is alignment with the lens when the trip bar 40 is rotated counterclockwise a predetermined distance about its pivotal axis. For economy in construction, the trip bar elements 40*a* may be duplicates, though the cam portion 42 is necessary only on the element which is to directly engage the rocker 31. Each trip bar element 40*a* also has a finger 43 which extends alongside its associated trip lever 10 in a position to be engaged by a lug 44 on its trip lever 10 as its rock lever upon release swings clockwise to tripped position. The lug 44 is so arranged relative to the finger 43 as to rock its trip bar elements 40*a* counter clockwise as the lever 10 swings clockwise and thus cause the cam portion 42 to engage the fin 31*a* and rock the rocker 31 clockwise against the force of the biasing spring 34 to dispose the flag 33 beneath the lens 28.

Thus, in FIG. 2, the flag is out of indicating position and the trip lever is in untripped condition. In this condition, the spring 34 is urging the rocker 31 counterclockwise with sufficient force to maintain the fin 31*a*

in engagement with the cam **42** and thus is urging the trip bar element **40***a* to rotate clockwise to the extent necessary to permit the flag **33** to move from beneath the lens **28**. However, due to the engagement of the lug **44** with the finger **43**, the trip bar element **40***a* is constrained from being thus rotated clockwise. If, under these conditions, the lever **10** is tripped, it immediately rotates the trip bar element **40***a* counterclockwise, causing the cam portion **42** to drive the flag **33** into alignment with the lens **28**.

In this connection, it will be noted that when the trip levers **10** are in latched position, the manual operator **6** may be moved to ON and OFF positions without moving the trip levers and hence without moving the trip bar **40**. Therefore, the flag **33** remains in the nonindicating position.

Referring to FIG. 5, the breaker is shown in the tripped position in which case the lever **10** has swung clockwise, rocking the trip bar **40** counterclockwise and positively moving the flag **33** beneath the lens **28**. From the tripped position, illustrated in FIG. 5, the breaker is restored to untripped condition by moving the manual operator **6** first clockwise to OFF position, thereby causing the reset shoulder **6***b* on the operator **6** to engage the reset pin **10***a* and swing the trip lever **10** counterclockwise into position such that its outer end engages the shoulder **19***a* of the trip mechanism and is latched thereby in untripped condition. When in this position, the manual operator **6** may be rotated counterclockwise to ON position to close the breaker and back to OFF position, as desired, the trip lever **10** remaining in latched position during such movements.

As mentioned, a plurality of housing units **1***a* are provided and each unit houses an assembly comprising a set of contacts and a trip mechanism such as herein described. However, the flag **33** is common to all of the units as also is the manual operator **6**. Accordingly, each of the assemblies is provided with an operator, such as manual operator **6**, but without an external operating handle such as the handle **6***a*, and all of these operators **6** are connected together by a suitable longitudinally extending key **46** which is eccentric to their common rotational axis. Thus, the single handle **6***a*, can operate all of the operators **6** to ON and OFF positions concurrently.

Likewise, since the flag **33** is to indicate a tripped condition of any one or more of the assemblies, the trip bar elements **40***a*, which are arranged one for each trip mechanism. are in coaxial relation and connected for rotation together by a suitable key **47** which extends from one end of the breaker housing to the other and constrains the trip bar elements **40***a* to rocking action as a unit or single trip bar **40**.

Thus, all of the assemblies can be turned OFF and ON and set to untripped condition in either OFF or ON positions of the operator, and upon tripping of any one assembly, the unitary trip bar **40** is operated to move the flag **33** into indicating position in alignment with the lens **28**.

Thus, the indicator **30** is operated, through the mechanical connection afforded by the trip bar **40** by the tripped one of the trip levers **10** and is positively driven to indicating position upon tripping against the resistance of a biasing spring.

Having thus described our invention, we claim:

1. In a circuit breaker:

a contact making and breaking assembly comprising a stationery contact, a movable contact, and a movable carrier for the movable contact;

a trip mechanism comprising a pivoted trip lever rotatable about its axis to tripped and untripped position, respectively,

current-responsive trip means operative under normal current conditions to latch the trip lever in untripped position and operative under abnormal current conditions to release the trip lever for movement to tripped position,

means operative to move the trip lever to tripped position when the lever is released by the trip mechanism,

and means connecting the trip lever and movable contact carrier for moving the carrier out of contact making position when the trip lever is moved to tripped position while the manual operation is in ON position;

an indicator movable into and out of an indicating position;

a manual operator movable to ON and OFF positions for moving the movable contact to and from contact making position, respectively;

and means connecting the trip lever and movable contact carrier for moving the carrier out of contact making position when the trip lever is moved to tripped position while the manual operator is in ON position;

a movable trip bar element;

means connecting the trip bar element to the trip lever for rocking the bar element by the lever when the lever is tripped;

means connecting the trip bar element to the indicator so as to move the indicator to an indicating position by the trip bar element when the trip lever is moved to tripped position, and

means operative to move the indicator to a nonindicating position when the trip lever is moved to untripped position.

2. The structure according to claim **1** wherein spring means bias the indicator to nonindicating position;

the means connecting the trip bar element to the indicator comprises a cam on the trip bar element normally permitting the indicator to move to non indicating position when the trip lever is in untripped position, and operative to positively move the indicator to indicating position when the trip bar element is rocked by the trip lever upon tripping of the trip lever.

3. The structure according to claim **1** wherein a plurality of additional ones of said contact making and breaking assemblies, each with one of said associated tripping mechanisms and manual operators, are arranged in a row in alignment with each other in a direction endwise of the pivotal axes of their trip levers; and

the trip bar is common to all of said assemblies and is connected to all of said trip levers for rocking by whichever lever is tripped, independently of the tripped and untripped condition of the other trip levers.

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BERNARD A. GILHEANY, *Primary Examiner.*

R. COHRS, *Assistant Examiner.*

U.S. DEPARTMENT OF COMMERCE

PATENT OFFICE

Washington, D.C. 20231

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,401,363 September 10, 1968

Charles D. Vyskocil et al.

It is certified that error appears in the above identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, line 27, "circiut" should read -- circuit --; line 64, "flog" should read -- flag --. Column 2, line 27, "possition" should read -- position --; line 29, "this", second occurrence, should read -- the --. Column 4, line 49, "exis" should read -- axis --. Column 5, line 65, "breaker:" should read -- breaker, --; line 67, "stationery" should read -- stationary --. Column 6, line 1, after "tripped" insert -- position --; line 10, beginning with "and means" cancel all to and including "ON position;" in line 14, same column 6.

Signed and sealed this 10th day of February 1970.

(SEAL)

Attest:

Edward M. Fletcher, Jr.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents