Oct. 3, 1939. J. SACHS 2,174,669

AUTOMATIC CIRCUIT BREAKER ASSEMBLY

Filed April 15, 1938 4 Sheets-Sheet 1

Fig. 1

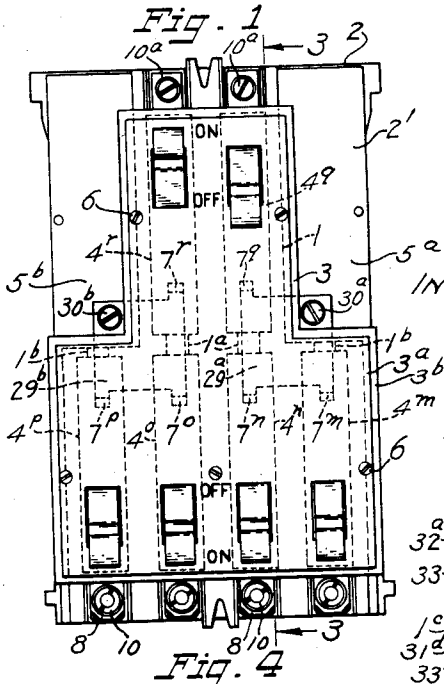


Fig. 3

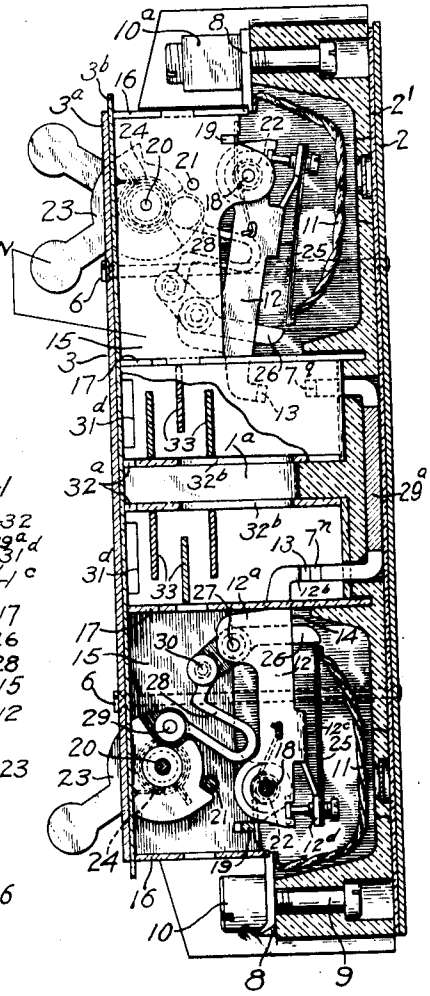


Fig. 2

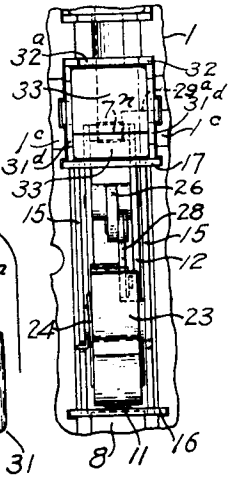


Fig. 4

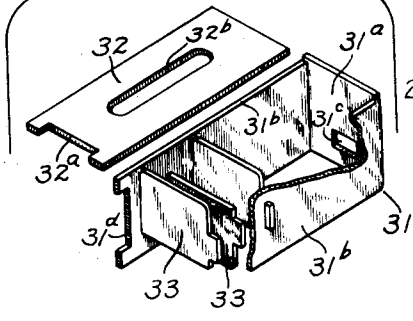
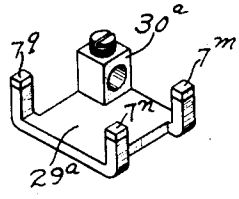


Fig. 5



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Oct. 3, 1939. J. SACHS 2,174,669

AUTOMATIC CIRCUIT BREAKER ASSEMBLY

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Fig. 6

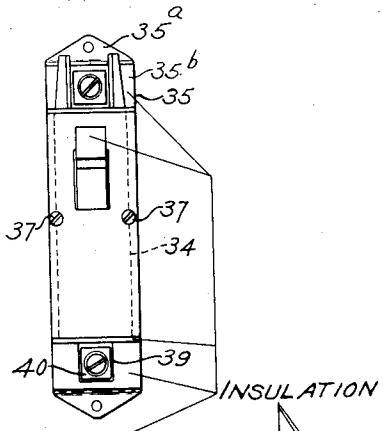


Fig. 7

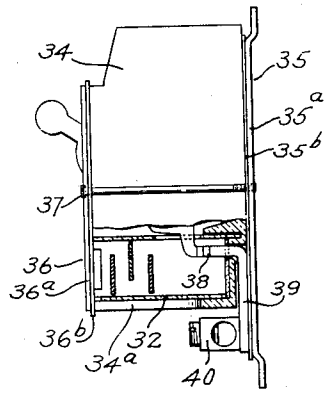


Fig. 8

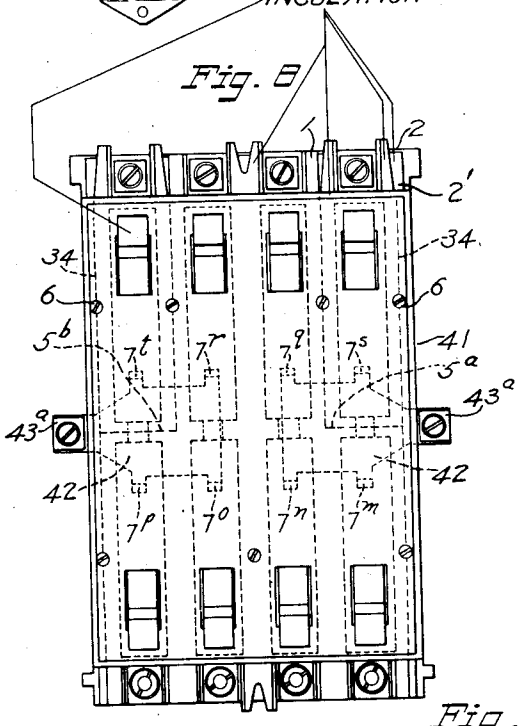


Fig. 9

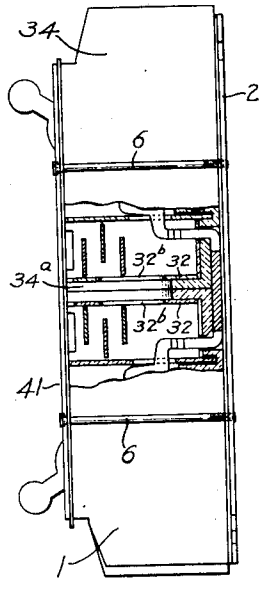
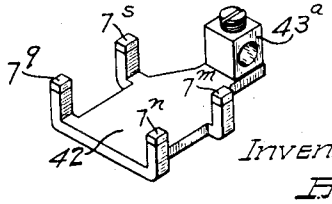


Fig. 10



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Oct. 3, 1939. J. SACHS 2,174,669

AUTOMATIC CIRCUIT BREAKER ASSEMBLY

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Fig. 11

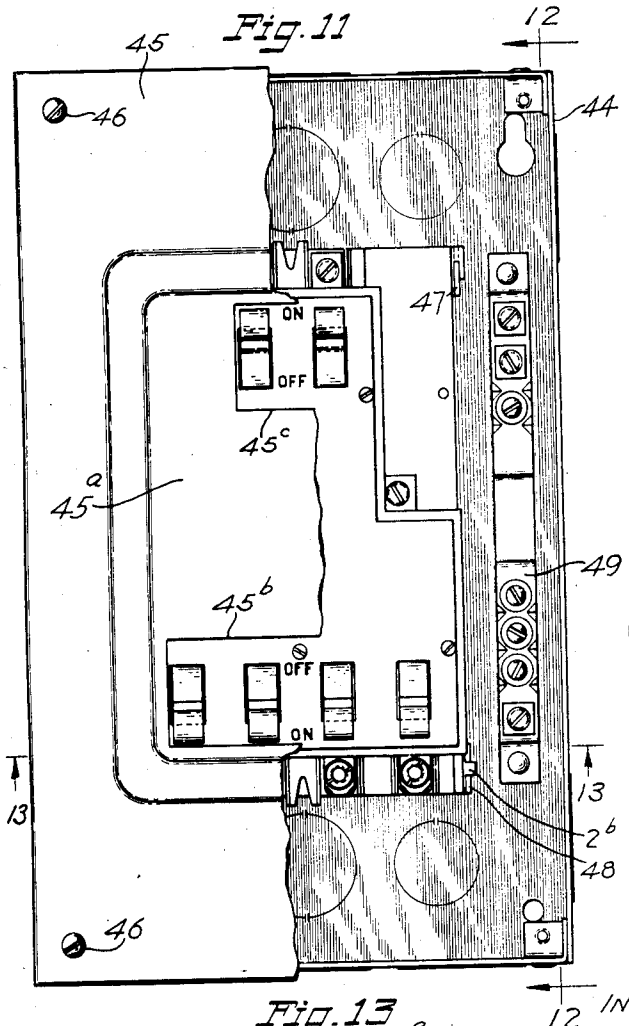


Fig. 12

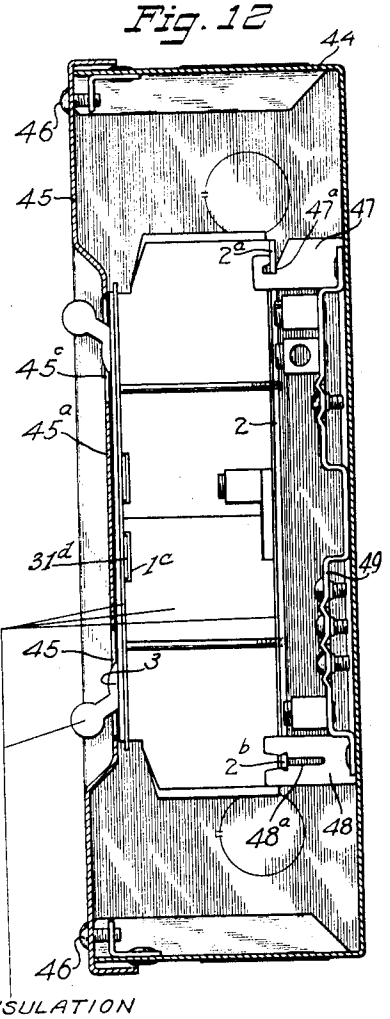
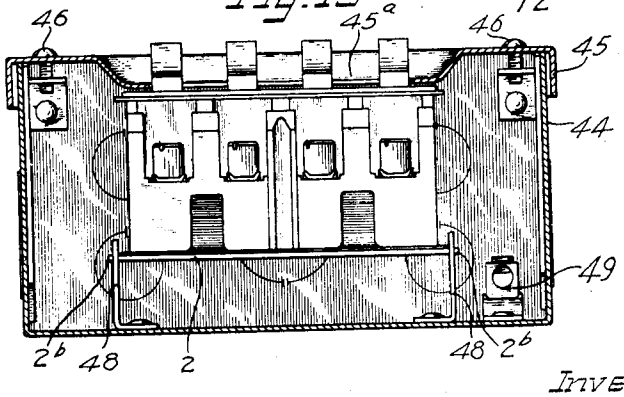


Fig. 13



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AUTOMATIC CIRCUIT BREAKER ASSEMBLY

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Fig. 14

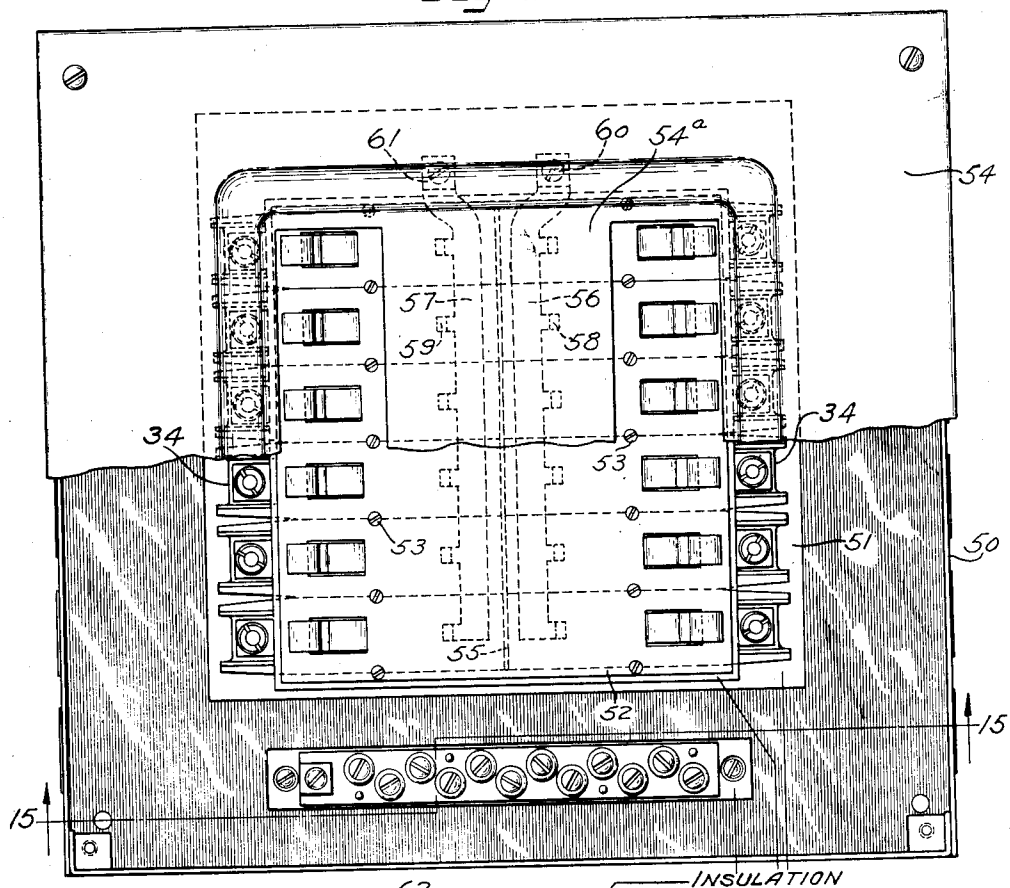


Fig. 15

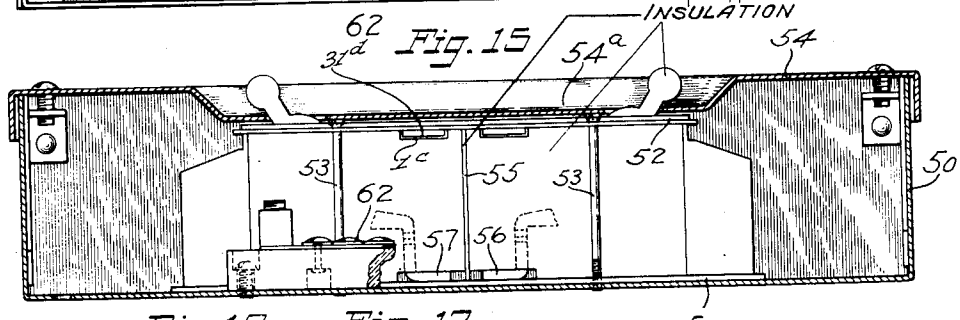


Fig. 16

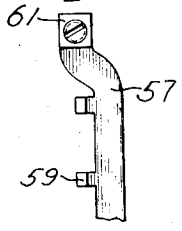
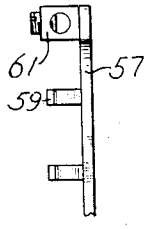


Fig. 17



Inventor: Joseph Sachs
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Patented Oct. 3, 1939

2,174,669

UNITED STATES PATENT OFFICE

2,174,669

AUTOMATIC CIRCUIT BREAKER ASSEMBLY

Joseph Sachs, West Hartford, Conn., assignor to Colt's Patent Fire Arms Manufacturing Company, Hartford, Conn., a corporation of Connecticut

Application April 15, 1938, Serial No. 202,297

21 Claims. (Cl. 175—307)

As to certain of its phases, the invention is applicable to a single circuit breaker mechanism or unit, but it is more particularly applicable to a panel or assembly consisting of two or more circuit breaker mechanisms or units.

One object of the invention is to provide an arrangement wherein each stationary contact is directly mounted upon the corresponding main bussing or other conductor and wherein the circuit breaker unit or units are mounted separately so that each unit can be readily separated from the corresponding stationary contact or contacts on the bussing or other conductor.

Another object of the invention is to provide an improved means for quenching or muffling the arcs of a plurality of circuit breaking mechanisms.

Another object of the invention is to provide a circuit breaker assembly having a plurality of mechanisms or a plurality of structurally separate units all covered at the front and held in place by a single front cover plate.

Another object of the invention is to provide an assembly comprising two or more structurally separate units, one of the units having at least three circuit breaking mechanisms and the other unit having only a single mechanism and being positioned in a corner notch in the first unit.

Another object of the invention is to provide an improved means whereby a circuit breaker unit or an assembly of units may be readily connected with or disconnected from a rear supporting wall.

Still other objects of the invention will be apparent from the following specification and claims.

In the accompanying drawings I have shown several embodiments of the invention, but it will be understood that the drawings are intended for illustrative purposes only and are not to be construed as defining or limiting the scope of the invention, the claims forming a part of this specification being relied upon for that purpose.

Of the drawings:

Fig. 1 is a front view of a multiple circuit breaker assembly, including a multiple housing unit, a front cover plate and a rear supporting plate.

Fig. 2 is an enlarged fragmentary front view with the front cover plate removed and showing a portion of the housing unit with one of the circuit breaking mechanisms in place therein.

Fig. 3 is an enlarged vertical sectional view taken along the lines 3—3 of Fig. 1.

Fig. 4 is an enlarged perspective view of one of the muffler devices.

Fig. 5 is a perspective view of one of the main conductors shown in Figs. 1 and 2 with the stationary contacts thereon.

Fig. 6 is a front view of a single circuit breaker unit, comprising a single housing unit, a front cover plate and a rear supporting plate.

Fig. 7 is a side view of the parts shown in Fig. 6, a portion of the housing unit being broken away to show the arc muffing device.

Fig. 8 is a view similar to Fig. 1 but showing a multiple housing unit such as shown in Fig. 1 and two single housing units such as shown in Figs. 6 and 7, all three housing units being combined to form a multiple circuit breaker asembly.

Fig. 9 is a side view of the parts shown in Fig. 8, portions of the housing units being broken away to show the arc muffling devices.

Fig. 10 is a perspective view of one of the main conductors shown in Figs. 8 and 9 with the stationary contacts thereon.

Fig. 11 is a front view of the multiple assembly shown in Fig. 1 mounted in an enclosing casing, parts of the casing being broken away.

Fig. 12 is a vertical sectional view taken along the line 12—12 of Fig. 11.

Fig. 13 is a transverse sectional view taken along the line 13—13 of Fig. 11.

Fig. 14 is a front view of a circuit breaker assembly including a plurality of single housing units such as shown in Figs. 6 and 7.

Fig. 15 is a transverse sectional view taken along the line 15—15 of Fig. 14.

Figs. 16 and 17 are front and side views respectively of one of the main conductors shown in Figs. 14 and 15 with the stationary contacts thereon.

In Figs. 1 to 5 of the drawings, I have shown a multiple circuit breaker assembly which includes a multiple housing unit 1, a rear supporting plate 2 and a front cover plate 3. The housing unit 1 has a plurality of open-front chambers therein each adapted to contain a single circuit breaking mechanism. As shown, there is a lower group of four chambers, 4^m, 4^n, 4^o, 4^p in side-by-side relationship and an upper group of two chambers 4^q, 4^r in side-by-side relationship, the two chambers 4^q, 4^r of the upper group being in end-to-end relationship with the central chambers 4^n, 4^o of the lower group. If attention is directed particularly to each half of the housing unit, it will be observed that each half has therein three similar open-front chambers with two of them in side-by-side relationship and with the third

in end-to-end relationship with one of the first two, and it will also be observed that there is a large corner notch in side-by-side and end-to-end relationship with the before-mentioned chambers. The two notches in the two halves of the unit are indicated at 5^a and 5^b. While the particular arrangement of chambers as shown and described is desirable and useful, I do not necessarily limit myself to this particular arrangement.

For a purpose to be hereinafter explained in detail, each two chambers in end-to-end relationship, such as 4^n, 4^q and 4^o, 4^r, preferably have limited communication with each other. For this purpose there are provided openings or slots 1^a, 1^a. The other chambers, such as 4^m and 4^p preferably have openings or slots 1^b, 1^b in their end walls.

The front cover plate 3 comprises a metal plate 3^a and an insulating plate 3^b at the rear of the metal plate. The two plates 3^a and 3^b which together constitute the front cover plate substantially close all of the chambers 4^m, 4^n, 4^o, 4^p, 4^q, 4^r at the front, but are provided with openings therein through which the handles of the several circuit breaker mechanisms can project. The rear supporting plate comprises not only the metal plate 2 but also an insulating plate 2' at the front of the metal plate. Screws 6, 6 extend through suitable holes in the front cover plate and in the rear supporting plate and serve to hold the described parts in assembled relationship.

Similar circuit breaking mechanisms are positioned in the several chambers of the housing unit 1 and as to the details of these mechanisms I do not narrowly limit myself. However, in order that the present invention may be clearly understood I have shown and will describe mechanisms similar to the mechanism disclosed in the co-pending application of Joseph Sachs and Paul M. Christensen for Automatic circuit breakers, Serial No. 202,295 filed on even date herewith. Fig. 3 shows two mechanisms which are identical in construction but reversed in position. In the description which follows reference will be had chiefly to the mechanism shown in Fig. 2 and in the lower part of Fig. 3, but reference will also be made to the mechanism shown in the upper part of Fig. 3 wherein the parts are in the positions which they occupy when the circuit is open.

For each mechanism there is provided a stationary main contact such as 7^n and also a stationary conductor 8 which is separated from the contact. The contact 7^n is rigidly mounted as hereinafter described in greater detail, and the conductor 8 is mounted on the housing unit 1 by means of a screw 9. For each of the lower mechanisms a nut 10 on the screw 9 constitutes a wire terminal. For each of the upper mechanisms there is a separate terminal 10^a connected with the corresponding conductor 8.

Directly connected electrically with each stationary conductor 8 is a flexible conductor 11. For making and breaking the circuit between the contact 7^n and the conductors 8 and 11 there is provided a contact member which is pivotally movable about a fixed axis. The said contact member comprises a conducting element 12 which carries a movable contact 13 adapted to engage and disengage the stationary contact 7^n. The conducting element 12 is formed of sheet metal bent so as to have a U-shape in transverse section. The legs 12^a of the U extend forward and these legs are connected at the rear by a yoke which has an aperture 14 therein, thus providing two separated transverse yoke portions 12^b and 12^c. The before-mentioned movable contact 13 is carried by the transverse yoke portion 12^b at the center thereof.

For supporting the contact member and associated parts there is provided an inner frame which includes two opposite similar insulating plates 15, 15 spaced apart and which also includes two transverse end plates 16 and 17. In Fig. 3 the section is so taken as to show the right hand plate of the upper frame and to eliminate the right hand plate of the lower frame. The end plate 16 serves to close the end of the corresponding chamber in the housing unit, and the end plate 17 serves as a partition extending across the chamber. The conducting element 12 of the movable contact member extends through slots in the plate 17, and the plate therefor serves to separate the arcing space at the contacts from the principal portions of the circuit breaking mechanism.

The plates 15, 15 of the inner frame are connected with each other by transverse members 18, 19, 20 and 21. The transverse member 18 is a pivot or bearing member which extends through holes in the legs of the conducting element 12, thus providing a pivotal support for the entire contact member. Surrounding the member 18 is a coil spring 22 which engages the conducting element 12 and also engages the insulating transverse member 19, this spring thus serving to bias the contact member in the contact disengaging or circuit opening direction. A handle or operating member 23 is pivotally supported on the said inner frame, the transverse member 20 being utilized as the pivotal support. The operating member 23 extends forward through the corresponding opening in the front cover plate, and it is biased in the clockwise direction by a spring 24.

In order that the operating member 23 may operate the contact member, there is provided a connecting mechanism which is controlled by means of a bi-metallic latch 25 bodily movable with the contact member and cooperating directly with an actuator 26 which is mechanically connected with the operating member. The actuator 26 is pivotally mounted at 27 between the two legs 12^a of the conducting element 12. The actuator 26 has a portion which extends rearward and projects through the aperture 14 in the conducting element 12.

A link 28 is pivotally connected with the operating member 23 at 29 and with the actuator 26 at 30. With the parts in the normal closed-circuit position as shown in the lower portion of Fig. 3, the pivotal axis at 29 is above or in front of a straight line connecting the pivotal axes at 20 and 30, the operating member itself thus cooperating with the link 28 to form a normally locked or overset toggle. The before-mentioned transverse member 21 engages a suitable shoulder on the operating member to limit movement thereof in the counter-clockwise direction.

The before-mentioned bi-metallic latch 25 normally engages the actuator 26 and holds it in its normal relationship with the other parts as shown in the lower portion of Fig. 3. The latch is rigidly secured by brazing or otherwise to an integral downward extension 12^d on the yoke portion 12^c of the conducting element 12. The latch is thus connected near the pivot end of the conducting element, and it extends substantially parallelly therewith to its point of en-

gagement with the actuator 26. The before-mentioned flexible conductor 11 is electrically connected directly with the bi-metallic latch 25 near the upper latching end thereof. This connection may be effected by brazing.

The stationary contact 7^n is rigidly supported and the before-mentioned link 28 is U-shaped and resilient so as to be adapted to yield as the toggle approaches its overset relationship, and the link thereupon serves to apply to the contact member the force necessary to provide the required pressure between the contacts. The force exerted by the link also normally serves to hold the toggle in overset relationship.

With the circuit breaker in closed-circuit position as shown in the lower portion of Fig. 3, it will be apparent that electrical connection is established from the stationary contact 7^n to the movable contact 13, thence through the conducting element 12 and the bi-metallic latch 25, and thence through the flexible conductor 11 to the stationary conductor 8. As already stated, the contact member is biased in the circuit-opening direction by means of the spring 22, and the operating member is biased in the clockwise or circuit-opening direction by means of the spring 24. However, actual movement in the circuit-opening direction is normally prevented by reason of the described overset toggle relationship between the operating member itself and the link 28, it being understood that the latch 25 normally holds the actuator 26 from relative movement in the clockwise direction. Normally the operating member 23 may be moved to move the contact member and thus open or close the circuit. During such normal movements the latch 25 remains engaged with the actuator 26.

If the handle or operating member be held in its closed-circuit position as shown in the lower portion of Fig. 3 and if an abnormal current condition such as an overload is attained, the bi-metallic latch 25 is automatically deflected rearward so as to disengage and release the actuator 26. This deflection ordinarily occurs chiefly by reason of the heating of the bi-metallic element. When the actuator is no longer held by the latch 25, the entire contact member is moved by the spring 22 to its open-circuit position this movement occurring even though the handle be held in closed-circuit position. Ordinarily, however, the handle is not held and the spring 24 moves the operating member to the position shown in the upper portion of Fig. 3, this in turn moving the link 28 and the actuator 26 to the positions there shown. This movement of the operating member and the actuator occurs as soon as the actuator has moved far enough to break the locking relationship between the operating member 23 and the link 28. All of the parts thus move practically instantaneously to the positions shown in the upper portion of Fig. 3, the actuator being immediately restored to engaging relationship with the latch. As soon as the latch has cocled sufficiently the operating member can be moved to again close the circuit.

In accordance with the present invention, the stationary contact 7^n is carried by or mounted directly upon a main conducting means, such as a conductor 29^a, and the contact is free from any permanent or direct connection with the housing unit 1. The housing unit has an opening in one wall thereof and the conducting means has a portion which extends through the opening and carries the contact. As shown there is an opening in the rear wall of the housing unit, and the contact is carried on a portion of the conductor 29^a which projects forward through the opening.

When there are three mechanisms in each half of the unit, as shown and described, the conductor 29^a serves as a bussing conductor and has three forward projecting portions which carry three suitably spaced stationary contacts 7^n, 7^m, 7^q. Preferably and as shown the rear wall of the housing unit has a recess for receiving the conductor 29^a and the said conductor is clamped between the housing unit and the rear supporting plate and is thus held in place. A wire terminal 30^a is connected with the bussing conductor 29^a and is positioned in the notch 5^a. A bussing conductor 29^b is provided at the left, this carrying contacts 7^o, 7^p, 7^r and being provided with a wire terminal 30^b in the notch 5^b.

It will be observed that the housing unit and the conductor 29^a and 29^b are without positive connection with each other except through the supporting plate, and that when detached from the supporting plate they are readily separable from each other. When the contact carrying portions of the conductors project forward through openings in the rear walls of the units separation is effected by relative forward or rearward movement.

Preferably an arc muffling device is positioned in each chamber adjacent the partition plate 17 and in the main at the front of the two contacts. The arc muffling device may be a separate structure normally held in place by the front cover plate, but being removable as a unit after the cover plate has been removed. The arc muffling device is preferab'y so constructed as to provide a circuitous passageway for the gases, and when the contacts are near the rear the passageway may advantageously extend in a generally forward direction.

The arc muffling devive as shown in the drawings comprises an insulating sheet 31 bent to provide a rear wall 31^a and two opposite parallel side walls 31^b, 31^b. There is also provided a transverse insulating sheet 32, which is preferably separate from the sheet 31. The rear wall 31^a has an opening 31^c therein through which projects the portion of the bussing conductor carrying the corresponding stationary contact. Carried by the opposite walls 31^b, 31^b are metallic plates 33, 33 oppositely positioned so as to provide a circuitous or serpentine passageway as clearly shown in Fig. 3. Preferably the side walls 31^b, 31^b have slots or apertures therein in which are seated the end portions of the plates 33, 33. The side walls of the chamber in the housing unit preferably have opposite grooves for the ends of the plates 33, 33 as shown in Fig. 2. The opposite side walls of the arc muffling device have notches 31^d, 31^d therein and the transverse end wall 32 has a notch 32^a therein. The main body of the housing unit has transverse notches 1^c, 1^c at the front registering with the notches 31^d, 31^d. These notches 1^c, 1^c communicate either with the exterior of the unit or with the next adjacent chamber.

When there are mechanisms in two chambers such as 4^n and 4^q in end-to-end relationship, the end walls 32, 32 of the arc muffling devices preferably have openings or slots 32^b, 32^b therein in register with the corresponding opening or slot 1^a in the housing structure. When the circuit is interrupted at the contacts of one mechanism, a portion of the gases move through the circuitous passageway provided by the plates 33, 33 of

the corresponding arc muffling device, and another portion of the gases move through the slots 32^b, 1^a, 32^b into the arc muffling device of the adjacent mechanism and then through the circuitous passageway therein. The interconnection of the two arc muffling devices makes it possible to utilize both of them and to thus obtain greater gas dispensing or cooling efficiency.

When a chamber such as 4^m or 4^q has no other chamber in end-to-end relationship there may be a slot 1^b in the end wall of the chamber, as already stated, but the end wall 32 of the corresponding arc muffling device does not have a slot 32^b therein. When the mechanism is in a chamber such as 4^m or 4^p without another chamber in end-to-end relationship therewith, all of the gases formed as the result of the separation of the contacts are forced to move through the corresponding circuitous passageway.

While the invention is particularly applicable to a multiple circuit breaker assembly such as shown in Figs. 1 to 3 it is also to some extent applicable to a single unit as shown in Figs. 6 and 7. The single housing unit 34 shown in these figures has an open-front chamber therein of the same size and shape as the chambers in the multiple housing unit 1. There is a rear supporting plate 35 comprising a metal plate 35^a with an insulating plate 35^b thereon, and there is also a front cover plate 36 comprising a metal plate 36^a and an insulating plate 36^b. Screws 37, 37 serve to hold the described parts in assembled relationship. By means of the supporting plate 35 the entire unit can be mounted on a suitable supporting wall, such as the rear wall of an enclosing casing.

A stationary contact 38 is carried by a forward projecting portion of a conductor 39 which is provided with a wire terminal 40. The conductor is in a recess formed in the back of the housing unit 34 and it is clamped between the housing unit and the supporting plate. The circuit breaker mechanism may be identical in construction with that already shown and described.

The arc muffling device may be the same as that already described, but it will be observed that inasmuch as there is no other unit in end-to-end relationship with the unit shown, the end wall 32 of the muffling device does not have a slot 32^b therein. However, the end wall of the housing may have a slot 34^a therein, which makes the housing unit more suitable for use in combination with other units.

In Figs. 8, 9 and 10 there is shown a circuit breaker assembly which is similar to that shown in Figs. 1 to 3 but which differs in that there are eight mechanisms instead of six. The main housing unit 1 and the rear supporting plate 2 may be identical in construction with those as shown in Figs. 1 to 3, and the circuit breaking mechanisms may be identical in construction. In order to provide eight mechanisms instead of six, two single housing units 34, 34 are located in the notches 5^a, 5^b of the housing unit 1 and a larger front cover plate 41 is provided, adapted to cover all of the units and cooperate with all of the eight mechanisms. Bussing conductors 42, 42 are provided which are similar to the bussing conductors 29^a and 29^b except that each of them carries four stationary contacts instead of three, the wire terminals 43^a, 43^a being positioned at the sides of the assembly. The bussing conductor 42 as shown in Fig. 10 carries four contacts 7^m, 7^n, 7^q and 7^s.

The arc muffling devices at the sides, as for instance those at the right side as shown in Fig. 9, function exactly as already described in connection with Figs. 1 to 4. Inasmuch as there are two units in end-to-end relationship, the muffler plates 32, 32 have slots 32^b, 32^b therein as shown, thus permitting the gases to pass from one muffling device to the other through the slots 32^b, 1^c, 34^a, 32^b.

It will be observed that by providing six-mechanism housing units such as 1 and single mechanism housing units such as 34, and by providing two different styles of front plates such as 3 and 41, and by providing two different styles of bussing conductors such as 29^a, 29^b and 42, it is possible to manufacture at a minimum cost either a six-unit circuit breaker assembly as shown in Fig. 1, or an eight-unit circuit breaker assembly as shown in Fig. 8.

The supporting plate for the circuit breaker assembly, such as the plate 2, can be mounted in a variety of ways and one suitable way is shown in Figs. 11 to 13. As shown, the entire assembly is mounted by means of the plate 2, in an enclosing casing 44. The casing 44 has an openable front cover 45 secured by screws 46, 46, the said cover preferably having a central depressed cover portion 45^a closely adjacent the front cover plate 3 of the circuit breaker assembly. The cover 45 also has openings 45^b and 45^c through which project the operating members or handles of the several mechanisms.

Brackets 47, 47 project forward from the rear wall of the casing 44, these brackets being near one edge of the supporting plate, as for instance the top edge. Interengaging means on the brackets and on the supporting plate enable the latter to be detachably hinged to the former. As shown, the brackets 47, 47 have slots 47^a adapted to receive laterally projecting ears 2^a, 2^a on the plate 2 near the top edge thereof. Other brackets 48, 48 project forward from the rear wall of the casing, these brackets being near the opposite edge of the supporting plate, in the present instance near the bottom edge. Interengaging means on the brackets 48, 48 and on the supporting plate enable the latter to be snapped into or out of connected relationship with the former. As shown, the brackets 48, 48 are provided with slots 48^a adapted to receive other laterally projecting ears 2^b, 2^b on the plate 2 near the bottom edge thereof. In connecting the circuit breaker assembly with the casing, the ears 2^a, 2^a are first entered in the slots 47^a and then the entire assembly is swung rearward to enter the ears 2^b, 2^b in the slots 48^a. The last said slots are slightly narrower than the ears and have shallow notches in their sides so that the said ears, after being forced into the slots, will be firmly but yieldably held at the notches. By applying force in the forward direction the ears 2^b, 2^b can be disengaged and the entire assembly can be removed.

The brackets 47, 47 and 48, 48 are of sufficient length to detachably hold the plate 2 at a suitable predetermined distance from the rear wall of the casing. Thus there is provided ample wire receiving space at the rear of the plate. If more convenient, some or all of the wires can be put in place before the circuit breaker assembly is mounted in the casing. Suitable provision is made at 49 for the connection of neutral wires.

In Figs. 14 to 17 there is shown a circuit breaker assembly wherein a plurality of single housing units, such as 34, 34, are connected directly with the rear wall of an enclosing casing 50. They are separated from the casing wall by an insulating

sheet 51. The units are in two rows and the units in the respective rows are in end-to-end relationship. A front cover plate 52 is provided of suitable size to cover and cooperate with all of the units and screws 53, 53 extending through the plate serve to hold the several housing units in place. The casing 50 has a front cover 54 with a central depressed portion 54a having openings for the several operating members or handles.

Preferably the units of the two rows are separated by an insulating sheet 55. Main conductors 56 and 57 extend transversely of the units and are positioned in the several recesses in the backs thereof. They are clamped between the housing units and the rear wall of the casing. These conductors have suitably spaced forward extending portions carrying stationary contacts 58 and 59 adapted to cooperate with the movable contacts of the several mechanisms. The conductors are provided respectively with wire terminals 60 and 61. Suitable provision is made at 62 for the connection of neutral wires.

The action of the arc muffling devices is as shown in Fig. 9. In order to provide a passageway from one arc muffling device to another the insulating sheet 55 may be provided with suitable slots or holes (not shown) registering with the several slots 34a in the housing units.

What I claim is:

1. In an automatic circuit breaker, the combination of a housing having a wall with an opening therein, an automatic circuit breaking mechanism located chiefly within the housing and having a contact which is movable to open and close the circuit and which when in closed-circuit position is adjacent the said opening in the housing wall, a conducting means positioned in part outside of the housing and having a portion which projects into the housing through the said opening, and a stationary contact carried by the projecting portion of the conducting means in position to be engaged by the movable contact when in closed-circuit position, the said conducting means and the said contact thereon being free from any direct connection with the housing and being so related to the said housing opening that they can be readily withdrawn from the housing by movement relative thereto while remaining in fixed relation to each other.

2. In an automatic circuit breaker, the combination of a housing having a wall with an opening therein, an automatic circuit breaking mechanism located chiefly within the housing and having a contact which is movable to open and close the circuit and which when in closed-circuit position is adjacent the said opening in the housing wall, a conducting means positioned in parts outside of the housing and having a portion which projects through and substantially fits and fills the said opening in the housing wall, and a stationary contact carried by the projecting portion of the conducting means in position to be engaged by the movable contact when in closed-circuit position, the said conducting means and the said contact thereon being free from direct connection with the housing and being so related to the said housing opening that they can be readily withdrawn from the housing by movement relative thereto while remaining in fixed relation to each other.

3. In an automatic circuit breaker, the combination of a housing having a rear wall with an opening therein, an automatic circuit breaking mechanism located chiefly within the housing and having a contact which is movable to open and close the circuit and which when in closed-circuit position is adjacent the said opening in the rear wall, and a conducting means positioned at the rear of the housing and having a portion which projects forward through the said opening in the housing rear wall and which carries at its forward end a stationary contact in position to be engaged by the movable contact when in closed-circuit position, the said housing and the said conducting means with the contact thereon being readily separable from each other by relative forward or rearward movement.

4. In an automatic circuit breaker, the combination of a housing having a rear wall with an opening therein, an automatic circuit breaking mechanism located chiefly within the housing and having a movable contact which is movable to open and close the circuit and which when in closed-circuit position is adjacent the said opening in the rear wall, a rear support for the housing, means for connecting the housing with the said rear support, and a conducting means positioned at the rear of the housing and having a portion which projects forward through the said opening in the housing rear wall and carries at its forward end a stationary contact in position to be engaged by the movable contact when in closed-circuit position, the said conducting means being engaged by and clamped between the housing and the rear support and the said housing and the said conducting means with the contact thereon being readily separable from each other by relative forward or rearward movement when the housing is disconnected from the support.

5. In an automatic circuit breaker assembly, the combination of a housing structure having a plurality of similar chambers therein and having a plurality of wall openings associated with the respective chambers, a plurality of automatic circuit breaking mechanisms respectively located chiefly within the several chambers of the housing structure and having contacts which are movable to open and close corresponding portions of the circuit, and a single conducting means positioned in part outside of the housing structure and having a plurality of portions which project into the housing structure through the respective openings, and a plurality of stationary contacts carried by the respective projecting portions of the conducting means in positions to be engaged by the respective movable contacts when in closed-circuit positions, the said conducting means and the said contact thereon being free from direct connection with the housing structure and being so related to the said housing structure openings that they can be readily withdrawn from the housing structure by movement relative thereto while remaining in fixed relation to each other.

6. In an automatic circuit breaker assembly, the combination of a housing structure having a plurality of similar chambers therein and having a plurality of rear wall openings associated with the respective chambers, a plurality of automatic circuit breaking mechanisms respectively located chiefly within the several chambers of the housing structure and having contacts which are movable to open and close corresponding portions of the circuit, and a single conducting means positioned at the rear of the housing structure and having a plurality of portions which project forward through the respective rear wall openings in the housing structure and which carry at their forward ends stationary contacts in positions to

be engaged by the respective movable contacts when in closed-circuit positions, the said housing structure and the said conducting means with the contacts thereon being readily separable from each other by relative forward or rearward movement.

7. In an automatic circuit breaker assembly, the combination of a housing structure having a plurality of similar chambers therein and having a plurality of rear wall openings associated with the respective chambers, a plurality of automatic circuit breaking mechanisms respectively located chiefly within the several chambers of the housing structure and having contacts which are movable to open and close corresponding portions of the circuit, a rear support for the housing structure, means for connecting the housing structure with the said rear support, and a single conducting means positioned at the rear of the housing structure and having a plurality of portions which project forward through the respective rear wall openings in the housing structure and which carry at their forward ends stationary contacts in positions to be engaged by the respective movable contacts when in closed-circuit positions, the said conducting means being engaged by and clamped between the housing structure and the rear support, the said housing structure and the said conducting means with the contacts thereon being readily separable from each other by relative forward or rearward movement when the housing structure is disconnected from the support.

8. In an automatic circuit breaker assembly, the combination of a housing structure comprising two or more separable units and having a plurality of similar chambers in the respective units, the units of the housing structure having a plurality of rear wall openings associated with the respective chambers, a plurality of automatic circuit breaking mechanisms respectively located chiefly within the several chambers of the said units and having contacts which are movable to open and close corresponding portions of the circuit, and a single conducting means positioned at the rear of the housing structure units and having a plurality of portions which project forward through the respective rear wall openings in the units and which carry at their forward ends stationary contacts in positions to be engaged by the respective movable contacts when in closed-circuit positions, the said housing structure units and the said conducting means with the contacts thereon being readily separable from each other by relative forward or rearward movement.

9. In an automatic circuit breaker assembly, the combination of a housing structure having at least two similar chambers therein in end-to-end relationship and having at least two rear wall openings associated with the respective chambers near the adjacent ends thereof, at least two oppositely positioned automatic circuit breaking mechanisms respectively located chiefly within the corresponding chambers of the housing structure and having contacts which are movable to open and close corresponding portions of the circuit, and a single conducting means positioned at the rear of the housing structure and having at least two portions which project forward through the respective rear wall openings in the housing structure and which carry at their forward ends stationary contacts in positions to be engaged by the respective movable contacts when in closed-circuit positions, the said housing structure and the said conducting means with the contacts thereon being readily separable from each other by relative forward or rearward movement.

10. An automatic circuit breaker assembly comprising in combination, a housing structure having two similar chambers therein in end-to-end relationship which chambers have limited communication with each other at their adjacent ends, two automatic circuit breaking mechanisms located chiefly within the respective chambers of the housing structure and each having two contacts relatively movable to open and close two portions of the circuit, the contacts of the respective mechanisms being located within and near the adjacent communicating ends of the chambers, and means in the respective chambers and near the adjacent ends thereof for forming circuitous passageways separate from the main portions of the chambers so that upon separation of the contacts of either mechanism to open the circuit one portion of the arc-formed gases will move through the circuitous passageway of the corresponding chamber and another portion of the said gases will enter the other chamber and move through the circuitous passageway thereof.

11. An automatic circuit breaker assembly comprising in combination, a housing structure having two similar chambers therein in end-to-end relationship which chambers have limited communication with each other at their adjacent ends, two automatic circuit breaking mechanisms located chiefly within the respective chambers of the housing structure and each having two contacts relatively movable to open and close two portions of the circuit, the contacts of the respective mechanisms being located near the adjacent communicating ends of the chambers and near the rear thereof, and means in the forward portions of the respective chambers and near the adjacent ends thereof for forming circuitous passageways separate from the main portions of the chambers so that upon separation of the contacts of either mechanism to open the circuit one portion of the arc-formed gases will move in a generally forward direction through the circuitous passageway of the corresponding chamber and another portion of the said gases will enter the other chamber and move in a generally forward direction through the circuitous passageway thereof.

12. An automatic circuit breaker assembly comprising in combination, a housing structure having two similar chambers therein in end-to-end relationship which chambers have limited communication with each other at their adjacent ends and are otherwise substantially closed except at the front, a front cover means substantially closing both chambers at the front, two automatic circuit breaking mechanisms located chiefly within the respective chambers of the housing structure and each having two contacts relatively movable to open and close two portions of the circuit, the contacts of the respective mechanisms being located near adjacent communicating ends of the chambers and the principal portions of the mechanisms being readily movable in the forward direction upon removal of the front cover means, and arc muffling devices in the respective chambers near the adjacent ends thereof and readily movable in the forward direction upon removal of the front cover means, the said arc muffling devices having means forming circuitous passageways separate from the main portions of the chambers so that upon separation of the contacts of either mechanism to open the

circuit one portion of the arc-formed gases will move through the circuitous passageway of the corresponding chamber and another portion of the said gases will enter the other chamber and move through the circuitous passageway thereof.

13. An automatic circuit breaker assembly comprising in combination, a housing structure having two similar chambers therein in end-to-end relationship which chambers have communication with each other at their adjacent ends, two automatic circuit breaking mechanisms located chiefly within the respective chambers of the housing structure and each having two contacts relatively movable to open and close two portions of the circuit, the contacts of the respective mechanisms being located near adjacent communicating ends of the chambers, and two similar arc muffling devices in the respective chambers near the adjacent ends thereof and having end walls with registering openings therein, the said arc muffling devices having means forming circuitous passageways separate from the main portions of the chambers so that upon separation of the contacts of either mechanism to open the circuit one portion of the arc-formed gases will move through the circuitous passageway of the corresponding chamber and another portion of the said gases will pass through the registering openings into the other chamber and move through the circuitous passageway thereof.

14. An automatic circuit breaker assembly comprising in combination, a housing stucture comprising two separable units having two similar chambers in the respective units, the said units being located with their chambers in end-to-end relationship and the said units having registering openings in their end walls providing limited communication between the chambers at the adjacent ends thereof, two automatic circuit breaking mechanisms located chiefly within the respective chambers of the housing structure units and each having two contacts relatively movable to open and close two portions of the circuit, the contacts of the respective mechanisms being located near adjacent communicating ends of the chambers, and means in the respective chambers and near the adjacent ends thereof for forming circuitous passageways separate from the main portions of the chambers so that upon separation of the contacts of either mechanism to open the circuit one portion of the arc-formed gases will move through the circuitous passageway of the corresponding chamber and another portion of the said gases will enter the other chamber and move through the circuitous passageway thereof.

15. The combination in an automatic circuit breaker assembly, of a housing structure having therein a plurality of similar open-front chambers, a single unitary plate substantially closing all of the chambers at the front but having a plurality of handle openings therein, a plurality of supporting frames positioned in the respective housing chambers and behind and in engagement with the front plate and being held by the plate and being otherwise freely movable in the forward direction, and a plurality of automatic circuit breaking mechanisms carried chiefly by the respective frames and freely movable in the forward direction when the frames are so moved, the said mechanisms being connectible in different portions of the circuit and each of them serving upon the attainment of excess current conditions to break that portion of the circuit in which it is connected and each of the said mechanisms having a movable handle at the front extending through the corresponding opening in the front plate.

16. The combination in an automatic circuit breaker assembly, of a housing comprising a plurality of separable units and having in the respective units a plurality of similar open-front chambers, a single unitary plate substantially closing all of the chambers of all units but having a plurality of handle openings therein at the fronts of the chambers, a plurality of supporting frames positioned in the respective chambers and behind and in engagement with the front plate and being held by the plate and being otherwise freely movable in the forward direction, and a plurality of automatic circuit breaking mechanisms carried chiefly by the respective frames and freely movable in the forward direction when the frames are so moved, the said mechanisms being connectible in different portions of the circuit and each of them serving upon the attainment of excess current conditions to break that portion of the circuit in which it is connected and each of the said mechanisms having a movable handle at the front extending through the corresponding opening in the front plate.

17. The combination in an automatic circuit breaker assembly, of a housing structure comprising a plurality of separable units and having in the respective units a plurality of similar open-front chambers, a single unitary plate substantially closing all of the chambers of all units but having a plurality of handle openings therein at the fronts of the chambers, a plurality of supporting frames positioned in the respective chambers and behind and in engagement with the front plate and being held by the plate and being otherwise freely movable in the forward direction, a plurality of automatic circuit breaking mechanisms carried chiefly by the respective frames and freely movable in the forward direction when the frames are so moved, the said mechanisms being connectible in different portions of the circuit and each of them serving upon the attainment of excess current conditions to break that portion of the circuit in which it is connected and each of the said mechanisms having a movable handle at the front extending through the corresponding opening in the front plate, a supporting plate in engagement with all of the housing units at the rear thereof, connection devices extending from the front plate to the rear supporting plate and serving to hold the plates in fixed relation to each other and to all of the housing units, and means on the rear supporting plate whereby it may be independently secured to a stationary rear wall.

18. The combination in an automatic circuit breaker assembly, of a housing structure comprising two separable units, one of the said units having therein three similar open-front chambers with two of them in side-by-side relationship and with the third in end-to-end relationship with one of the first two and the said unit having a notch therein and the other of the said units being positioned in the notch in the first said unit and having therein a single open-front chamber similar to the chambers in the first said unit and in side-by-side and end-to-end relationship with them, front cover means substantially closing all of the chambers of both units but having a plurality of handle openings therein at the fronts of the chambers, and a plurality of automatic circuit breaking mechanisms located chiefly within the respective chambers and connectible in different portions of the circuit, each

of the said mechanisms serving upon the attainment of excess current conditions to break that portion of the circuit in which it is connected and each of the said mechanisms having a movable handle at the front extending through the corresponding opening in the front cover means.

19. The combination in an automatic circuit breaker assembly, of a housing structure comprising two separable units, one of the said units having therein three similar open-front chambers with two of them in side-by-side relationship and with the third in end-to-end relationship with one of the first two and the said unit having a notch therein and the other of the said units being positioned in the notch in the first said unit and having therein a single open-front chamber similar to the chambers in the first said unit and in side-by-side and end-to-end relationship with them, a single unitary plate substantially closing all of the chambers of both units but having a plurality of handle openings therein at the fronts of the chambers, and a plurality of automatic circuit breaking mechanisms located chiefly within the respective chambers and connectible in different portions of the circuit, each of the said mechanisms serving upon the attainment of excess current conditions to break that portion of the circuit in which it is connected and each of the said mechanisms having a movable handle at the front extending through the corresponding opening in the front plate.

20. The combination in an automatic circuit breaker assembly, of a housing structure comprising two separable units, one of the said units having therein three similar open-front chambers with two of them in side-by-side relationship and with the third in end-to-end relationship with one of the first two and the said unit having a notch therein and the other of the said units being positioned in the notch in the first said unit and having therein a single open-front chamber similar to the chambers in the first said unit and in side-by-side and end-to-end relationship with them, a single unitary plate substantially closing all of the chambers of both units but having a plurality of handle openings therein at the fronts of the chambers, a plurality of supporting frames positioned in the respective housing structure chambers and behind and in engagement with the front plate and being otherwise freely movable in the forward direction, and a plurality of automatic circuit breaking mechanisms located chiefly within the respective chambers and carried chiefly by the respective frames, the said mechanisms being freely movable in the forward direction when the frames are so moved and being connectible in different portions of the circuit and each of the said mechanisms serving upon the attainment of excess current conditions to break that portion of the circuit in which it is connected and each of the said mechanisms having a movable handle at the front extending through the corresponding opening in the front plate.

21. The combination in an automatic circuit breaker assembly, of an insulating housing structure, a plurality of automatic circuit breaking mechanisms carried by the housing structure and connectible in different portions of the circuit and each of them serving upon the attainment of excess current conditions to break that portion of the circuit in which it is connected, a supporting plate to which the housing structure is connected at the rear, a rear wall behind the supporting plate, brackets projecting forward from the rear wall near one edge of the supporting plate, interengageable means on the brackets and on the supporting plate enabling the latter to be detachably hinged to the former, other brackets projecting forward from the rear wall near the opposite edge of the supporting plate, and interengageable means on the last said brackets and on the supporting plate enabling the latter to be snapped into or out of connected relationship with the former, the supporting plate when hinged to the first said brackets and when in connected relationship with the second said brackets being detachably held at a predetermined distance in front of the rear wall.

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