Nov. 19, 1929. J. SACHS 1,736,371

AUTOMATIC CIRCUIT BREAKER

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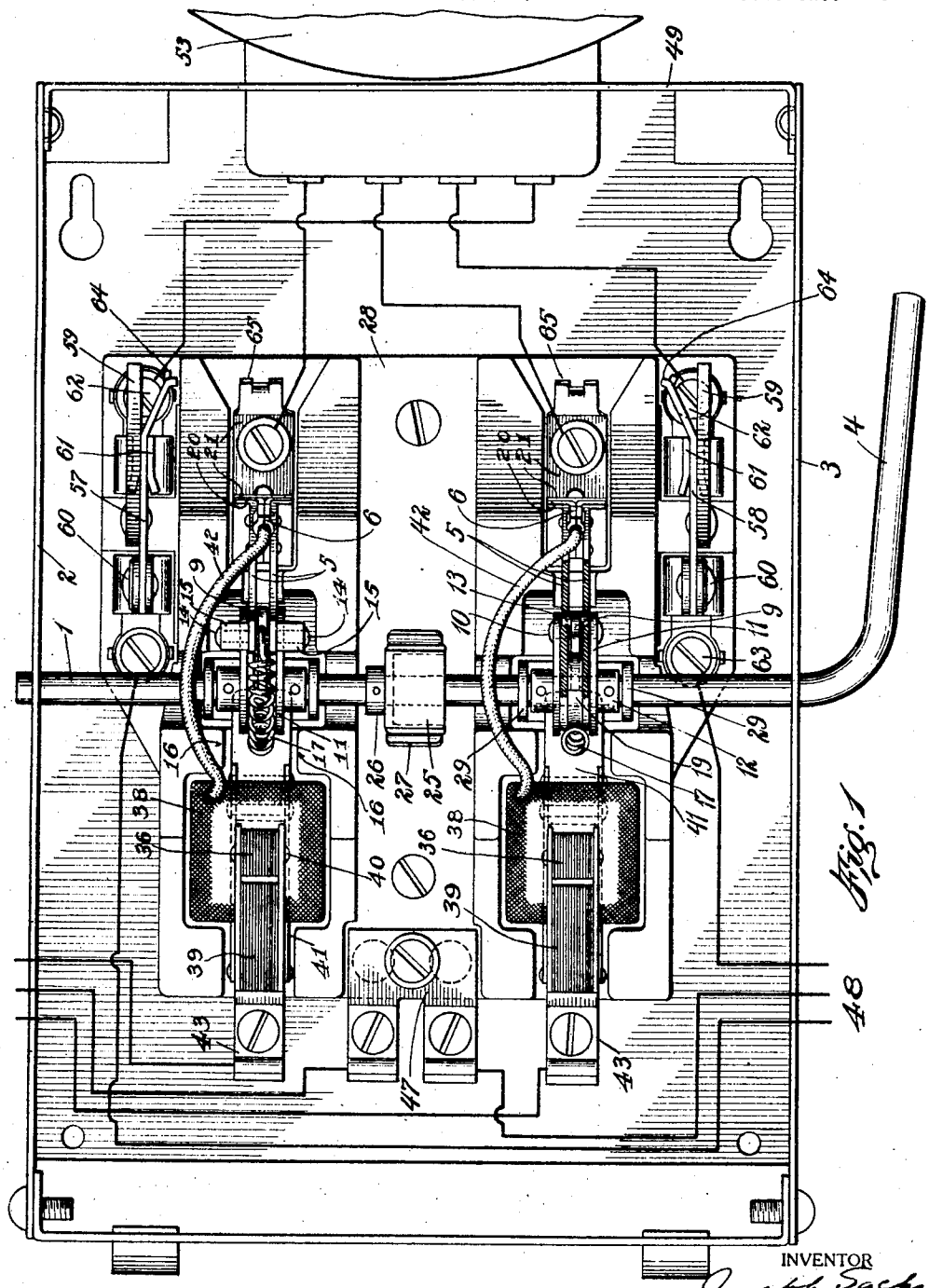

Fig. 1

INVENTOR
Joseph Sachs
BY Jeffrey Kinnicutt & Eggleston
ATTORNEY

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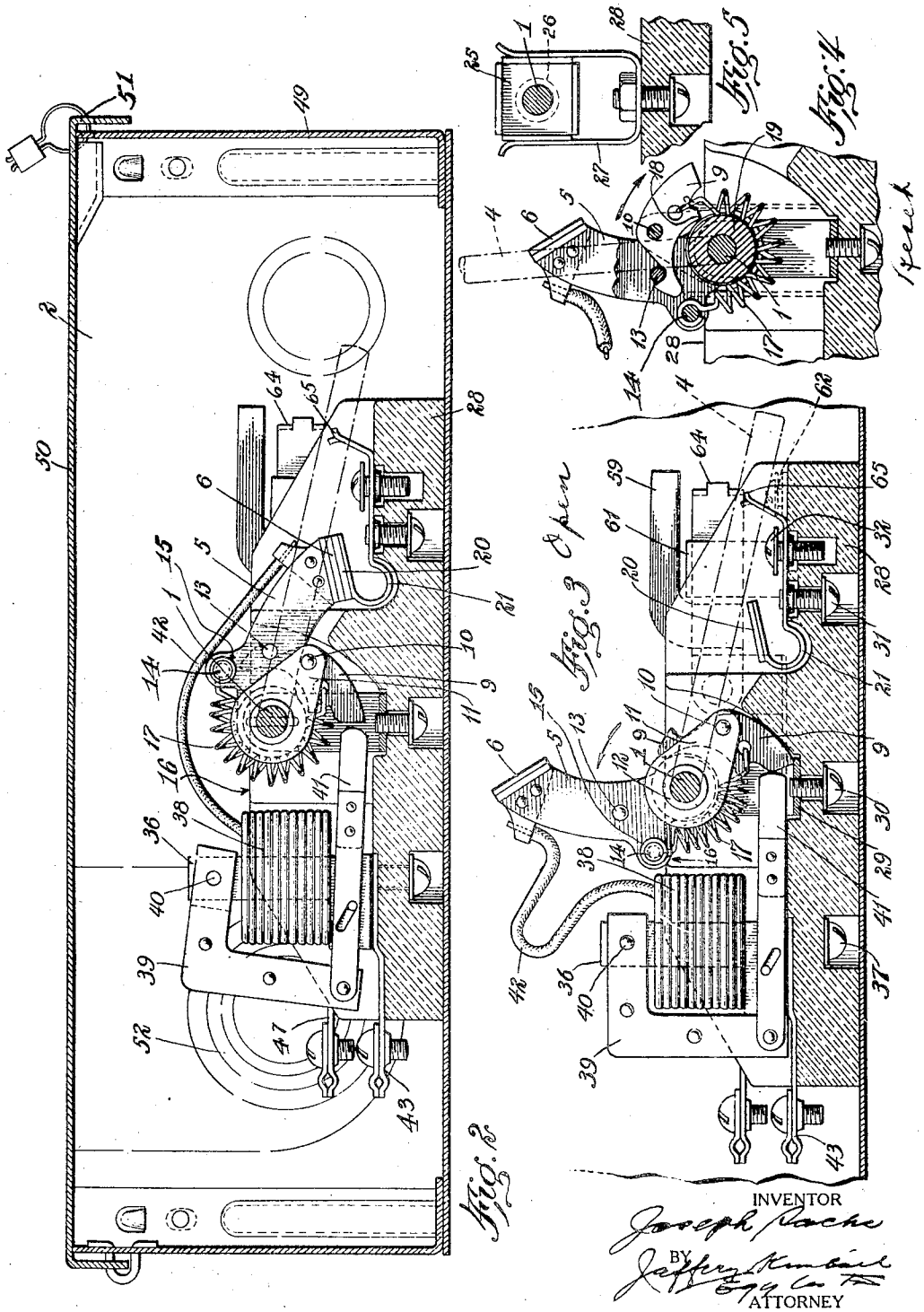

INVENTOR
Joseph Sachs
BY
Jaffery Kimball & Co
ATTORNEY

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UNITED STATES PATENT OFFICE

JOSEPH SACHS, OF WEST HARTFORD, CONNECTICUT

AUTOMATIC CIRCUIT BREAKER

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The invention is here described as applied to an automatic circuit breaker which opens on an excess of current. By reason of the compactness of the structure, the low cost of manufacture and other features, it is particularly adapted for use with small motors and household devices, and to house service-entrance installations where it may take the place of the usual service switch as well as the fuses, and also affords the householder an opportunity of restoring the service himself after the switch has opened by an overload, providing the overload has been removed.

In the accompanying drawings: Figure 1 is an elevation of an enclosed over-load circuit breaker embodying my invention as assembled with a meter etc. in a service-entrance installation.

Figure 2 is a vertical sectional view of the circuit breaker and its casing of Fig. 1, showing the switch contacts closed.

Figure 3 is a similar sectional view showing the switch contacts open.

Figure 4 is a sectional detail adjacent the switch-arm, showing a step in the operation of closing the switch contacts.

Figure 5 is a detail of the mechanism which releasably holds the switch-arm, etc. in the various positions.

A circuit breaker embodying the invention may be variously used but for the purpose of fully illustrating the invention I have shown it as forming a part of a meter service installation. Such a meter service installation may include a single circuit breaker unit or two or more similar units, and in the installation illustrated there are two such units which are enclosed in a casing or cabinet having opposite side walls 2 and 3. The two circuit breaker units are alike and a description of one of them will serve as a description of the other.

Each circuit breaker unit comprises a transverse supporting rod 1 which is preferably rotatable about its own axis so as to constitute a shaft or spindle. When there are two circuit breaker units a single rod 1 may be used. When the rod is so rotatable it is preferably provided with a handle 4 connected therewith at or near one end. As shown the handle 4 is an integral part of the spindle and it is located outside of the enclosing casing, the spindle 1 extending through apertures in the side walls 2 and 3 of the casing.

The circuit-closing on contact carrying member is a two-part arm 5 mounted on the operating shaft 1, about which it can turn freely. The contact member 5 comprises two parallel plates which are spaced apart and are connected with each other for movement in unison. The said plates are connected in part by a stud or pin 13 which extends transversely. The shaft 1 being of metal, the two parallel plates of the contact member will usually be made of isulating material, these carrying a metal contact member 6 adapted to engage a cooperating fixed contact 20. Mounted on the rod or spindle 1 for rotation about the axis thereof is a member 11 which I will designate as an actuator. When the rod 1 is in the form of a manually operable spindle as shown and described the actuator is rigidly connected therewith. As shown the actuator comprises two separate elements or plates which are located outside of the plates forming the contact member 5 but I do not limit myself as concerns the exact relative arrangement. Each plate has a collar 12 by means of which it is pinned to the shaft 1. The two plates of the actuator are located on opposite sides of the contact member 5 so that they serve to hold the said member in place on the spindle. A latch 9 serves to releasably couple the switch-arm 5 to the actuator 11 and the operating shaft 1 at the proper times. This latch is pivoted on a transverse pin 10 which extends between the two plates of the actuator. The latch 9 is hung midway between the two plates of the actuator 11 and hence passes between the two plates of the contact member as shown in Fig. 1 and hooks over the pin 13 connecting the two plates of the switch-arm. One end of a coiled spring 17 is fastened to another pin 14 on the switch-arm while its other end is fastened to the tail of the latch 9 as shown in Fig. 2. The spring 17 serves therefore to turn the switch-arm on the shaft

to open the circuit when the latch 9 is disengaged from the pin 13, and also serves to control the latch 9, holding it engaged with the pin 13 or pulling it back (when disengaged from the pin 13) to a position in which it can reengage the pin 13 again. The shoulder 18 on the latch strikes the hub between the two parts of the switch-arm 5 (see Fig. 4) to limit this backward movement when the latch is disengaged from the pin 13. When the switch is opened automatically by the spring 17, the abutments 15 on the ends of pin 14 strike the shoulders 16 on the insulating base 28 to limit the movement of the switch-arm 5 to the position shown in Fig. 3.

Figs. 2, 3 and 4 illustrate the operations of these parts. In Fig. 2 the latch is engaged with the switch-arm pin 13 so that the switch-arm is coupled to the operating shaft 1 and by turning the handle 4 and the actuator 11 the operator can open or close the switch at will. When the latch 9 is turned on its pivot 10 to the position shown in Fig. 3, however, (compare with its position in Fig. 2) the latch is disengaged from the pin 13 and this releases the switch-arm 5 from the operating shaft 1, and the switch-arm 5 is now free to swing up and open under the pull of the spring 17 as shown in Fig. 3. To re-engage the operating shaft 1 with the released switch-arm or switch-arms, the handle 4 is manipulated to turn the operating shaft 1 from its position in Fig. 2 to its position in Fig. 4, i. e. the switch-open position. This movement causes the hooked end of the released latch to pass under and re-engage with the pin 13 as shown in Fig. 4. This couples the released switch-arm 5 to the operating shaft 1 again so that again it is under the manual control of the operating shaft 1 and handle 4, and may be returned to the position of Fig. 2 by turning the handle 4 and shaft. The transverse pin 10 serves as a positive stop additional to the latch 9 for limiting the movement of the actuator with respect to the switch arm or contact member in the circuit-opening direction. As will be clear from an inspection of Fig. 4 that any effort to further move the spindle and actuator in the counter-clockwise circuit-opening direction will be resisted by the pin 10 engaging the contact member 11.

The spring 17 is usually coupled to the latch 9 at a point rather close to the pin 10, while the pin 14 is much farther from the axis of the shaft 1. That is to say, the lever arm through which the spring works on the switch 5 is longer than the lever arm through which the spring works on the latch. This permits the use of a strong spring 17 exerting considerable force to open the switch, but holding the latch hook to the pin 13 with only a comparatively light pressure so that it is easily displaced to uncouple the switch-arm.

It will be observed that the mechanism so far described is a complete device in itself which is well adapted for use in enclosed circuit breakers and the like. It may be supported by the enclosing casing without any additional supports. If the enclosing casing is omitted it can be supported on the switch base 28 by means of transversely spaced parallel supporting elements 29. These two elements 29, 29 may be formed integrally from a single piece of metal which may be fixed to the base by the through-bolts 30, and which as an alternative may also be used when the circuit-breaker is enclosed. Further, the unit so far described is adapted for use with any type of cooperating switch contacts 6 and 20, and with mechanism responding to any kind of phenomenon for automatically uncoupling the switch arm 5 from the operating member 1.

When switch contacts 6 and 20 of the type shown are used (20 being mounted on a spring support as indicated at 21) it is necessary that some means be provided for holding the two cooperating contacts 6 and 20 in firm engagement; it is also desirable that some means be provided for releasably holding the switch open (position of Fig. 3). The mechanism shown in Fig. 5 is suited for this purpose. In brief this consists of a squared member 25 which may be struck up from sheet metal and provided with a flange 26 for pinning it to the operating shaft 1. One or more flexible arms 27 bear against the sides of the member 25 and thus serve to hold the switch-arm in the position shown in Fig. 2, or in the position shown in Fig. 3 as the case may be, yet permitting the turning of the shaft 1 from one position to the other at the will of the operator.

The latch for connecting the actuator and the contact member whether constructed in detail as already described or otherwise, may be regarded as constituting a part of an electro-responsively controlled means. I have shown the latch as constituting a bodily movable mechanical connection between the actuator and the contact member and I have shown the electro-responsively controlled means as further comprising an electro-responsive device mounted separately from the latch but operatively related thereto. It will be understood as concerns the broader phases of the invention I do not limit myself to the exact arrangement of the several parts of the electro-responsively controlled means as herein described.

As shown the electro-responsive device for operating the latch 9 is of the electro-magnetic type, and comprises a laminated L-shape core 36 bolted to the base 28 at 37, on the longer leg of which is placed the energized coil 38; a cooperating L-shape laminated armature 39 is hinged to 36 at 40 and reciprocates a connecting member 41 which

is arranged to strike the tail of the latch 9. This present circuit breaker is intended to be mounted with the end 49 uppermost. Ordinarily, therefore, when the switch is closed, gravity holds the pivoted armature 39 and the reciprocating connecting member 41 retracted or to the left as shown in Fig. 2. One end of the coil 38 is connected to the switch contact 6 by means of the flexible lead 42 and the other to the line terminal 43, so that the coil 38 is energized by the same current which traverses the switch contacts and the device is adapted to operate on overloads as before indicated. When the coil 38 is sufficiently energized, i. e. by excess current, it attracts the L-member 39 to the member 36 and thrusts the connecting member 41 and tail of the latch 9 to the right against the pull of the spring 17 (Fig. 3). This uncouples the switch-arm 5 from the actuator 11 and the shaft 1 and the switch flies open under the pull of the spring 17 as previously described. Should the switch be closed manually while the condition inducing the overload persists, the armature is attracted again as soon as the contact 6 is brought into engagement with the contact 20 and the switch opens immediately again. Otherwise it may be left closed. It will be observed however that in no case can the circuit breaker be held closed, manually, so long as the phenomenon which opened it persists.

The insulating base 28 may be provided with insulating partitions separating the live parts it carries as shown, and may be fastened to the casing in any way. The manner in which the cooperating switch contact 20 is carried on the insulating base 28 is apparent from Fig. 3 where it will be noticed that a screw 31 passes through the base into the spring member 21 which supports this contact; a screw bolt 32 provides for the connection of one of the line terminals to the carrier 21 and hence to the switch contact 20.

The circuit breaker as thus far described has various uses as will be apparent and the construction is one which is well adapted for the collection of a number of breakers under the control of a single member, such as the handle 4, as is illustrated in the present drawings by the assembly of two such devices along the same shaft. The collected units may or may not have a common base 28. It will be understood that when two or more circuit breaker units are operated from a single shaft or spindle each of them may operate independently of the other to open the circuit when excess current conditions occur. Even though only one of the circuit breakers is opened it may be restored to closed position by first moving the handle to the open-circuit position and then returning it to the closed position as already described.

In the present figures the double-element device is shown applied to a house meter-service-entrance installation as before stated. A three-wire system being assumed, the common neutral terminal 47 of such devices which serves to connect the third or neutral wire of the house or load side 48 to the neutral wire of the incoming or service side of the system, can also be fixed to the insulating base 28 at a convenient place. At one end of the enclosing casing shown the wall 49 is removable and is so recessed as to permit the extension of the terminal box of the meter 53 into the casing; this wall is locked in place by the closing and sealing of the cover 50 at 51, so that all access is prevented to the meter terminals and the exposed metal of the conductors, such as otherwise might make undetectable theft of current possible. This construction of the casing and the removable wall is well known and will be recognized from the drawings without further description. Certain of the casing walls are provided with the usual knock-outs as indicated at 52 in Fig. 2 for the incoming and outgoing leads and their conduits. The two circuit breakers are connected on the service side of the meter as will be apparent from an inspection of Fig. 1.

I have also shown such meter-testing switches 57 and 58 and clip contacts as are desirable for readily testing the meter 53 in service-entrance installations. These are also mounted on the insulating base 28. In brief each testing switch 57 and 58 comprises a pivoted switch arm provided with an extension 59 by which the switch arm can be turned on its pivot 60 and the lines opened thereat. When depressed each switch arm engages with a fixed cooperating contact 61 to complete the circuit from the line terminal 62 to the line terminal 63. Each testing switch blade is further provided with a suitable clip contact as illustrated at 64, and the contact supports 21 are similarly provided with clip contacts 65 to permit the ready attachment and detachment of the meter testing apparatus. The method of testing need not be described. By the arrangement illustrated the circuit remains protected during the testing period, that is to say, the current supplying the house (and also the testing loads) passes through the circuit breakers just as under ordinary conditions and hence should an overload occur on either the house or the testing circuit during the testing period, these switches respond and protect the system just as under ordinary conditions.

I do not herein broadly claim the use of an automatic circuit breaker as a part of a meter service installation this being set forth and claimed in my patent for electric service installation, No. 1,696,150 dated December 18, 1928.

It will be understood that my invention is not limited to the details shown and de-

scribed, except as distinctly appears in the following claims.

Claims:

1. In a circuit breaker of the class described, the combination of a transverse rotatable operating spindle, an actuator rigidly connected with the spindle for rotation therewith, a movable contact member mounted directly on the spindle for pivotal movement thereon, the said member being located adjacent the actuator and being biased for movement to its open-circuit position independently of the spindle and actuator, a manually movable handle transversely spaced from the actuator and contact member and operatively connected with the spindle independently of the actuator, and an electro-responsively controlled means including a releasable bodily movable mechanical connection interposed between the actuator and the contact member and normally biased toward its operative relationship, the said mechanical connection enabling the actuator to actuate the contact member for ordinary switching purposes when the handle is manually moved and the said mechanical connection being automatically released upon the passage of excess current to permit the contact member to automatically move independently of the actuator to its open-circuit position.

2. In a circuit breaker of the class described, the combination of a transverse rotatable operating spindle, an actuator rigidly connected with the spindle for rotation therewith, a movable contact member mounted directly on the spindle for pivotal movement thereon, the said member being located adjacent the actuator and being biased for movement to its open-circuit position independently of the spindle and actuator, a manually movable handle operatively connected with the spindle, an electro-responsively controlled means including a releasable bodily movable mechanical connection interposed between the actuator and the contact member and normally biased toward its operative relationship, the said mechanical connection enabling the actuator to actuate the contact member for ordinary switching purposes when the handle is manually moved and the said mechanical connection being automatically released upon the passage of excess current to permit the contact member to automatically move independently of the actuator to its open-circuit position, a spring mounted adjacent the spindle, and means fixed on the spindle for engaging the spring to yieldably hold the spindle either in the closed-circuit position or in the open-circuit position.

3. In a circuit breaker of the class described, the combination of a transverse rotatable operating spindle, two similar transversely spaced actuators rigidly connected with the spindle for rotation therewith, two similar independently movable contact members mounted directly on the spindle for pivotal movement thereon, the said members being respectively located adjacent the actuators and each being biased for movement to its open-circuit position independently of the other and independently of the spindle and the corresponding actuator, a manually movable handle operatively connected with the spindle, and two similar independent electro-responsively controlled means each including a releasable bodily movable mechanical connection interposed between one actuator and the corresponding contact member and normally biased toward its operative relationship, each mechanical connection enabling the corresponding actuator to actuate the corresponding contact member for ordinary switching purposes when the handle is manually moved and each mechanical connection being automatically released independently of the other upon the passage of excess current to permit the corresponding contact member to automatically move independently of its actuator to its open-circuit position.

4. A circuit breaker as set forth in claim 3 wherein the handle is connected with the spindle independently of either actuator and is transversely spaced from both of the actuators and contact members.

5. In a circuit breaker of the class described, the combination of a pivotally mounted manually movable actuator, a contact member mounted for pivotal movement coaxially with the actuator and biased for movement to its open-circuit position independently of the actuator, an electro-responsively controlled means including a releasable bodily movable latch normally connecting the actuator and the contact member to enable the former to move the latter in the circuit-closing direction, the said latch being normally biased toward its operative relationship and being automatically released upon the passage of excess current to permit the contact member to automatically move independently of the actuator in the circuit-opening direction, and means additional to the latch providing a positive stop for limiting the movement of the actuator with respect to the contact member in the circuit-opening direction.

6. A circuit breaker as set forth in claim 5 wherein the stop means for limiting the relative movement between the actuator and the contact member is a transverse rod carried by one of them and extending between two spaced parallel plates forming parts thereof.

7. In a circuit breaker of the class described, the combination of two transversely spaced parallel supporting elements, a transverse rod extending between the said elements and supported thereby, a manually operable actuator mounted on the rod between the

two elements for pivotal movement about the axis of the rod, a contact member mounted on the rod between the two elements for pivotal movement about the axis of the rod, the said contact member comprising two parallel plates spaced apart and connected with each other for movement in unison and the said member being biased for movement to its open-circuit position independently of the actuator, and an electro-responsively controlled means including a releasable bodily movable latch normally located in part between the two plates of the contact member and normally connecting the said member with the actuator to enable the actuator to control the movement of the contact member for normal switching purposes, the said latch being normally biased toward its operative relationship and being automatically released upon the passage of excess current to permit the contact member to automatically move independently of the actuator in the circuit-opening direction.

8. A circuit breaker as set forth in claim 7 wherein the transverse rod is rotatable and has the actuator rigidly connected therewith, wherein the contact member is pivotally movable on the rod independently thereof, and wherein there is provided a handle outside of the supporting elements for operating the rod and actuator and thereby normally operating the contact member.

9. In a circuit breaker of the class described, the combination of two transversely spaced parallel supporting elements, a transverse rod extending between the said elements and supported thereby, a manually operable actuator mounted on the rod between the two elements for pivotal movement about the axis of the rod, a contact member mounted on the rod between the two elements for pivotal movement about the axis of the rod, a releasable bodily movable latch normally connecting the contact member with the actuator to enable the actuator to control the movement of the contact member for normal switching purposes, a single coil spring connected with the contact member and the latch for biasing the former toward its open-circuit position and for biasing the latter toward its operative position, the said spring extending in an arcuate path around a part of the actuator, and an electro-responsive device additional to the latch for automatically releasing the latch upon the passage of excess current to permit the contact member to automatically move independently of the actuator in the circuit-opening direction.

10. In a circuit breaker of the class described, the combination of a transverse horizontal supporting rod, a manually operable actuator mounted on the rod for pivotal movement about the axis thereof, a contact member mounted on the rod for pivotal movement about the axis thereof and biased for movement to its open-circuit position independently of the actuator, a releasable bodily movable latch normally connecting the contact member with the actuator to enable the actuator to control the movement of the contact member for normal switching purposes, a magnet mounted in fixed position with the axis of its coil horizontal and with its armature horizontally pivoted and movable substantially vertically, and a substantially vertically movable connector pivotally connected at its upper end with the armature and adapted at its lower end to engage the latch to release it when the magnet is energized by the passage of excess current therethrough and to thereby permit the contact member to automatically move independently of the actuator to its open-circuit position:

In testimony whereof, I have signed this specification.

JOSEPH SACHS.