Jan. 21, 1936. H. C. GRAVES, JR 2,028,204

ELECTRIC CIRCUIT INTERRUPTER

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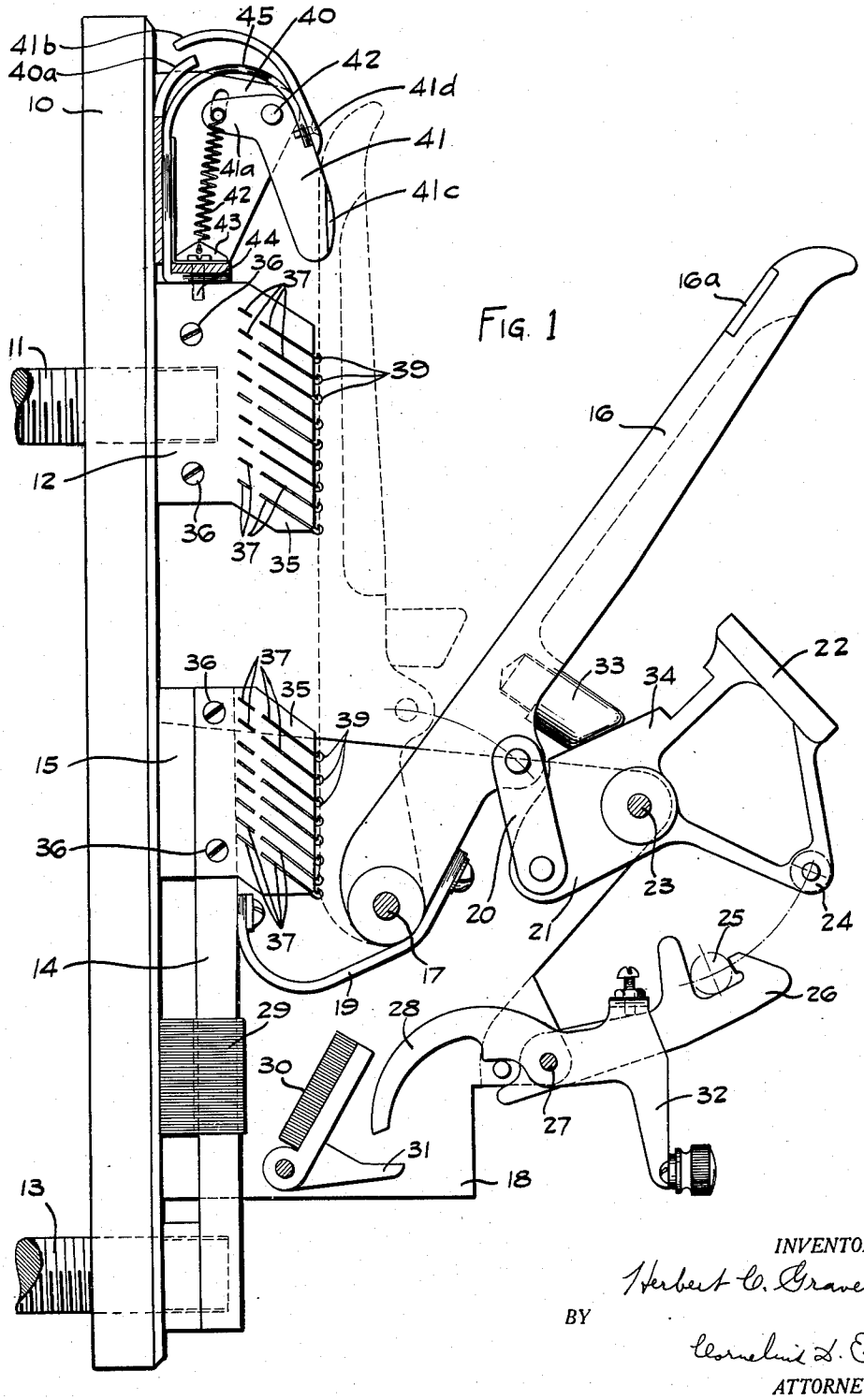


FIG. 1

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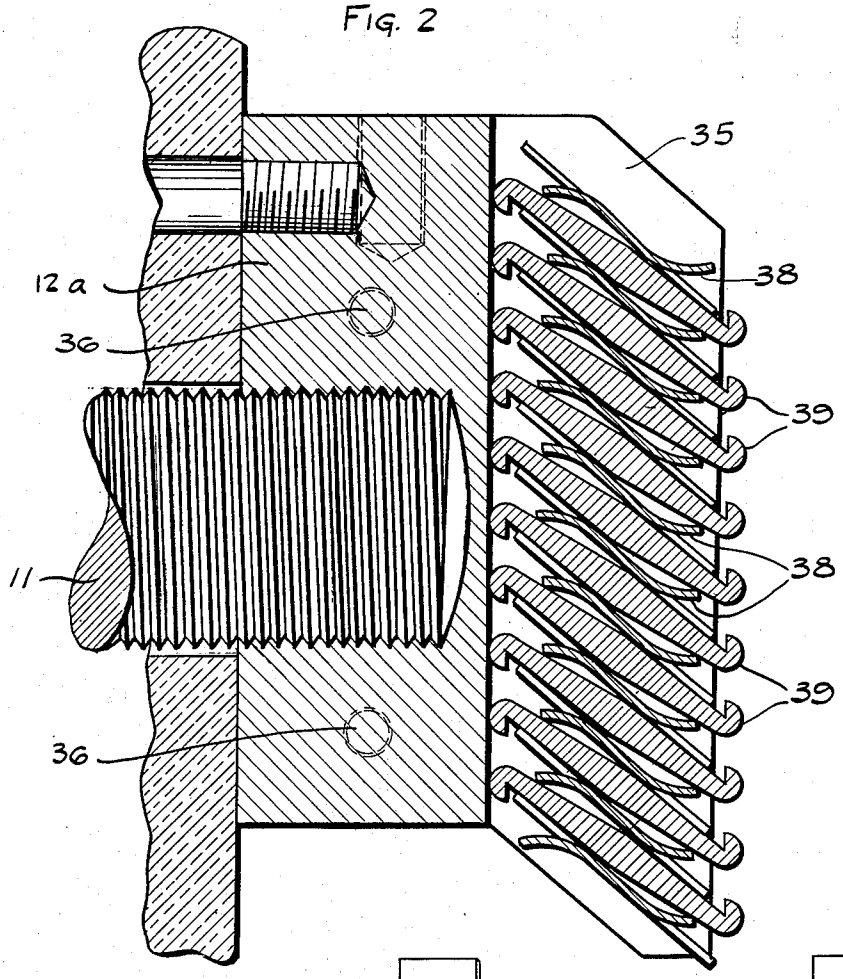
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ELECTRIC CIRCUIT INTERRUPTER

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FIG. 2



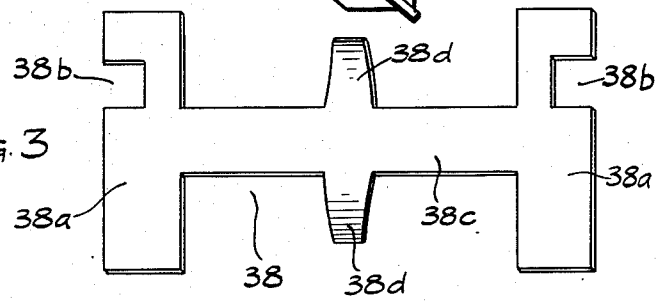


FIG. 3

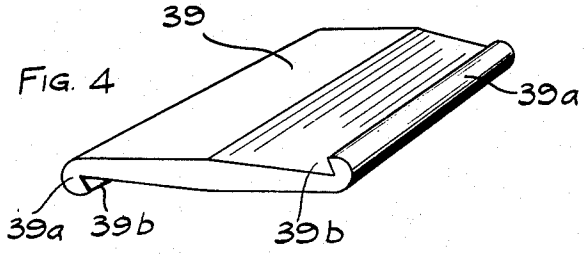


FIG. 4

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ELECTRIC CIRCUIT INTERRUPTER

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FIG. 6

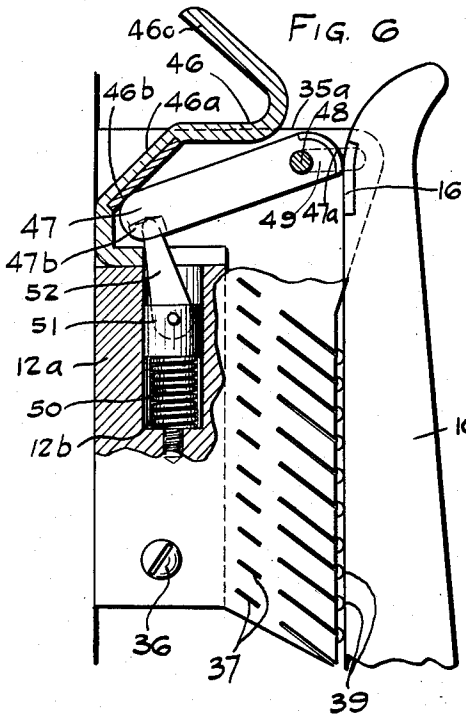


FIG. 7

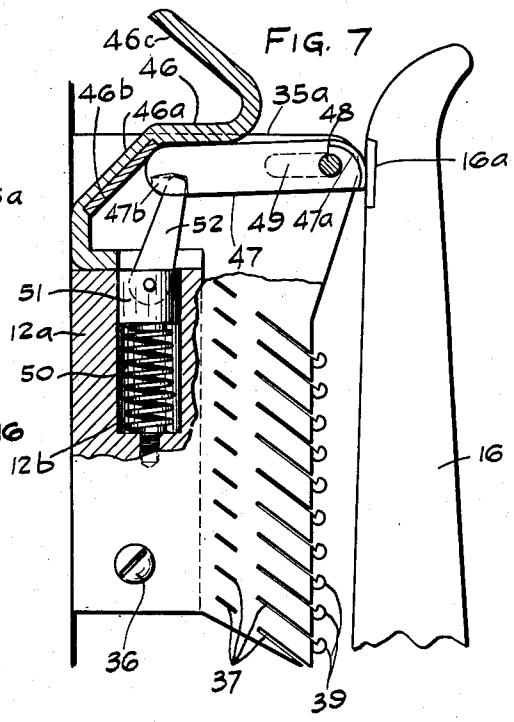
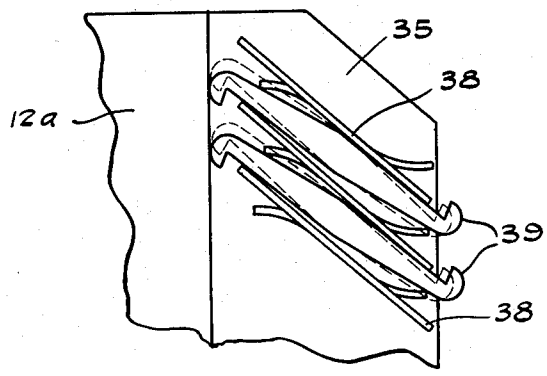


FIG. 5



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Patented Jan. 21, 1936

2,028,204

UNITED STATES PATENT OFFICE

2,028,204

ELECTRIC CIRCUIT INTERRUPTER

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Application May 15, 1934, Serial No. 725,721

35 Claims. (Cl. 200—166)

My invention relates to electric circuit interrupters and more particularly to new and improved separable contacts therefor. While my invention is of general application, it is particularly suitable for use in circuit interrupters of the automatic circuit breaker type.

In the art of electric circuit interrupters, it is well-known that, if the cooperating separable contacts are rigid metallic blocks or elements, any appreciable misalignment between the contact surfaces due to inaccuracies of manufacture or assembly, or due to wear or other unforeseen causes, results in unequal pressure distribution throughout the contact surfaces and, in extreme conditions, in single point contact. Among well-known consequences of such faulty contacts is localized overheating which may result in welding or pitting of the contacts.

In accordance with my invention, an electric circuit interrupter comprises a pair of cooperating relatively movable contact structures having opposed substantially plane contact surfaces normal to or at any other suitable angle to, the plane of relative motion. There is provided one or more rigid conducting elements disposed to form a bridging connection between the opposed contact surfaces which, in circuit-closing position of the interrupter, may be substantially parallel. Specifically, this bridging connection may comprise one or more rigid plate-like members having parallel cylindrical edges for making line contacts with the opposed contact surfaces. The rigid conducting elements may be mounted substantially parallel in a housing structure and retained therein by a plurality of plate or leaf springs which allow the rigid conducting elements a limited freedom of motion for procuring a wiping of the contact surfaces and, at the same time, determine the contact pressures between the conducting elements and the contact surfaces. The housing containing the rigid conducting elements and their retaining springs may be secured to one of the relatively movable contacts. Further, and more specifically in accordance with my invention, a group of rigid conducting elements, together with their housing structure, may be associated with each of a pair of stationary contacts, the movable contact structure comprising a single rigid conducting bridging member.

Further, in accordance with my invention, one of the relatively movable contact structures may be provided with an auxiliary rigid arcing contact element mounted with a limited freedom of motion and biased into engagement with its contact surface and that associated with the other main contact structure.

For a better understanding of my invention, together with other and further features thereof, reference is had to the following description, taken in connection with the accompanying drawings, and its scope will be pointed out in the appended claims.

In the drawings, Fig. 1 is a view in side elevation of the essential elements of an automatic circuit breaker embodying the improved contact structures of my invention, illustrated in circuit-opening position;

Fig. 2 is an enlarged cross-sectional detail of one of the improved contact structures;

Figs. 3 and 4 are perspective views, respectively, of a rigid conducting element and its cooperating retaining spring;

Fig. 5 is a fragmentary detail view in side elevation of my improved contact structure, while Figs. 6 and 7 illustrate, partly in cross-section, modified forms of arcing contact structure suitable for use in connection with my invention.

Referring now more particularly to Fig. 1, there is shown a circuit interrupter comprising a base or panel member 10 from which is supported a terminal stud or connector 11 connected to a stationary contact assembly 12. A second terminal stud or connector 13 is also supported from the panel 10 and connects with a bus-bar or conductive strip 14, the upper end of which is connected to the contact assembly 15.

Cooperating with the stationary contact assemblies 12 and 15 is a movable rigid bridging contact structure or arm 16 which, as indicated, may have a channel-shaped cross-section to increase its rigidity. The bridging contact arm 16 is journalled on a pivot 17 supported between side plates 18, the front one of which is omitted from Fig. 1 for the sake of clarity, secured to the base 10. The contact arm 16 may be connected to the contact assembly 15, also, by the flexible conductor or pig-tail 19. An operating mechanism for the movable contact arm 16 comprises a link 20 and an arm 21 of a crank 22 journalled on a pivot 23 supported from the side plates 18. The elements 20, 21 form a toggle and may be operated either manually or by any suitable power mechanism.

The operating mechanism 20—21—22 of the contact arm 16 is latched in circuit-closing position, as indicated in dotted outline, by the engagement of a roller 24 secured to the crank 22 with a detent 25 in a latch 26 pivoted between the side plates 18 at 27. The latch 26 is provided with a unitary or separate cooperating extension or tail 28 co-acting with an electromagnet 29 excited from the vertical bus-bar 15 and having a movable armature 30, a tripping arm 31 of which is disposed to engage the extension 28. If desired, a manually operable lever 32 may also be provided for manually disengaging the latch 26. The contact arm 16 is provided with a stop 33 cooperating with a stop surface 34 of the crank 22 to limit the movement of the contact arm 16 in circuit-opening position.

The contact assembly 12 includes a housing structure comprising a pair of side plates 35 secured to the contact block or structure 12a (Fig. 2) by suitable screws 36. The side plates 35 project outwardly beyond the contact block 12a and in these projections are cut a plurality of parallel discontinuous slots 37 preferably at an angle to the plane of the contact surface of the structure 12a. The slots in the two side plates 35 are in alignment. A similar housing structure comprising side plates 35 is included in the contact assembly 15.

Supported in the slots 37 of the contact assemblies 12 and 15 are a plurality of leaf or plate springs 38, shown in perspective in Fig. 3. These members may be of substantially a double E shape, the outer transverse arms 38a being formed with recesses 38b for engaging the portions of the side-plates 35 separating the aligned slots. Projecting from the central arm 38c of the spring element 38 are the arms 38d bent outwardly in opposite directions from the plane of the spring element, as shown clearly in Fig. 2.

Interposed between the spring elements 38 are a plurality of rigid conducting elements 39 which are plate-like members having parallel, substantially cylindrical edges 39a cut away at 39b to form hook-like grooves engaging the ends of the arms 38a of the spring elements 38. The conducting elements 39 may be conveniently formed by stamping or extruding and, in case the contact surfaces of the structures 12 and 15 and the contact arm 16 are substantially parallel in circuit-closing position of the interrupter, which is the preferred arrangement, the elements 39 may all be identical.

Associated with the stationary contact assembly 12 is an auxiliary arcing contact structure comprising a housing formed of side-plates 40 and back-plate 40a in which is mounted an arcing contact 41 journalled on a pivot 42 supported between the side plates 40. The contact 41 has an associated arm 41a connected by a biasing spring 42 to a clamp 43 secured to the contact block 12a by a screw 44, which serves also to clamp the housing structure 40—40a in position. The contact element 41 has an arc-resistant insert or facing 41c cooperating with a corresponding arc-resistant insert 16a in the contact arm 16. The arcing contact 41 is electrically connected to the contact block 12a by a flexible conductor 45 which is formed into a loop in a recess between the housing extension 40a and a guard-plate 41b, secured to the arcing contact 41 as by a screw 41d. The other terminal of the flexible conductor 45 may be secured to the contact block 12a by the clamp 43.

The operation of the actuating mechanism of the above-described circuit interrupter will be well understood by those skilled in the art. As the operating crank 22 is rotated clockwise, the toggle mechanism 20—21 is extended to move the contact arm 16 into circuit-closing position, as indicated in dotted outline in Fig. 1. As the contact arm 16 moves into such circuit-closing position, a circuit is initially established between the contact surface 16a and the contact surface 41c of the arcing contact. As the contact arm moves up into initial engagement with the ends of the diagonally disposed rigid conducting elements 39 of the contact assemblies 12 and 15, which normally occupy the positions represented by the full lines of Fig. 5, these elements are forced into their retaining housings against the action of their biasing springs 39, finally occupying the positions shown in dotted lines in Fig. 5. It will be seen that this movement between the full line and dotted line positions of Fig. 5 constitutes a substantial pivotal movement of the elements about their longitudinal axis. During this movement, also, the cylindrical edges of the elements 39 roll and slide along the opposing contact surfaces of the contact assemblies 12 and 15 and the arm 16, producing a wiping or cleaning of the contact surfaces.

By virtue of the plurality of rigid conducting elements with parallel edges resiliently held in contact with the opposing contact surfaces of the retaining spring members 38, a plurality of line contacts are established between the contact surfaces of the assemblies 12 and 15 and the bridging contact 16, establishing optimum contact conditions irrespective of appreciable misalignment between the rigid contact structures occasioned by manufacturing or assembling inaccuracies.

It will be readily understood that the circuit interrupter may be operated to circuit-opening position by biasing springs (not shown) in response to operation of the overload electromagnet 29—30, which is effective to disengage the latch 26 and the roller 24 of the operating crank 22 or to a manual disengagement of the latch 26 by the arm 32. In moving from circuit-closing position to circuit-opening position, the steps described above are followed in a reverse sequence, contact being initially broken at the rigid conducting elements 39 and finally broken between the arcing contact surfaces 16a and 41c. Substantial biasing pressure is maintained on the arcing contact 41 by the spring 42 throughout the range of movement of the contact element 41, which corresponds to a relatively limited range of extension of the spring 42.

In Figs. 6 and 7 is shown a modified form of the arcing contact structure of Fig. 1. In this case, the side-plates 35 of the housing structure of the conducting elements of Fig. 1 are modified also to form the housing plates 35a which extend upwardly beyond the main contact structure 12a, forming the sides of the housing of the auxiliary arcing contact structure. Between the upper projections of the side-plates 35a extends a modified U-shaped member 46 secured and electrically connected to the contact structure 12a. One of the arms of the member 46 has an inclined portion 46a, the inner surface of which is faced with suitable facing 46b serving as a combined contact and cam surface. The member 46 may terminate in an arcing horn 46c. An arcing contact element 47 is journalled on a pivot 48 sliding in horizontal slots 49 in the side plates 35a, and is provided with a suitable arc-resistant contact surface 47a cooperating with the arcing contact surface 16a of the bridging arm 16.

In order to bias the arcing contact element 47 into engagement with the contact arm 16, there is provided a biasing spring 50 disposed in a recess or bore 12b of the contact structure 12a and operating through a piston 51, sliding in the bore 12b, and a link 52 which engages a recess 47b in the inner end of the arcing contact element 47. As the movable contact arm 16 moves from circuit-closing position, as illustrated in Fig. 6, through the intermediate position of Fig. 7 to complete circuit-opening position, the biasing spring 50, operating through its piston 51, link 52 and the cam surface 46b, maintains engagement between the arcing contact element 47 and the contact arm 16a. In addition, as the main circuit

is broken at the rigid conducting elements 39, the current flowing in the circuit, including the arcing contact 47 and the contact arm 16, which is approximately a loop, produces electrodynamic forces on the contact element 47, increasing the contact pressure between the contact element 47 and the contact arm 16, assisting in maintaining these contacts in engagement. Obviously, upon movement of the contact arm 16 from circuit-opening to circuit-closing position, the operative steps are the same, but in a reverse sequence.

It will be understood, of course, that a number of circuit interrupters of the type described may be operated in parallel where larger capacities are required, the several circuit interrupters being mounted and operated either individually or as a group. Also, a number of such circuit interrupters may be combined to form a multipole circuit breaker.

While I have described what I at present consider the preferred embodiments of my invention, it will be obvious to those skilled in the art that various changes and modifications may be made without departing from my invention, and I, therefore, aim in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of my invention.

What I claim is:

1. In an electric circuit interrupter, cooperating relatively movable contact structures having opposed substantially plane contact surfaces, a rigid conducting element disposed between said opposed surfaces to engage both in circuit-closing position of said interrupter, and resilient means for pressing said conducting element against both of said opposed contact surfaces when said interrupter is in circuit-closing position.

2. In an electric circuit interrupter, cooperating relatively movable contact structures having opposed substantially plane contact surfaces normal to the plane of relative motion, a rigid conducting element mounted with a limited freedom of motion and disposed between said opposed contact surfaces to engage both in circuit-closing position of said interrupter, and resilient means for pressing said conducting element against both of said opposed contact surfaces to procure a wiping of both of said contact surfaces thereby.

3. In an electric circuit interrupter, cooperating relatively movable contact structures having opposed substantially plane contact surfaces at an angle to the plane of relative motion, a plurality of rigid conducting elements disposed to engage both of said opposed contact surfaces and to form a bridging connection therebetween in circuit-closing position of said interrupter, and resilient means for pressing said conducting elements against said opposed contact surfaces when said interrupter is in circuit-closing position.

4. In an electric circuit interrupter, cooperating relatively movable contact structures having opposed substantially plane contact surfaces at an angle to the plane of relative motion, a plurality of rigid plate-like conducting elements disposed to form line contacts with said opposed contact surfaces in circuit-closing position of said interrupter, and means for resiliently effecting contact between said conducting elements and said opposed contact surfaces.

5. In an electric circuit interrupter, cooperating relatively movable contact structures having opposed substantially plane contact surfaces at an angle to the plane of relative motion, a plurality of independently movable rigid conducting elements disposed to form a bridging connection between said contact surfaces in circuit-closing position of said interrupter, and means for resiliently effecting contact between said conducting elements and said opposed contact surfaces.

6. In an electric circuit interrupter, cooperating relatively movable contact structures having opposed substantially plane contact surfaces at an angle to the plane of relative motion and substantially parallel in circuit-closing position of the interrupter, a plurality of duplicate rigid conducting elements disposed to form a bridging connection between said contact surfaces in circuit-closing position of said interrupter, and means for resiliently effecting contact between said conducting elements and said opposed contact surfaces.

7. In an electric circuit interrupter, cooperating relatively movable contact structures having opposed substantially plane contact surfaces at an angle to the plane of relative motion, a plurality of duplicate extruded rigid conducting elements disposed to form a bridging connection between said contact surfaces in circuit-closing position of said interrupter, and means for resiliently effecting contact between said conducting elements and said opposed contact surfaces.

8. In an electric circuit interrupter, cooperating relatively movable contact structures having opposed substantially plane contact surfaces at an angle to the plane of relative motion, a plurality of rigid conducting elements disposed to form a bridging connection between said contact surfaces in circuit-closing position of said interrupter and mounted with a limited freedom of motion, resilient means for normally retaining said conducting elements in a position corresponding to a separation of said contact surfaces greater than that in circuit-closing position thereof, whereby movement of said contact structures to circuit-closing position effects a wiping of both said contact surfaces by said conducting elements.

9. In an electric circuit interrupter, cooperating relatively movable contact structures having opposed substantially plane contact surfaces, a plurality of rigid conducting elements having substantially parallel cylindrical edges and disposed to form a bridging connection between said contact surfaces in circuit-closing position of said interrupter, said conducting elements being mounted with a limited freedom of angular motion about their longitudinal axes, resilient means for normally retaining said conducting elements in a predetermined angular position such that movement of said contact structures to circuit-closing position effects an angular movement of said conducting elements against the action of said resilient means.

10. In an electric circuit interrupter, cooperating relatively movable contact structures having opposed substantially plane contact surfaces, a plurality of rigid plate-like conducting elements disposed in parallel planes inclined to one of said contact surfaces to form line contacts with both of said opposed contact surfaces in circuit-closing position of said interrupter, and means for resiliently supporting said conducting elements with a limited freedom of motion with respect to both of said surfaces, movement of said contact structures to circuit closing position decreasing the angle of inclination of said conducting elements to effect a wiping of said contact surfaces.

11. In an electric circuit interrupter, cooperating relatively movable contact structures having opposed substantially plane contact surfaces at

an angle to the plane of relative motion, a plurality of rigid conducting elements disposed to form a bridging connection between said contact surfaces in circuit-closing position of said interrupter, and a plurality of spring elements disposed with respect to said conducting elements to retain the same in position and to effect contact between said conducting elements and said opposed contact surfaces.

12. In an electric circuit interrupter, cooperating relatively movable contact structures having opposed substantially plane contact surfaces, a plurality of rigid conducting elements disposed to form a bridging connection between said contact surfaces in circuit-closing position of said interrupter, and a plurality of leaf springs interposed between said conducting elements to effect contact between said opposed contact surfaces and said conducting elements and to retain the same in position.

13. In an electric circuit interrupter, cooperating relatively movable contact structures having opposed substantially plane contact surfaces, a plurality of rigid conducting elements disposed to form a bridging connection between said contact surfaces in circuit-closing position of said interrupter, and a plurality of leaf springs alternated with said conducting elements to effect contact between said opposed contact surfaces and said conducting elements.

14. In an electric circuit interrupter, cooperating relatively movable contact structures having opposed substantially plane contact surfaces, a plurality of rigid conducting elements disposed to form a bridging connection between said contact surfaces in circuit-closing position of said interrupter, and a plurality of leaf springs interposed between said conducting elements to effect contact between said conducting elements and said opposed contact surfaces, said conducting elements including hook-like means engaging means for retaining said conducting elements in position.

15. In an electric circuit interrupter, cooperating relatively movable contact structures having opposed substantially plane contact surfaces, a plurality of rigid conducting elements disposed to form a bridging connection between said contact surfaces in circuit-closing position of said interrupter, and a plurality of leaf springs interposed between said conducting elements to effect contact between said conducting elements and said opposed contact surfaces, each of said conducting elements being disposed between and engaged by adjacent springs.

16. In an electric circuit interrupter, cooperating relatively movable contact structures having opposed substantially plane contact surfaces, a plurality of rigid conducting elements disposed to form a bridging connection between said contact surfaces in circuit-closing position of said interrupter, and a plurality of leaf springs interposed between said conducting elements to effect contact between said conducting elements and said opposed contact surfaces, each of said springs being disposed between and engaging adjacent contact elements.

17. In an electric circuit interrupter, cooperating relatively movable contact structures having opposed substantially plane contact surfaces, a plurality of rigid conducting elements disposed to form a bridging connection between said contact surfaces in circuit-closing position of said interrupter, and a plurality of duplicate leaf springs interposed between said conducting elements to effect contact between said conducting elements and said opposed contact surfaces.

18. In an electric circuit interrupter, cooperating relatively movable contact structures having opposed substantially plane contact surfaces, a plurality of rigid conducting elements disposed to form a bridging connection between said contact surfaces in circuit-closing position of said interrupter, and a plurality of leaf springs interposed between said conducting elements to effect contact between said conducting elements and said opposed contact surfaces, said springs being disposed substantially out of current-carrying relation with said contact surfaces.

19. In an electric circuit interrupter, cooperating relatively movable contact structures having opposed substantially plane contact surfaces, a plurality of rigid conducting elements disposed to form a bridging connection between said contact surfaces in circuit-closing position of said interrupter, and a plurality of plate springs alternated between said conducting elements, said springs having oppositely extending arms bent in opposite directions from the plane of the plate and engaging adjacent conducting elements to effect contact therebetween and said contact surfaces.

20. In an electric circuit interrupter, cooperating relatively movable contact structures having opposed substantially plane contact surfaces at an angle to the plane of relative motion, a housing structure including a pair of side plates, and a rigid conducting element resiliently supported in said housing and disposed to form a bridging connection between said contact surfaces in circuit-closing position of said interrupter.

21. In an electric circuit interrupter, cooperating relatively movable contact structures having opposed substantially plane contact surfaces at an angle to the plane of relative motion, a housing structure including a pair of side plates and supported from one of said contact structures, and a plurality of rigid conducting elements resiliently supported in said housing and disposed to form a bridging connection between said contact surfaces in circuit-closing position of said interrupter.

22. In an electric circuit interrupter, cooperating relatively movable contact structures having opposed substantially plane contact surfaces at an angle to the plane of relative motion, a housing structure including a pair of side plates, a plurality of rigid conducting elements, and a plurality of spring elements supported between said side plates and engaging and supporting said conductive elements, said housing structure being so disposed that said conductive elements form a bridging connection between said contact surfaces in circuit-closing position of said interrupter.

23. In an electric circuit interrupter, cooperating relatively movable contact structures having opposed substantially plane contact surfaces, a housing structure including a pair of side plates, a plurality of rigid conducting elements, and a plurality of leaf springs supported in unstrained condition between said side plates and engaging and supporting said conductive elements, said housing structure being so disposed that said conductive elements form a bridging connection between said contact surfaces in circuit-closing position of said interrupter.

24. In an electric circuit interrupter, cooperating relatively movable contact structures having

opposed substantially plane contact surfaces, a housing structure including a pair of side plates, a plurality of spring elements supported between said side plates, and a plurality of rigid conductive elements insertable between said spring elements after assembly in said housing, said spring elements resiliently supporting and retaining said conductive elements within said housing, said housing structure being so disposed that said conductive elements form a bridging connection between said contact surfaces in circuit-closing position of said interrupter.

25. In an electric circuit interrupter, a pair of stationary contact structures, a movable rigid bridging contact structure cooperating therewith, said contact structures having opposed substantially plane contact surfaces at an angle to the plane of relative motion, a plurality of rigid conducting elements disposed to form bridging connections between the opposed contact surfaces of said stationary contact structures and said bridging contact structure in circuit-closing position of said interrupter, and resilient means for pressing said contact elements against said opposed contact surfaces.

26. In an electric circuit interrupter, a pair of stationary contact structures, a movable rigid bridging contact structure cooperating therewith, said contact structures having opposed substantially plane contact surfaces at an angle to the plane of relative motion, a group of rigid conducting elements individual to each of said stationary contact structures and supported therefrom, said conducting elements being disposed to form bridging connections between the opposed contact surfaces of said stationary contact structures and said bridging contact structure in circuit-closing position of said interrupter, and resilient means for pressing said contact elements against said opposed contact surfaces.

27. An electric circuit interrupter comprising cooperating relatively movable contact structures having opposed substantially plane contact surfaces at an angle to the plane of relative motion, a plurality of rigid conducting elements disposed to form a bridging connection between said contact surfaces in circuit-closing position of said interrupter, resilient means for pressing said conducting elements against said opposed contact surfaces, and means for moving said contact structures into and out of engagement.

28. In an electric circuit interrupter, cooperating relatively movable contact structures having opposed substantially plane contact surfaces at an angle to the plane of relative motion, a plurality of independently movable rigid conducting elements disposed to form a bridging connection between said contact surfaces in circuit-closing position of said interrupter, and resilient means for individually biasing said conducting elements into contact with said opposed contact surfaces.

29. In an electric circuit interrupter, cooperating relatively movable contact structures having opposed substantially plane contact surfaces at an angle to the plane of relative motion, a plurality of independently movable rigid conducting elements disposed to form a bridging connection between said contact surfaces in circuit-closing position of said interrupter, and a plurality of resilient elements for individually biasing said conducting elements into contact with said opposed contact surfaces.

30. A circuit interrupter comprising relatively movable contact surfaces each of which, in the closed-circuit position of the interrupter, lies within the projected area of the other, a plurality of parallel rigid conducting elements diagonally disposed between said contacts, within said projected areas, and whose opposite ends are adapted to engage said surfaces respectively, and resilient means for pressing said elements against both of said surfaces.

31. A circuit interrupter comprising a contact block, a plurality of substantially parallel rigid conducting elements each engaging said contact block at one end and disposed with its other end extending diagonally therefrom, a second contact block relatively movable toward said first contact block to engage the extending ends of said elements, and resilient means for pressing each of said elements individually against both of said blocks when the interrupter is in closed-circuit position.

32. A circuit interrupter comprising a contact block, a second contact block movable relatively thereto, a plurality of substantially parallel rigid conducting elements each engaging one of said contact blocks at one end and disposed with their opposite ends substantially in a plane normal to the plane of relative movement of said blocks, and resilient means for pressing said elements individually against both of said blocks when the interrupter is in circuit-closing position.

33. In an electrical circuit interrupter, cooperating relatively movable contact structures having opposed substantially plane contact surfaces, a series of parallel rigid conducting elements extending diagonally between said plane contact surfaces, and resilient means yielding to permit said conducting elements while substantially parallel to change their inclination to said contact surfaces and at the opposite ends wipe said surfaces under circuit-closing pressure.

34. In an electrical circuit interrupter, cooperating relatively movable contact structures having opposed substantially plane contact surfaces, intermediate contact structure comprising a series of rigid parallel conducting elements extending diagonally between said contact surfaces, a plurality of springs alternately disposed between and forming supports for said laminations, and means for supporting said springs independent of said contact structures, said springs yielding to permit said conducting elements while substantially parallel to change their inclination to said contact surfaces and at the opposite ends wipe said surfaces under circuit-closing pressure.

35. In an electrical circuit interrupter, cooperating relatively movable contact structures having opposed substantially plane contact surfaces, a plurality of rigid conducting elements extending diagonally between said plane contact surfaces, and leaf-springs, disposed on opposite sides of each of said elements to support them, said springs when said interrupter is in circuit-closing position acting individually to bias individual elements against both of said contact surfaces and acting collectively to maintain said elements substantially parallel to each other in the open and closed circuit positions of said interrupter.

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