Oct. 31, 1939. J. G. JACKSON 2,177,774

CIRCUIT BREAKER

Filed July 25, 1936 2 Sheets-Sheet 1

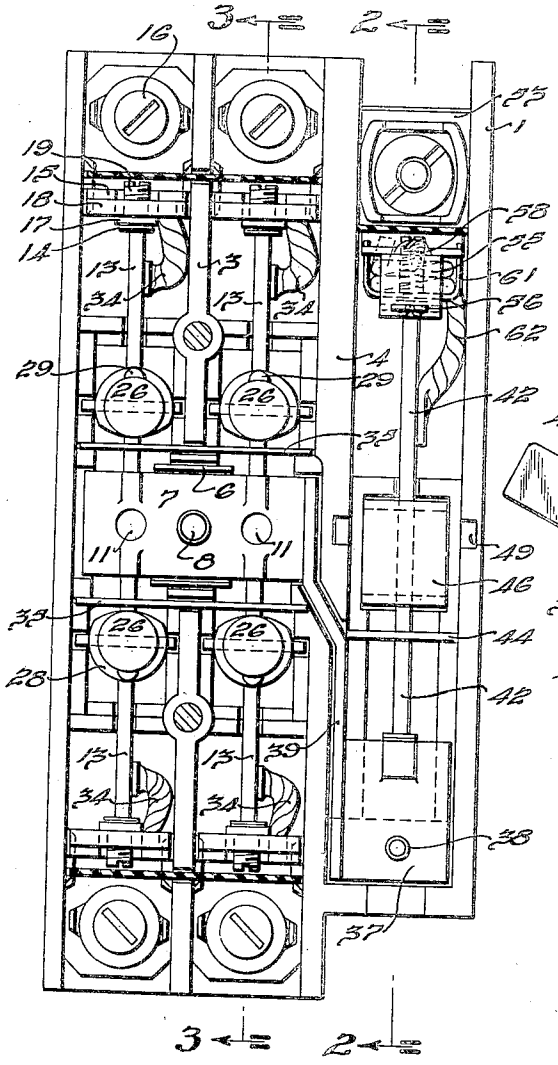


FIG. 1.

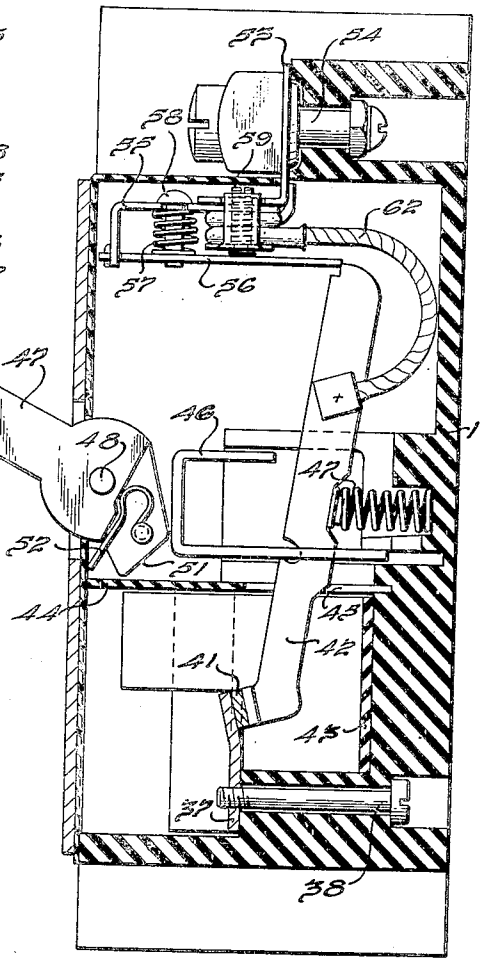


FIG. 2.

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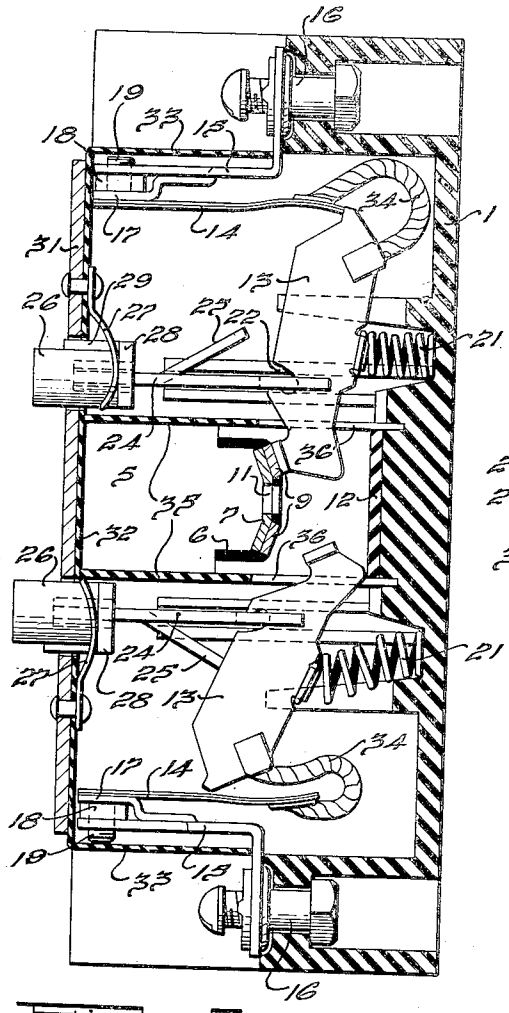


FIG. 3.

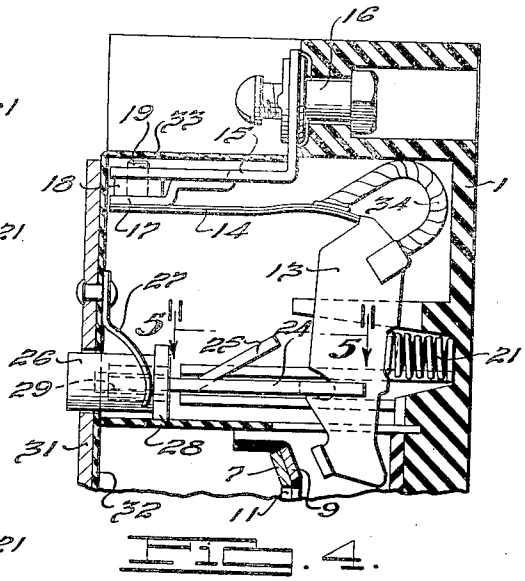


FIG. 4.

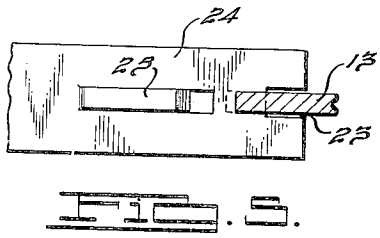


FIG. 5.

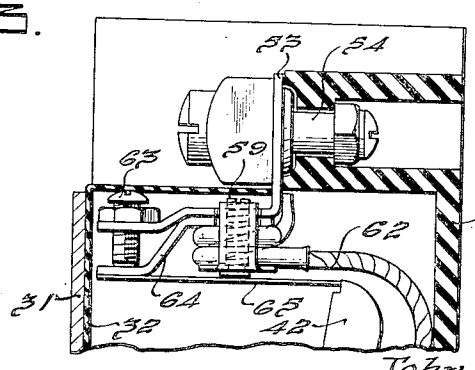


FIG. 6.

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2,177,774

CIRCUIT BREAKER

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Application July 25, 1936, Serial No. 92,644

13 Claims. (Cl. 175—294)

This invention relates to devices for making and breaking electric circuits and more particularly to electric circuit breakers automatically operable in response to current overload.

One object of the present invention is to provide an improved circuit breaker assembly adapted for main and branch circuit protection.

Another object of the invention is the provision of an electric circuit breaker having a main circuit breaker mechanism capable of interrupting short circuit currents and branch circuit breaker mechanisms for the individual branches capable of independently opening their respective branch circuits on the occurrence of moderate overloads.

Another object of the invention is the provision of an electric circuit breaker having a main circuit breaker mechanism operating instantaneously in response to a predetermined minimum current and a plurality of branch circuit mechanisms operable to open their respective branch circuits after a definite time lag in response to overload currents less than the predetermined minimum value for which the main breaker mechanism is set.

Another object of the invention is the provision of an electric circuit breaker having individual main and branch circuit breaker mechanisms, with the branch circuit mechanisms operating to open their respective circuits with a time lag in response to overload currents below a predetermined value and with the main circuit breaker mechanism operating to open the circuit through all the branch circuit breaker mechanisms substantially instantaneously upon the occurrence of an overload above a predetermined value.

Other objects and features of the invention will be readily apparent to those skilled in the art from the following specification and appended drawings illustrating certain preferred embodiments of the invention in which:

Figure 1 is a front elevational view of the circuit breaker according to the present invention with the front cover and the main circuit breaker handle removed to more clearly show internal parts.

Figure 2 is a vertical sectional view on the line II—II of Figure 1.

Figure 3 is a vertical sectional view on the line III—III of Figure 1.

Figure 4 is a partial sectional view showing the circuit breaker mechanism at the top of Figure 3 in a different position.

Figure 5 is an enlarged detail view on the line V—V of Figure 4.

Figure 6 is a partial sectional view of a modified form of trip unit for the main circuit breaker mechanism.

The circuit breaker according to the present invention comprises an insulating base 1 of generally cup shape, provided with a pair of barrier walls 3 and 4. Barrier wall 4 divides that portion of the base enclosing the main circuit breaker mechanism from the rest of the enclosure. Barrier wall 3 provides a partial separation between adjacent branch circuit breaker mechanisms. The central portion of the barrier wall 3 is cut away to provide a common compartment 5 for the escape of arc gases. That portion of wall 3 below the compartment 5 is further recessed to receive a fibre insulating plate 6 on which is supported a contact plate 7. The plates 6 and 7 may be rigidly secured to the base by means of a stud 8. Contact plate 7 carries contact surfaces 9 adjacent to its corners and between contiguous contact surfaces are disposed openings 11, permitting escape of any arc gases which may be generated in the common chamber 5. The arc chambers formed by the sides of walls 3 and 4 and the adjacent side wall of the base may be provided with suitable fibre liners.

The switching members for the branch circuit breaker mechanisms are constituted by floating contact members 13, carrying contact surfaces adjacent to one end cooperating with the stationery contact surfaces 9 and latched at their opposite ends by current traversed bimetallic members 14, adjustably mounted on connectors 15 which are rigidly mounted on ledges at the exterior of the circuit breaker enclosure by means of spun over portions of metallic inserts 16.

The bimetals 14 are mounted on pressed out portion 17 at the interior ends of the connectors 15 and bridging portions 18 are disposed between the pressed out portions 17 and the main portions of the connectors and studs 19 are threaded therein for adjusting the overlap of the bimetallic members 14 with the latching ends of the contact members 13 and hence, for adjusting the movement of the bimetallic members and the value of the currents necessary to trip the mechanism.

The contact members 13 are biased against the stationary contact surfaces 9 and the ends of bimetallic latches 14 by means of relatively heavy compression springs 21. The front edges of the contact members 13 are provided with notches 22 which receive the front edges of slots 23 in rectilinearly movable elements 24, guided within

notches in the side wall of the base and in the walls 3 and 4. Abutments 25 are pressed out of the main body of the elements 24 so as to limit the rotation of the contact members 13, to be hereinafter described.

Push button handles 26 are rotatably mounted upon reduced front end portions of the elements 24 and are biased against the shoulders formed at the reduced end portions by means of springs 27, bearing on shoulders 28 on the push buttons. The push buttons are provided with male projections 29 received within corresponding female openings in a metallic cover 31, which may be sealably secured to the base by means of spun over rivets or in any other desired manner. Beneath the metallic cover plate 31 is provided a fibre sheet 32 having end portions 33 received within suitable notches and guides on the barrier walls 3 and 4 and the side wall of the base and serving to seal off the ends of the branch circuit breaker enclosure.

The bimetallic member 14 and the contact member 13 are electrically connected by means of a flexible lead 34 which may be brazed or otherwise secured therebetween.

To enclose the arc chambers and the common arc gas receiving chamber 5 from the breaker mechanisms, fibre barrier plates 35 are provided which have restricted slots 36 therein receiving the contact members 13.

Within the chamber formed by the barrier wall 4 and the right hand side wall of the base, is mounted the main stationary contact plate 37 by means of stud 38. An integral conducting portion 39 extends through an opening in the barrier wall 4 and interconnects the main contact plate 37 and the common contact plate 7 of the branch circuit breaker mechanisms. The contact plate 37 carries a contact surface 41 and has cooperating therewith a contact surface at one end of an elongated floating contact member 42. The arc chamber surrounding these cooperating contact surfaces may be provided with a fibre liner 43 and a fibre barrier 44, having a slot 45 closely receiving the contact member 42. The contact member 42 has a double notch engagement with a rectilinearly movable element 46 suitably guided for movement at right angles to the back of the base by guiding projections therein. The compression spring 47 biases the contact member 42 against the stationary contact surface and a latching surface to be hereinafter described. An operating handle 47 is pivotally mounted on a shaft 48 mounted within suitable notches 49 in the side wall of the base and the barrier wall 4. This handle is provided with an interior cam surface cooperating with the front face of the element 46 to move it rectilinearly, which cam surface includes a flat portion 51, forming a stable manual OFF support for the element.

A light spring 52 biases the handle for rotation in a counter-clockwise direction as shown and performs the function of springs 27 in the branch circuit breaker mechanism.

At the end of the enclosure opposite the stationary contact plate 37 is mounted a conducting support 53 as by means of a spun over portion of a metallic insert 54. To the interior end of the support 53 is welded or otherwise secured an L shaped magnetic bracket 55 to the end of which is pivotally mounted a magnetic armature latch member 56 adapted to be engaged with the end of the contact member 42 to latch it in its operating position. The armature 56 is biased away from the bracket 55 by means of a compression spring 57 and its movement therefrom is limited by stud 58 threaded into armature 56 and having its body portion slidable within an opening in the bracket 55. Through the attached portion of the bracket 55 is threaded a magnetic screw 59 having its inner end headed about a generally U shaped member 61 which has its legs suitably guided in notches in the support 53. A flexible lead 62 interconnects the conducting support 53 and the contact member 42. This lead is wound about the magnetic screw 59 and the windings are retained in place by the U shaped member 61.

The interior end of the magnetic screw 59 forms a pole face adapted to attract the armature 56 upon the occurrence of a predetermined overload current about the magnetic path formed by the bracket 55, the armature 56 and the screw 59. The adjustment of the stud 58 will vary the overlap of the armature latch 56 with the end of the contact member 42 and will have some effect upon the air gap in the magnetic circuit. Adjustment of the screw 59 will directly vary the air gap and these two adjustments, together with the number of turns of the flexible lead 62 about the magnetic screw will determine the value of the current which will trip this main breaker mechanism.

The operation of the individual branch circuit breaker mechanisms will now be described.

The mechanism shown at the top of Figure 3 is in the normal operating or closed circuit position. Upon the occurrence of overload through the bimetallic member 14 it will become heated and warp toward the end of the base, thereby unlatching the corresponding end of the contact member 13 which will be rotated under the bias of the spring 21 into the position shown by the circuit breaker mechanism at the bottom of Figure 3, thus moving the contact surface on the contact member away from its cooperating contact surface 9 and opening the circuit through that branch. This rotation of the contact member 13 will be limited by the engagement of the abutment 25 with the front edge of the contact member. It is to be noticed that in this automatic opening of the circuit, the member 13, the element 24 and the push button handle 26 are all moved outwardly so as to place the push button handle in a position indicating the automatic trip position of the breaker mechanism. This result is obtained because the normal operating compression spring 21 has a considerably stronger bias than the handle maintaining spring 27.

To reset the parts after automatic operation, push button 26 is pressed inwardly, whereupon the back edge of the contact member 13 adjacent to its contact surface will engage the bottom of the arc chamber and the member 13 will rotate about its pivotal engagement with the element 24 to rotate the latching end back into position beneath the bimetallic latching member 14. Release of the push button will thereafter permit the parts to resume their normal operating position.

If it is desired to open a branch circuit mechnism manually, the push button 26 is pressed inwardly until the male projection 29 moves out of its cooperating female opening whereupon the handle may be rotated to engage the end of this projection with the under side of the cover whereupon the parts will assume as a stable position that shown in Figure 4. With the contacts sep-

arated in manual disengagement, to again place the parts in closed circuit position, the push button 26 is rotated back to the position where the male projection 29 registers with the female opening in the cover whereupon the push button will be free to move outwardly and the parts will assume their normal closed circuit position.

The operation of the main breaker mechanism is substantially the same as the branch circuit breaker mechanism, with the exception that the handle 47 is rotated about its pivotal shaft 48 to effect the reciprocation of the element 46. When the flat portion 51 of the cam surface engages the front surface on the element 46 the stable manual OFF position will be produced with the contact member 32 rotated to disengage its contact carrying end from the stationary contact surface 41.

This main circuit breaker is adapted to open the circuit through all the branch mechanisms upon the occurrence of a predetermined overload without delay. This value can be set at any desired current and its upper limit will be determined by the rupturing capacity of the branch circuit breaker mechanisms.

Upon the occurrence of this predetermined value the armature 56 will be pulled into engagement with the pole face formed by the end of the magnetic screw 59. This releases the latching end of the contact member 42 and permits it to rotate in a counter-clockwise direction under the bias of the spring 47, thus interrupting the current through all the branch circuits. This release will permit the spring 47 to overcome the spring 52 and will rotate the operating handle to indicating position. To reset breaker mechanism after an automatic trip, the handle is rotated beyond the manual OFF position until the tip beyond the flat 51 moves the element 46 far enough toward the base so that the latching end of contact member 42 will be re-rotated into position beyond the armature latch 46. Release of the handle will place the parts in the manual OFF position with the flat 51 engaging the element 46, whereupon rotation of the handle beyond the flat will again permit the parts to assume the normal closed circuit position.

With this type of circuit breaker, it is intended that the branch circuit breaker mechanisms will only be required to interrupt moderate sustained overloads and that short circuit currents and high overloads will be interrupted by the main circuit breaker mechanism. With this functioning considerable economy in the construction of the branch circuit mechanism is obtained over the case where each of the branch circuit breaker mechanisms must be capable of interrupting short circuit currents.

As a practical example, the main circuit breaker mechanisms may be set to operate at 600% of the rated current of the highest rated branch circuit mechanism. Then, for instance, if the maximum rating of a branch circuit mechanism were 50 amperes, the branch circuit mechanisms would have to be capable of successfully interrupting 300 amperes and all overloads above this value would always be interrupted by the main circuit breaker mechanism.

The bimetallic latches 14 will always have some time lag whereas the magnetic armature latch 56 will operate without this time lag and overloads beyond 300 amperes will always be interrupted by the main circuit breaker mechanisms while the low sustained overloads will be interrupted by the individual branch circuit breaker mechanisms without interrupting the circuits through the remaining branch circuit breaker mechanisms. This permits the attainment of considerable economy in the construction of branch circuit mechanism while retaining the desirable time lag on moderate overloads and retaining as well, the ability to rupture currents of short circuit value.

While the main circuit breaker tripping unit has been shown as magnetic, it is obvious that any other type of tripping unit may be used so long as the time lag therein will be greater than in the tripping units of the branch mechanisms for moderate overloads and lesser for the high overload and short circuit currents, in order that the moderate overloads will be individually interrupted by the branch circuit breaker mechanisms and that high overloads and short circuits will be interrupted by the main circuit breaker mechanism.

A slightly modified form of trip unit for the main circuit breaker mechanism has been illustrated in Figure 6. Here the conducting support 53 has been extended to receive an adjusting stud 63, bearing against a magnetic portion 64 which is welded or otherwise secured to the support 53 and to the free end of which is secured a magnetic spring latching member 65. The other parts remain the same as in the preferred form of tripping unit. Here the overlap of the spring latch 65 is determined by adjustment of the stud 63. This latch 65 must be sufficiently rigid to withstand the thrust of the contact member 42 but must have sufficient resilience so as to permit bending under the attraction of the magnetic field so as to permit the latch 65 to move as an armature into engagement with the pole face formed by the magnetic screw 59.

While certain preferred embodiments of the invention have been specifically disclosed, it is understood that the invention is not limited thereto as many variations will be readily apparent to those skilled in the art and the invention is to be given its broadest possible interpretation within the terms of the following claims.

What is claimed is:

1. In a multi-circuit circuit breaker adapted for main and branch circuit protection, a plurality of branch circuit breaker mechanisms having electrically common parts from which they are adapted to feed to their individual circuits, said mechanisms including means for automatically opening the circuits therethrough upon the occurrence of sustained moderate overloads, a main circuit breaker mechanism electrically connected to feed to said electrically common parts and including means for automatically interrupting the circuit therethrough upon the occurrence of high overload currents, a sealable enclosure for the main and branch circuit breaker mechanisms and the connection therebetween to prevent access thereto, and terminals for said circuit breaker mechanisms at the exterior of the enclosure and accessible for the connection of circuit wiring.

2. A unitary multi-circuit circuit breaker adapted for both main and branch circuit protection comprising a sealable enclosure, a plurality of individual branch circuit breaker mechanisms within said enclosure having means automatically operable upon the occurrence of sustained moderate overloads to individually open the circuits through said mechanisms, a main circuit breaker mechanism mounted within said enclosure and connected to feed to said branch circuit breaker mechanisms, said main circuit

breaker mechanism including means for interrupting the circuit therethrough automatically operable upon the occurrence of a relatively high overload current, and terminals for said main and branch circuit breaker mechanisms accessible at the exterior of said sealable enclosure for the connection of circuit wiring.

3. A unitary multi-circuit circuit breaker adapted for both main and branch circuit protection comprising a sealable enclosure, a plurality of individual branch circuit breaker mechanisms within said enclosure including means automatically operable in response to sustained moderate overloads for individually opening the circuits through said mechanisms, a main circuit breaker mechanism mounted within said enclosure and connected to feed to said branch circuit breaker mechanisms and having means automatically operable in response to a relatively high overload current to interrupt the circuit through said main circuit breaker mechanism, said last mentioned means operating with substantially no time delay upon the occurrence of a predetermined value of overload current, and terminals for said main and branch circuit breaker mechanisms readily accessible at the exterior of the enclosure for the connection of circuit wiring.

4. A unitary multi-circuit circuit breaker adapted for both main and branch circuit protection comprising a sealable enclosure, a plurality of branch circuit breaker mechanisms within said enclosure having means automatically operable to individually open the circuits therethrough upon the occurrence of sustained moderate overloads, a main circuit breaker mechanism mounted within said enclosure and connected to feed to said branch circuit breaker mechanisms, said main circuit breaker mechanism including means automatically operable to break the circuit therethrough upon the occurrence of a relatively high overload current, said first mentioned means responding individually to break the circuits through their mechanisms upon the occurrence of sustained moderate overloads therethrough, said last mentioned means operating before said first mentioned means to interrupt the circuit through the main circuit breaker mechanism upon the occurrence of a high overload or short circuit current, and terminals for said main and branch circuit breaker mechanisms accessible at the exterior of the enclosure for the connection of circuit wiring.

5. In an automatic electric circuit breaker assembly adapted for main and branch circuit protection, a plurality of branch circuit breaker mechanisms having means individually automatically operable to interrupt the current through their respective mechanisms, said means including thermal current responsive tripping units, said mechanisms being incapable of successfully interrupting currents of relatively high or short circuit value, and a main circuit breaker mechanism capable of interrupting short circuit currents connected to feed to said branch circuit breaker mechanisms and including means automatically responsive to a predetermined current value within the safe interrupting capacity of the branch circuit breaker mechanisms to interrupt the circuit through the main circuit breaker mechanism, said last mentioned means comprising a magnetic trip unit operating in response to currents above said predetermined value with substantially no time delay.

6. In a unitary multi-circuit circuit breaker adapted for main and branch circuit protection, a sealable enclosure having at least two substantially independent compartments therein, a main circuit breaker mechanism mounted in one of said compartments having means automatically operable in response to a predetermined value of current to break the circuit therethrough, said mechanism being capable of interrupting currents of short circuit value, a plurality of branch circuit breaker mechanisms in another of said compartments having means automatically operable in response to overload currents below said predetermined value for opening the circuits through the individual mechanisms, said branch circuit breaker mechanisms having a safe interrupting capacity in excess of said predetermined value but of less than short circuit value, said last mentioned means being individually operable with a small time delay to the current overloads to which they are responsive, means extending between said compartments and sealed within said enclosure and connecting the main circuit breaker mechanism to feed to said branch circuit breaker mechanisms, and terminals for said main and branch circuit breaker mechanisms mounted at the exterior of said enclosure and readily accessible for the connection of circuit wiring.

7. In a unitary multi-circuit circuit breaker adapted for main and branch circuit breaker protection, a sealable enclosure, a plurality of electrically common contacts within said enclosure, a main circuit breaker mechanism having a short circuit current interrupting capacity and including means automatically operable in response to currents above a predetermined value to interrupt the circuit through the mechanism, said mechanism including a contact cooperating with one of said common contacts to feed thereto, and a plurality of branch circuit breaker mechanisms having contacts individually cooperating with the others of said common contacts and including means individually automatically operable in response to overload currents of less than said predetermined value to individually interrupt the circuits through said mechanisms at said cooperating contacts.

8. In a unitary multi-circuit circuit breaker adapted for main and branch circuit breaker protection, a sealable enclosure, a contact element within said enclosure having a plurality of contact faces thereon, a main circuit breaker mechanism having a contact cooperating with one of said contact faces to feed to said contact element, said mechanism having the capacity of safely interrupting currents of short circuit value and including means automatically operable in response to currents above a predetermined minimum value to open the circuit through said mechanism at said contact and the contact face with which it cooperates, a plurality of branch circuit breaker mechanisms having individual contacts cooperating with the others of said contact faces and including means individually automatically operable in response to overload currents below said predetermined minimum value to interrupt the circuits through said branch circuit breaker mechanisms at said contacts and contact faces, said last mentioned means operating with a short time delay in response to overload currents of less than said predetermined value, said first mentioned means operating substantially instantaneously in response to overload currents above said predetermined value.

9. In a unitary multi-circuit circuit breaker adapted for main and branch circuit protection, a cluster of stationary contact surfaces, a main cir-

cuit breaker mechanism having a contact cooperating with one of said contact surfaces to feed to said cluster and including means automatically operable substantially instantaneously upon the occurrence of an overload current above a predetermined value to interrupt the circuit through said mechanism, a plurality of branch circuit breaker mechanisms having individual contacts cooperating with the other of said contact surfaces and including means individually automatically operable with a small time delay in response to overload currents below said predetermined value to interrupt the circuit through their respective mechanisms.

10. In a unitary multi-circuit circuit breaker adapted for main and branch circuit protection, a cluster of stationary contact surfaces, a main circuit breaker mechanism having a contact cooperating with one of said contact surfaces to feed to said cluster and including means automatically operable substantially instantaneously upon the occurrence of an overload current above a predetermined value to interrupt the circuit through said mechanism, a plurality of branch circuit breaker mechanisms having individual contacts cooperating with the other of said contact surfaces and including means individually automatically operable with a small time delay in response to overload currents below said predetermined value to interrupt the circuit through their respective mechanisms, and a sealable enclosure for said mechanisms, means, contacts and contact surfaces to prevent unauthorized access thereto, and terminals for said main and branch circuit breaker mechanisms mounted at the exterior of said enclosure and readily accessible for the connection of circuit wiring.

11. A unitary multi-circuit circuit breaker adapted for both main and branch circuit protection comprising a base, a main automatic electric circuit breaker mechanism mounted on said base and including means automatically operable in response to overload currents above a predetermined value to break the circuit through said mechanism, a plurality of branch circuit breaker mechanisms mounted on said base and including means individually automatically operable in response to overload currents below said predetermined value to interrupt the circuits through their individual mechanisms, means connecting said branch mechanisms to feed through the main mechanism, cover means sealably attached to said base to provide a sealed enclosure for said mechanisms and the connecting means, a main terminal for said main mechanism supported on said base at the exterior of said enclosure, a plurality of branch terminals individually connected to the branch mechanisms and also mounted on the base at the exterior of the enclosure, and manual operating means for said mechanisms projecting through the cover means to the exterior of the enclosure.

12. A unitary multi-circuit circuit breaker adapted for main and branch circuit breaker protection comprising a base, a main circuit breaker mechanism mounted on said base and including means automatically operable substantially instantaneously upon the occurrence of an overload current in excess of a predetermined value to open the circuit through said mechanism, a plurality of branch circuit breaker mechanisms mounted on said base and including means individually automatically operable with a short time delay in response to overload currents below said predetermined value to open the circuits through their individual mechanisms, cover means sealably attached to said base to provide a sealed enclosure for said mechanisms and the connecting means to prevent access thereto, terminals for said main and branch circuit breaker mechanisms supported on the base at the exterior of the enclosure, and manual operating means for said mechanisms projecting through the cover means to the exterior of the enclosure.

13. A unitary multi-circuit circuit breaker adapted for main and branch circuit breaker protection comprising a base, a main circuit breaker mechanism mounted on said base and having a safe interrupting capacity for currents of short circuit value, said mechanism including means automatically operable substantially instantaneously in response to overload currents above a predetermined value to open the circuit through the mechanism, a plurality of branch circuit breaker mechanisms mounted on said base and having safe interrupting capacities in excess of said predetermined current value but of less than short circuit magnitude, said last mentioned mechanisms including means individually automatically operable with a time delay in response to overload currents below said predetermined value to interrupt the circuits through the individual mechanisms, means connecting said branch mechanisms to feed through the main mechanism, cover means sealably attached to said base to provide a sealed enclosure for said mechanisms and connecting means, terminals for said main and branch mechanisms supported on said base at the exterior of the enclosure, and manual operating means for said mechanisms projecting through the cover means to the exterior of the enclosure.

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