Feb. 27, 1962 V. N. STEWART 3,023,292

ELECTRIC CIRCUIT INTERRUPTER

Filed Oct. 1, 1958 2 Sheets-Sheet 1

Fig. 1.

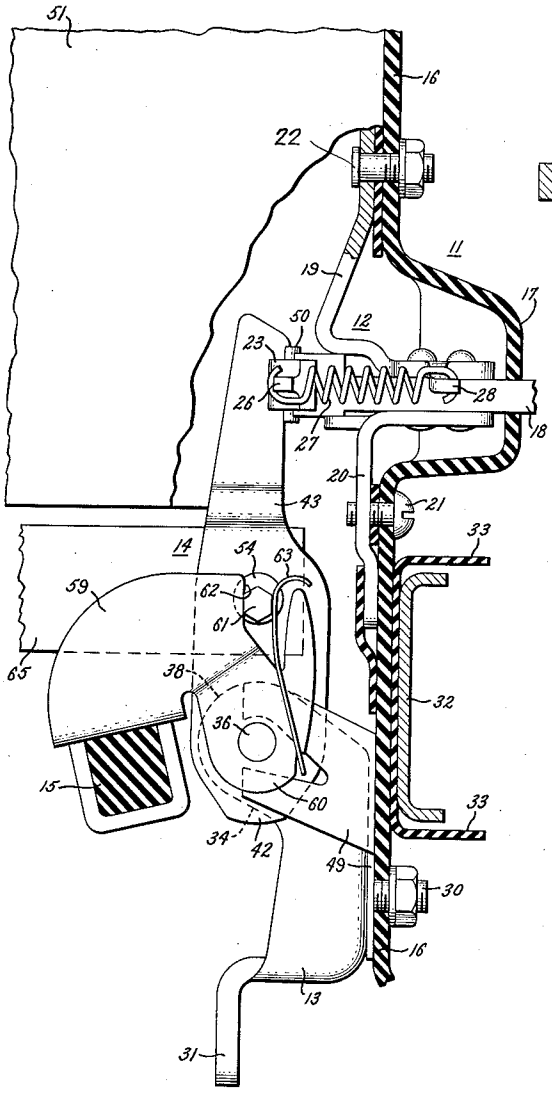


Fig. 3.

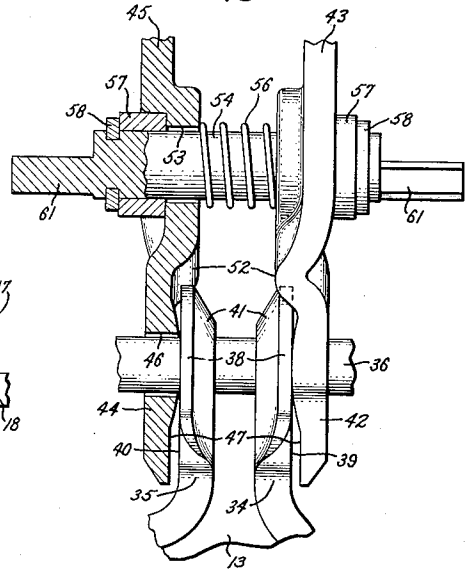
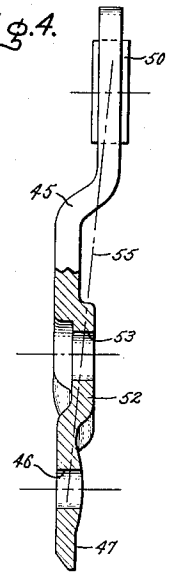


Fig. 4.



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Fig. 2.

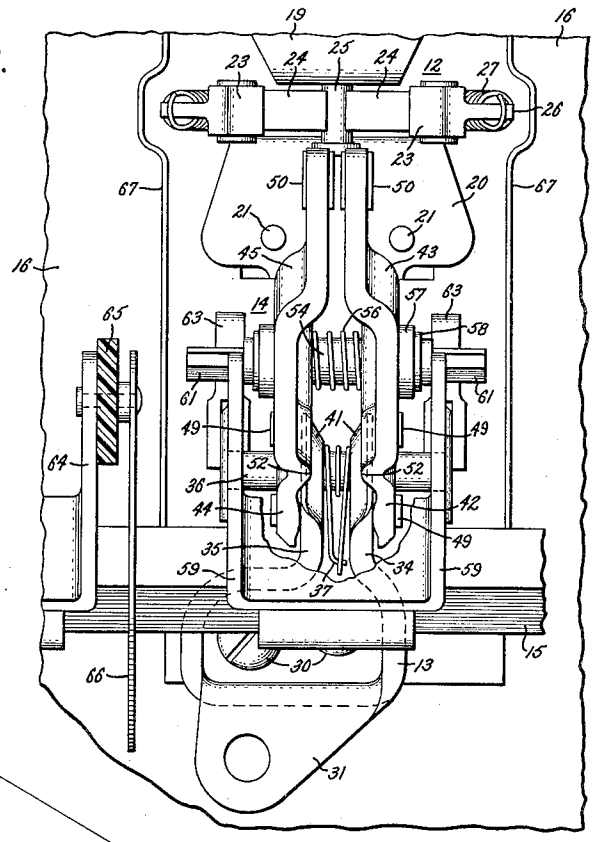
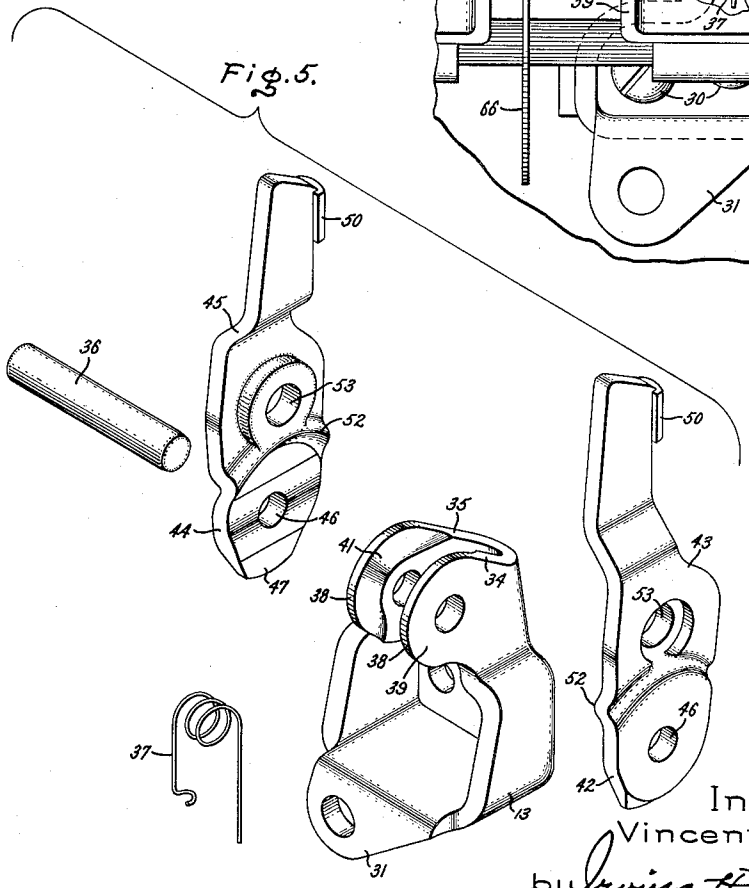


Fig. 5.



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ELECTRIC CIRCUIT INTERRUPTER

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6 Claims. (Cl. 200—166)

This invention relates to electric circuit interrupters or breakers, and more particularly it relates to an improvement in the contact structure of a low voltage air circuit breaker.

One object of the invention is the provision of a relatively simple and inexpensive circuit breaker contact structure comprising a movable contact member pivotally mounted on an electroconductive support and electrically connected thereto by means of a current-conducting joint which is maintained substantially free from contamination by the electric arc and arc products produced during circuit breaking operation of the contact structure.

A general object of this invention is to provide an improved circuit breaker contact structure of the character described hereinafter.

In carrying out my invention in one form, an electric circuit breaker is provided with a relatively stationary contact member, an electroconductive bracket, and an elongated movable contact arm pivotally connected near one end to the bracket for arcuate movement at its other end into and out of circuit making engagement with the relatively stationary contact. The bracket and the one end of the arm are provided with contiguous surfaces to form a current-conducting joint, and the movable contact arm has intermediate its ends an integral protrusion disposed to provide a deflecting shield for the joint. In this manner, the electric arc and arc products which are generated during a circuit breaking operation are prevented from entering the joint except by a very tortuous path, and the joint is maintained substantially free from contamination.

My invention will be better understood and its various objects and advantages will be more fully appreciated from the following description taken in conjunction with the accompanying drawings in which:

FIG. 1 is a side elevation of a circuit breaker contact structure embodying a preferred form of my invention, with the movable contact member shown in its closed circuit position;

FIG. 2 is a front elevation of the contact structure illustrated in FIG. 1, with a movable contact member moved to its open circuit position;

FIG. 3 is an enlarged partial section of the connection shown in FIGS. 1 and 2 between the movable contact member and its supporting bracket;

FIG. 4 is a profile view of one arm of the movable contact member constructed in accordance with my invention; and

FIG. 5 is an exploded perspective view of the supporting bracket and a pair of movable contact arms.

Referring now to FIG. 1, I have shown an electric circuit breaker or interrupter comprising a base member **11**, a relatively stationary contact member **12** mounted on the base, an electroconductive bracket **13** mounted on the base in spaced relation to the stationary contact member, a movable contact member **14** pivotally supported by bracket **13** and disposed in cooperative relationship with the stationary contact member **12**, and actuating means such as a crossbar **15** coupled to the movable contact member **14** for moving this member into and out of circuit-making engagement with the stationary contact member **12**. The components **12**, **13** and **14** comprise the contact structure of one pole unit of an alternating or direct current circuit breaker or interrupter, and other

similar pole units (not shown) can be mounted for gang operation on the base member **11** adjacent to the pole unit that has been illustrated in FIGS. 1 and 2.

The base member **11** supports the current-conducting studs of the breaker and the other breaker parts connected directly to the studs. As illustrated in FIG. 1, the base member comprises a sheet **16** of electric insulating material of substantially uniform thickness. The sheet **16** is shaped to form a channel-shaped section or depression at **17**, and the bottom of this section is provided with an aperture for snugly admitting and partially supporting an upper breaker stud **18**. For the purposes of the present description, the contact structure **12**—**14** will be considered mounted on the front of the base **11**, and the upper breaker stud **18** is connected to a suitable electric power source or bus (not shown) located behind or to the rear of the base. The contact structure shown in the drawings and described herein to illustrate a preferred embodiment of my invention is designed for connection to an electric power bus rated 600 volts A.-C. and capable of supplying as much as 25,000 amperes short-circuit current.

The stationary contact member **12** is mounted on the upper breaker stud **18**. As can be seen in FIG. 1, the upper stud **18** is secured to the sheet **16** of base member **11** by suitable support means such as generally L-shaped angles **19** and **20**. The angles **19** and **20** are respectively disposed above and below stud **18** and are fastened thereto by three copper rivets or the like. The lower angle **20** is provided with a pair of tapped holes, and a pair of appropriate bolts **21** is used to secure this angle to the base member **11**. The supporting angle **19**, which extends above the breaker stud **18** as is shown in FIG. 1, serves as an arc runner in cooperation with the stationary contact member **12**. This angle is provided with a stud **22** for securing it to the insulating sheet **16** of the base **11**.

The end of breaker stud **18** extending forward from the base member is divided into two horizontally diverging branches, whereby this stud in plan view has a generally Y-shaped appearance. In the preferred embodiment of my invention illustrated in FIGS. 1 and 2, the stationary contact member **12** comprises at least one pair of elongated contact elements or fingers **23**, each finger **23** being pivotally supported intermediate its ends on the outer end of a different diverging branch of the breaker stud **18**. For this purpose, the outer ends of the diverging branches are respectively provided with generally cylindrical bearing surfaces having centerlines oriented in a vertical direction as viewed in FIGS. 1 and 2. Each bearing surface is recessed so that shoulders are formed at its upper and lower ends to prevent vertical movement of the associated contact finger. If desired, the length of the bearing surface can be made sufficient to accommodate more than one contact finger **23** in side-by-side relation.

The bearing surfaces at the outer ends of the diverging branches of the breaker stud **18** provide fulcrums for a pair of contact fingers **23**, and the pivotal connection between each contact finger and the breaker stud forms a current-conducting joint. The fingers are respectively supported on opposite bearing surfaces in opposing relationship with respect to each other for pivotal movement in a common horizontal plane. The opposing or inner ends of the contact fingers are movable in separate, relatively short arcuate paths, and the opposing ends are respectively provided with generally flat, complementary contact surfaces **24** normally disposed in a common vertical plane as viewed in FIGS. 1 and 2.

The inner end of each contact finger **23** is arranged to engage a common stop **25** for determining the limit of the arcuate movement of the contact surfaces **24** in one

direction. The stop 25, as is indicated in FIG. 2, comprises a pin vertically disposed intermediate the divergent branches of the breaker stud 18 and fixedly connected to the upper and lower supporting angles 19 and 20. Associated with the outer end 26 of each contact finger 23 is suitable spring means, for example, the illustrated tension spring 27 which may be anchored at one end to a fixed member such as provided by a laterally extending lug 28 of the upper supporting angle 19. Thus, spring means 27 establishes a biasing torque in the contact finger 23 tending to move the contact surface 24 along its arcuate path in a forward direction away from the base member 11, and such movement by the finger is limited by stop pin 25. The abovedescribed structure provides for a relatively limited deflection of each contact finger in a rearward direction.

The biasing torque is opposed and overcome and each contact finger 23 of the relatively stationary contact member 12 is tilted slightly on its fulcrum by the action of the movable contact member 14. In the illustrated embodiment of the invention, as will be more fully explained hereinafter, the movable contact member 14 includes a pair of arms respectively provided with contact surfaces 50 which move in parallel planes disposed approximately perpendicular to the plane defined by the arcuate paths of the contact surfaces 24 of the fingers 23. The actuating means 15 provides actuating force for moving each contact surface of member 14 into and out of circuit-making abutting engagement with the contact surface 24 of a different contact finger. During a circuit making operation, the contact surfaces 50 are jointly carried rearwardly from their open circuit position (FIG. 2) into substantially simultaneous engagement with both of the cooperating contact surfaces 24, and as the contact surfaces 50 move further to their fully closed position (FIG. 1) the spring means 27 are forced to yield and the relatively stationary contact fingers 23 are tilted on their fulcrums. In this manner conventional contact wiping action is obtained. Although an abutting type contact arrangement has been shown and described for the purpose of ilustration, it will soon become apparent that my invention is well suited for application with other arrangements, such as, for example, a movable contact blade disposed to slide between and spread apart a pair of generally parallel cooperating contact elements.

It can be seen in FIGS. 1 and 2 that the electroconductive bracket 13 for supporting the movable contact member 14 is mounted on base member 11 by means of a pair of suitable bolts 30 or the like. The bracket 13 has a lower lip 31 provided with a hole for the purpose of connecting a suitable current-conducting member or another breaker stud (not shown) to the bracket. Part of the bracket 13 is disposed adjacent the front surface of the insulating sheet 16 of base member 11, and a rigid reinforcing member 32 is disposed adjacent the rear surface of the sheet 16 in overlapping relationship with bracket 13 and the lower supporting angle 20, respectively. The reinforcing member 32 is provided so that the loading of the insulating sheet 16 in the area between the relatively stationary contact member 12 and the bracket 13 will be in compression rather than in flexure. A channel 33 of insulating material is disposed intermediate the reinforcing member 32 and the rear of sheet 16 to provide additional electrical insulation between the sides of member 32 and the fastening bolts 21 and 30.

The bracket 13 includes a pair of spaced-apart upstanding lugs 34 and 35 projecting in front of base member 11. A removable pivot pin 36 is supported by the lugs 34 and 35, the axis of the pivot pin extending in a horizontal direction generally parallel to the plane of the base member 11 as viewed in FIGS. 1 and 2. The pivot pin 36, which passes through both of the lugs 34 and 35 and protrudes from their outwardly facing sides, respectively, is retained in place by a releasable clamp 37 connected to the pin intermediate the lugs. As is seen most clearly in FIG. 5, the clamp 37 comprises a resilient helical coil loosely encircling pin 36, the length of the helix corresponding approximately to the span between the lugs 34 and 35. The opposite ends of the coil of clamp 37 extend tangentially therefrom and are arranged for movement between first and second cooperating positions. In FIG. 2, the ends are shown in a position wherein they releasably engage each other, and in this self-locked position the circumference of the coil is contracted for firmly grasping the encircled pin and preventing axial movement and removal thereof. By separating the ends and permitting them to assume their other position (shown in FIG. 4) in accordance with the resilience of the coil, the circumference of the coil can be expediently expanded for assembling or disassembling purposes.

Each upstanding lug 34, 35 has a rounded upper end 38 shaped like the convex surface of a cylinder, and as clearly indicated in FIG. 5, the centerline of the convex surface 38 is coextensive with or at least parallel to the axis of pivot pin 36. The outwardly facing sides of the lugs 34 and 35 are respectively provided with substantially flat, smooth slide surfaces 39 and 40 disposed generally perpendicular to the axis of the pivot pin 36. For reasons which will soon be made clear, the rounded edge of the inner side of each lug, that is, the side opposite to the side having the slide surface, is beveled or chamfered as shown at 41 in FIGS. 2, 3 and 5.

The connection between the movable contact member 14 and the supporting bracket 13 will now be described with particular reference to FIGS. 3 and 5. One end 42 of an elongated contact arm 43 is disposed adjacent the slide surface 39 of the upstanding lug 34 and is rotatably mounted on a protruding portion of pivot pin 36; and one end 44 of another elongated contact arm 45 is disposed adjacent the slide surface 40 of lug 35 for rotatable mounting on the oppositely protruding portion of the pivot pin. The contact arms 43 and 45 are arranged in generally parallel relation for joint operation and comprise the movable contact member 14.

The connection between each movable contact arm 43, 45 and the electroconductive bracket 13 is arranged to provide three separate current-conducting joints. The first such joint is provided by the bearing surfaces between the contact arm and the pivot pin 36 on which it rotates, that is, between pin 36 and the periphery of a hole 46 which has been located in the one end 42, 44 to accommodate the pin 36. The surface of the pivot pin 36 and the periphery of hole 46 may be silver plated and burnished to ensure a wear-resistant, low electric resistance current-conducting path.

The second current-conducting joint is obtained by providing the pivoted ends 42, 44 of each movable contact arm with a smooth, pertaining slide surface 47 on its relatively broad inner side, i.e., on the side of the contact arm facing the supporting bracket 13. Each slide surface 47 is disposed generally parallel to the respective adjoining slide surface 39 or 40 of the bracket lugs 34 and 35, and therefore all of the slide surfaces are disposed substantially perpendicular to the axis of pivot pin 36 which corresponds to the axis of rotation of the movable contact arms 43 and 45.

The slide surface 47 of each movable contact arm includes a raised section which, as can best be seen in FIGS. 3–5, preferably comprises a portion of a cylinder. The crest of this raised section is oriented so that it extends in a direction substantially perpendicular to the longitudinal centerline of the contact arm, and it is intersected by the hole 46 provided for pivot pin 36. The crests of the raised sections of the two slide surfaces 47 respectively cooperate with and are contiguous to the slide surfaces 39 and 40 of bracket 13, and pivotal movement of the contact arms on pin 36 causes each crest to slide over the associated slide surface of the relatively stationary bracket 13. The contiguous portions of each

pair of cooperating slide surfaces define a line contact which provides the second current-conducting joint between each movable contact arm and the supporting bracket. Of course, as an alternative to the specific arrangement illustrated and described above, a raised section could be located on each of the slide surfaces **39** and **40** and the slide surfaces **47** could be made substantially flat.

Contact pressure at the joints formed by the respective pairs of contiguous slide surfaces is maintained by means of an electroconductive spring member **49** which preferably comprises a U-shaped spring clip. As indicated in FIGS. 1 and 2, the resilient upstanding legs of the clip **49** are split for respectively bearing against the outer sides of the pivoted ends **42** and **44** of the contact arms **43** and **45** at points disposed on opposite sides of the pivot pin **36**. The electroconductive spring member **49** is secured to the bracket **13**, and since it also is in engagement with each movable contact arm it provides the third current-conducting joint. In addition, spring member **49** applies a sidewise force which maintains contact pressure at the contiguous surfaces of both pairs of cooperating slide surfaces **39**, **47** and **40**, **47**. This force is supplemented by an electromagnetic force whenever the movable contact member **14** is conducting current. Whenever the parallel contact arms **43** and **45** conduct alternating current, a magnetic force is established tending to reduce the spacing between these two arms and thereby establishing additional contact pressure at the contiguous slide surfaces, the magnitude of this sidewise force being proportional to the square of the current magnitude.

The diameter of hole **46** in the pivoted ends of the movable contact arms is made slightly greater than the diameter of pivot pin **36**. This arrangement permits the contact arms **43** and **45** to rock on pivot pin **36**. The crests of the raised sections of the slide surfaces **47** provide fulcrums for the rocking movement of the arms **43** and **45**, respectively. This arrangement allows for a certain degree of misalignment of the various parts and a liberal manufacturing tolerance without adversely affecting the positiveness of the electric contact between the movable elements and the supporting bracket **13**.

By utilizing three parallel current-conducting joints for each of the two parallel arms of the movable contact member **14**, the overall electric resistance of the pivotal connection has been efficiently reduced thereby significantly decreasing temperature rise. In this manner it is possible to obtain a successful contact structure without the conventional flexible braids or conductors.

In the illustrated embodiment of my invention, the corresponding free ends of the contact arms **43** and **45** are provided respectively with transverse contact surfaces **50** disposed for abutting engagement with the contact surfaces **24** of the relatively stationary contact fingers **23**. Rotary movement of the contact arms on pivot pin **36** carries the contact surfaces **50** through arcuate paths which define vertical planes intersecting at approximately right angles the horizontal plane of movement of the relatively stationary contact surfaces **24**, as viewed in FIGS. 1 and 2. This arrangement permits the convenient utilization of more than one stationary contact finger for each movable contact arm, whereby a plurality of separate points of circuit-closing engagement can be provided between the movable contact member **14** and the relatively stationary contact member **12**.

The cooperating contact surfaces **24** and **50** preferably are made of silver tungsten carbide material which will successfully perform the continuous current-carrying function of the contacts and also the required circuit making and breaking duty without appreciable contact erosion or pitting or contact welding as a result of electric arcing. Therefore it is not necessary to provide separate arcing and main contacts. With the various parts shown in FIGS. 1 and 2 appropriately dimensioned,

the contact structure will safely carry at least 225 amperes continuously at 600 volts A.-C., and the same contact structure can be modified to carry at least 600 amperes continuously merely by changing the relatively stationary contact member **12** so that two additional contact fingers (**23**) are respectively disposed adjacent those shown and by appropriately extending the contact surfaces **50** of the movable contact arms. All of the contact surfaces **24** and **50** are conveniently located in a common arcing chamber of a single arc chute **51** for the purpose of interrupting the electric arc drawn between these cooperating contact surfaces during a circuit opening operation thereof. The arc chute **51**, shown in block form in FIG. 1, may be of any suitable design and is located above the contact structure.

During circuit interruption an electric arc is drawn and extinguished in the arc chute **51**, and arc products are produced. Although almost all of the arc products are harmlessly exhausted at the top of the arc chute, there will be a tendency on the part of some particles of foreign matter to move downward to the vicinity of the pivotal connection between the movable contact member **14** and its supporting bracket **13**. If these particles of foreign matter were to enter and contaminate the current-conducting joints formed by the cooperating pairs of contiguous slide surfaces **39**, **47** and **40**, **47**, they would cause harmful wear and undesired increase in the contact resistance at these joints. In accordance with my invention, I provide deflecting shields for preventing the foreign matter generated during circuit breaking action from entering the current-conducting joints by straight-line paths from the area of arc interruption.

The movable contact arms **43** and **45** are provided intermediate their respective ends with oppositely offset portions **52**. An offset portion **52** protrudes on the relatively broad inner side of each arm and, as seen most clearly in FIG. 5, preferably is in the form of a curved embossment extending completely across the width of the arm. The concave part of the embossment overhangs and cooperates with the convex surface **38** of the adjacent upstanding lug **34**, **35** to shield the current-conducting joint formed by the associated pair of contiguous slide surfaces. See FIGS. 2 and 3. The length of the semi-circular embossment **52** is made sufficient to provide continuous shielding of the joint as the movable contact arms **43** and **45** are moved between their respective open and closed circuit positions. During circuit breaking action of the contact structure, the embossment or protrusion **52** will deflect the arc products away from the current-conducting joint thereby preventing contamination of the joint. The lugs **34** and **35** have been chamfered at **41** so that any particles of foreign matter striking a lug in this area will be deflected harmlessly away from the joint instead of into it. In this manner the arc products are prevented from entering the current-conducting joints except by extremely tortuous paths, and the joints are maintained substantially free from contamination.

As can be most clearly seen in FIGS. 3 and 5, the offset or protruding portion **52** of each contact arm is provided with a transverse hole **53** the centerline of which is oriented parallel to the pivot pin **36**. An actuating member such as a cylindrical impelling shaft **54** is rotatably disposed in hole **53**, and by this means actuating force is applied to the movable contact member **14** for jointly moving the contact arms **43** and **45** between open and closed circuit positions. The offset portion **52** of each of the contact arms is so constructed and arranged that the resultant actuating force applied to the arm by shaft **54** is directed along a line of action intersecting a straight line **55** drawn from the center of the circuit making surface area of the contact surface **50** to the center of the pivotal connection between the arm and pivot pin **36**. See FIG. 4.

The straight line **55** intersects the axis of rotation of

the movable contact arms (the axis of pivot pin 36) at an oblique angle as shown in FIG. 4. This is because the contact arms 43 and 45 have been spaced closer together at their corresponding free ends than at the pivot pin 36 in order to obtain a compact arrangement at the cooperating contact surfaces 24 and 50. As is shown in FIG. 2, the free ends of the contact arms are axially offset with respect to the pivotally connected ends 42 and 44, respectively, and each free end is disposed inside a plane normal to the pivot pin 36 that intersects the bearing area providing the pivotal connection between the associated movable contact arm (the periphery of hole 46) and pin 36. By connecting the impelling shaft 54 to the offset portion 52 of each contact arm as described above, the actuating force applied to the arm produces no net moment with regard to the straight line 55, and there is substantially no torsion or twisting tendency in the arm in its closed circuit position. Such a tendency would be undesirable because it would cause uneven forces along the length of the crest of the raised section of slide surface 47 with respect to the cooperating contiguous slide surfaces 39 or 40, whereby the effectiveness of this current-conducting joint between the movable contact member 14 and the supporting bracket 13 would be seriously impaired.

The impelling shaft 54 fits relatively loosely in the holes 53 located in the offset portions 52 of the movable contact arms 43 and 45, whereby each arm can slide on shaft 54 while rocking on pivot pin 36. Thus the contact surface 50 of each arm is free to move in a lateral or transverse direction, and such lateral movement is controlled by resilient means associated with the contact arm. As is shown in FIGS. 2 and 3, the resilient means preferably comprises a helical spring 56 disposed on impelling shaft 54 intermediate the contact arms 43 and 45. The spring 56 applies a transverse force to each contact arm and establishes in the arm a relatively weak biasing torque with respect to the pivot provided by the line contact at the joint formed by the associated pair of contiguous slide surfaces 39 and 47 or 40 and 47. This biasing torque is in a direction tending to spread apart the contact arms. Such movement by each contact arm is stopped and its normal position is determined by a bushing 57 disposed on shaft 54 between a retaining ring 58 or the like and a circular outer side of the offset portion 52 of the arm.

During circuit making action of the contact structure, contact surface 50 comes into abutting engagement with contact surface 24 of a relatively stationary contact finger 23, and as the cooperating contact surfaces wipe the contact finger 23 is tilted on its fulcrum in opposition to its biasing torque. The arrangement is such that a transverse force is supplied to contact surface 50 by contact surface 24 as the contact finger 23 moves pivotally on its fulcrum. Due to the resilient means 56, the movable contact arm yields to this transverse force and the contact surface 50 is able to move laterally while following the arcuate path of contact surface 24. As a result, the relative movement between the cooperating contact surfaces 24 and 50 is reduced thereby reducing the amount of friction between these surfaces and improving the performance of the contact structure.

The movable contact member 14 is coupled to the actuating means or crossbar 15 by means of the impelling shaft 54 and a generally U-shaped connecting link 59. Each leg of the connecting link 59 is provided with an extension 60 which, as is clearly seen in FIG. 1, is connected to the pivot pin 36. Thus, the crossbar 15 is supported for pivotal movement by pin 36. End portions 61 of impelling shaft 54 extend laterally from the contact arms 43 and 45 and are made eccentric with respect to the cylindrical body of this shaft. The end portions 61 are coupled to the connecting link 59 in a manner permitting controlled rotation of the shaft 54. This has been done by providing each end portion 61 with flat sides forming a hexagon, parallel sides of the hexagon being positively but resiliently locked between a shoulder 62 of the connecting link 59 and a cooperating cantilever flat spring 63 carried by link 59. See FIG. 1.

By means of a conventional open-end wrench applied to the hexagonal end portion 61, the shaft 54 may be rotated to any one of six angular positions. In each of these six positions, the movable contact member 14 is located in a different relative angular position with respect to the crossbar 15 and with respect to the relatively stationary contact member 12. The purpose of this adjustment is to accurately establish the fully closed position of the movable contact member regardless of liberal manufacturing tolerances, whereby the desired amount of contact wipe can be precisely obtained.

The crossbar 15 is connected to a circuit breaker operating mechanism by means of another link 64 and a connecting member 65. The operating mechanism, which has not been shown, may be of any suitable type for moving the connecting member 65 forward and backward in a generally horizontal direction (as viewed in the drawings) and thereby reciprocally carrying the crossbar 15 about its pivot between first and second relatively fixed positions.

The crossbar 15 may be extended across the width of the circuit breaker for connection in a similar manner to other pole units of a multipole circuit breaker. An isolating barrier 66 of insulating material is shown mounted on the crossbar 15 in FIG. 2. Other barriers 67 are provided for the purpose of isolating the various current-conducting parts of the illustrated pole unit from the corresponding parts of adjacent pole units and from ground.

While I have shown and described a preferred form of my invention by way of illustration, many modifications will occur to those skilled in the art. Therefore, I contemplate by the concluding claims to cover all such modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In the contact structure of an electric circuit breaker: a base member; a relatively stationary contact member mounted on the base member; an electroconductive bracket mounted on the base member in spaced relation to the stationary contact member; an elongated movable contact arm supported near one end thereof by the bracket for movement of its other end into and out of circuit making engagement with the stationary contact member, the bracket and said one end of said arm having contiguous surfaces forming a current-conducting joint and the movable contact arm having an integral protrusion disposed near said one end to shield said joint from an electric arc and arc products which may be produced during circuit breaking action of the contact structure; and actuating means coupled to the movable contact arm for moving said arm.

2. In the contact structure of an electric circuit breaker: a base member; a relatively stationary contact member mounted on the base; an upstanding electroconductive lug mounted on the base in spaced relation to the stationary contact member, the lug having a rounded upper end shaped like the convex surface of a cylinder and having a slide surface on one side disposed generally perpendicular to the centerline of said convex surface; an elongated movable contact arm having one end connected to the lug adjacent the one side thereof for pivotal movement with respect to an axis disposed approximately perpendicular to said slide surface, the other end of he arm being arcuately movable into and out of circuit-making engagement with the stationary contact member, said arm having on one side a pertaining surface disposed in contiguous relationship with the slide surface of said lug to form a current-conducting joint and having intermediate its ends on its one side a concave-shaped emboss-

ment which overhangs and cooperates with the convex surface of said lug to shield said joint from the electric arc and arc products produced during circuit breaking action of the contact structure; and actuating means coupled to the movable contact arm for pivotally moving said arm.

3. In the contact structure of an electric circuit breaker: a base member; a relatively stationary contact member mounted on the base member; an electroconductive lug mounted on the base member in spaced relation to the stationary contact member, one side of the lug having a slide surface and an edge of the opposite side of the lug being chamfered; an elongated movable contact arm having one end rotatably connected to the lug on an axis disposed approximately perpendicular to the slide surface of said lug, the other end of the arm being arcuately movable into and out of circuit-making engagement with the stationary contact member, said arm having on one side a pertaining surface disposed in contiguous relationship with said slide surface to form a current-conducting joint, one of said surfaces being substantially flat and the other having a raised section, said movable contact arm including intermediate its ends on said one side a protruding portion disposed to partially overhang and act in combination with the chamfered edge of said lug to shield said joint from an electric arc and arc products which may be generated during circuit breaking action of the contact structure; and actuating means coupled to the movable contact arm for rotating said arm on said axis.

4. In the contact structure of an electric circuit breaker: a base member; a relatively stationary contact member mounted on the base member; an electroconductive lug mounted on the base member in spaced relation to the stationary contact member, one side of the lug having a slide surface; an elongated contact arm having one end connected to the lug for pivotal movement on an axis disposed generally perpendicular to the slide surface of said lug, the arm having on one side a pertaining surface disposed in contiguous relationship with said slide surface to form a current-conducting joint, one of said surfaces being substantially flat and the other having a raised section defining with the flat surface a line contact, the free end of the arm having at least one contact surface arcuately movable in a plane spaced laterally with respect to the one side of said arm and disposed for circuit-making engagement with at least one cooperative contact surface of the relatively stationary contact member, the arm including intermediate its ends on said one side an offset portion disposed to shield said current-conducting joint from an electric arc and arc products which may be produced during circuit breaking action of the contact structure; and an actuating member connected to the offset portion of the movable contact arm for moving said arm about said axis, said offset portion being constructed and arranged so that the resultant of an actuating force applied to the arm through said actuating member is directed along a line of action intersecting an intermediate portion of a straight line drawn from the center of the circuit-making surface area of said free end to the center of the pivotal connection between arm and lug.

5. In the contact structure of an electric circuit breaker: a base member; a relatively stationary contact member mounted on the base; an electroconductive bracket mounted on the base in spaced relation to the stationary contact member; an elongated contact arm pivotally connected near one end to the bracket for rotation on an axis, the arm having on one side at said pivotally connected end a slide surface generally perpendicular to the axis of rotation and disposed in contiguous relationship with a cooperating slide surface of the bracket to form a current-conducting joint, the free end of the arm having at least one contact surface disposed for movement into and out of circuit-making abutting engagement with at least one cooperative contact surface of the relatively stationary contact member, said free end being axially offset with respect to the pivotal connection between arm and bracket so that the center of the circuit-making surface area of said free end defines with the center of said pivotal connection a straight line intersecting the axis of rotation at an oblique angle, the arm including intermediate its ends on said one side an offset portion disposed to shield said current-conducting joint from an electric arc and arc products produced during circuit breaking action of the contact structure; and an actuating member connected to the offset portion of the movable contact arm for supplying actuating force to move said arm about said axis, said offset portion being constructed and arranged so that the acuating force applied to the arm produces no net moment with regard to said straight line.

6. In the contact structure of an electric circuit breaker: a relatively stationary contact member; a stationary electroconductive bracket disposed in spaced relation to the stationary contact member; and a pivotally supported elongated contact arm having a free end cooperating with the stationary contact member, said contact arm being disposed for pivotal movement from a closed circuit position wherein its free end is in engagement with the stationary contact member to an open circuit position wherein its free end is separated from the stationary contact member, said contact arm having a relatively broad side adjoining a cooperating side of the bracket, both of said sides being oriented generally perpendicular to the axis of pivotal movement of the contact arm and having contiguous slide surfaces forming a current-conducting joint between the arm and the bracket, said broad side of the arm having a curved embossment extending across its width and overhanging the bracket to shield said joint throughout said pivotal movement of the contact arm from the electric arc and arc products produced between said free end and said stationary contact member.

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