Jan. 23, 1968 C. L. JENCKS ET AL 3,365,561

MULTIPLE FINGER TYPE CURRENT-CARRYING CONTACT ARM PIVOT ASSEMBLY

Filed Nov. 21, 1966 2 Sheets-Sheet 1

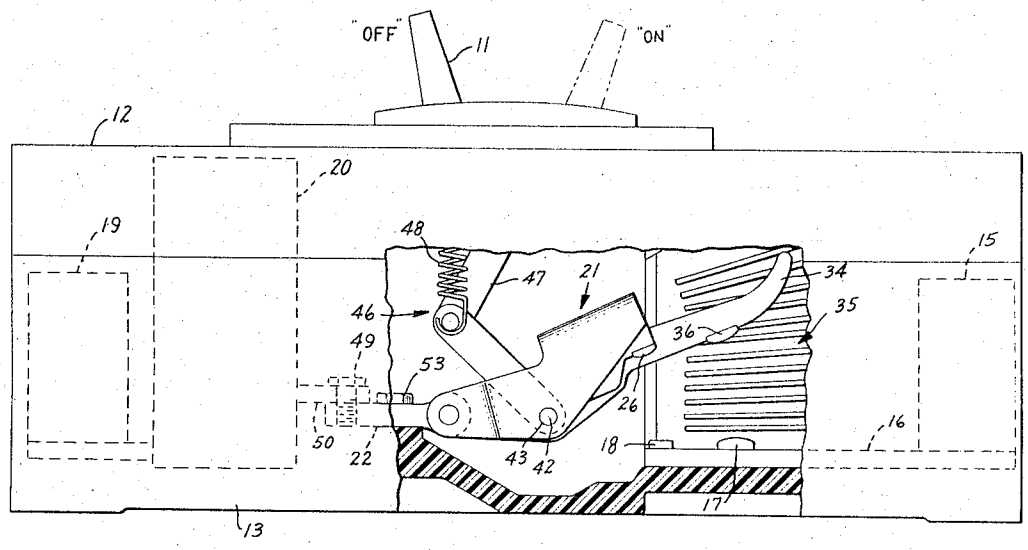


FIG. 1

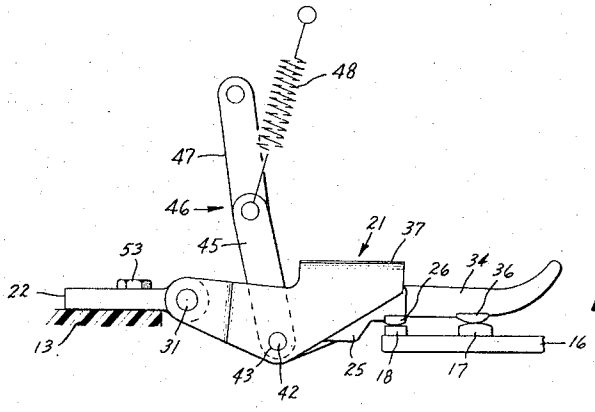


FIG. 2

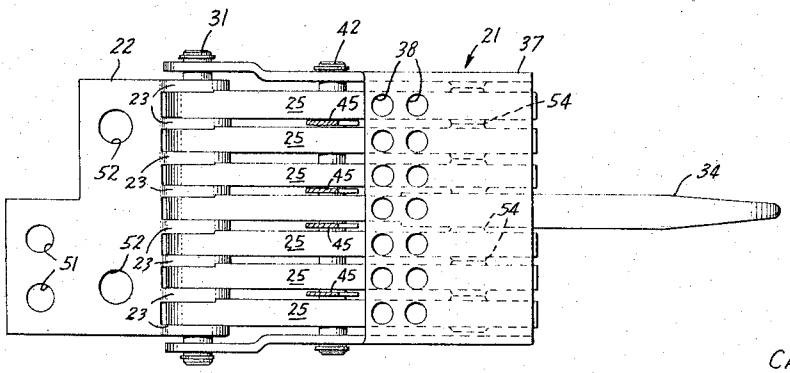


FIG. 3

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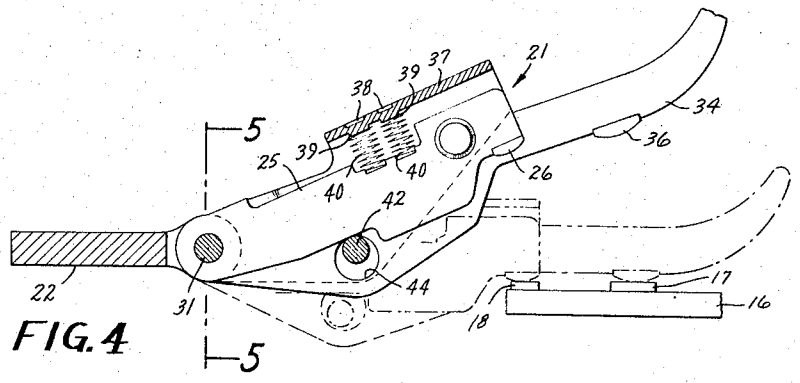


FIG. 4

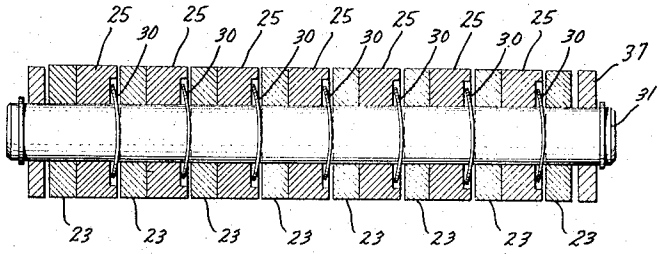
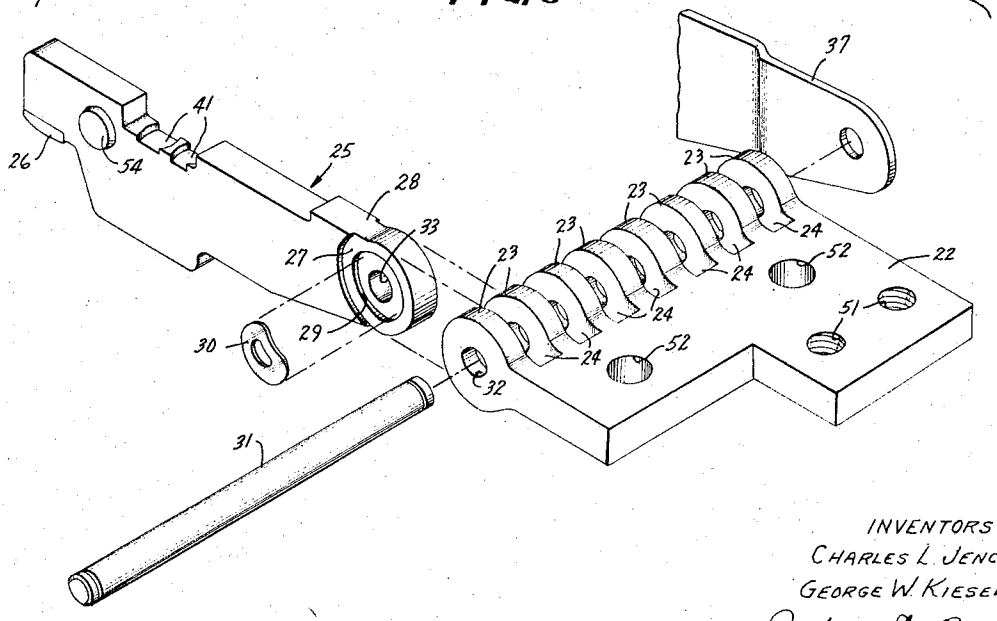


FIG. 5

FIG. 6



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MULTIPLE FINGER TYPE CURRENT-CARRYING CONTACT ARM PIVOT ASSEMBLY

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ABSTRACT OF THE DISCLOSURE

A multiple finger type current-carrying contact arm pivot assembly including a stationary block of metal having spaced aligned segments providing slots therebetween and having aligned holes therein transversely thereof and a plurality of blade-like conductive contact fingers each including an end portion extending into one of the slots; a conductive pivot pin extends through all of the spaced segments and contact finger end portions so that in the closed circuit position of the contact arms the contact closing force presses each contact arm against the pivot pin to maintain a good current path; in addition, biasing means is included between each adjacent pair of segments biasing the contact arm end against one side of one of the segments to supplement the first current path and particularly to assure a conductive path of at least short time current-carrying ability to prevent arcing at the supporting pin during times when current is flowing through the arm although contact closing force is not being applied, such as while arcing occurs between stationary and movable contacts during opening movement.

Our invention relates to circuit breakers of substantial current-carrying capacity and more particularly to an improved current-carrying contact arm pivot assembly for such circuit breakers.

Prior art circuit breakers of the type referred to have normally embodied pivoted, current-carrying contact arm assemblies which have required fairly complex structural arrangements in order to perform their intended function in a desirable manner. A representative showing of such a prior art form of contact arm pivot assembly can be found for example in Patent 3,263,051 of Gauthier et al., which is assigned to the same assignee as the present application. As shown in this patent, it has been customary practice to employ a pivoted current-carrying contact arm pivotally supported in the base of the circuit breaker, and flexible conductors such as multistrand braids connecting the movable contact arm with one terminal of a conventional circuit breaker trip unit. Although this form of contact arm pivot assembly is generally satisfactory, it presents certain disadvantages for use in high capacity circuit breakers.

Thus in circuit breakers of high capacity, such for example as 2000 or more amperes, the size of the flexible conductors or braid required is such that the flexing thereof requires substantial force thereby adding to the already great force required to operate the contact arm. In addition, it is desirable that circuit breakers of the type described be made as small as possible consistent with effective operation. The use of flexible conductors with a pivoted contact arm construction requires substantial additional space beyond that required by the contact arm itself.

While attempts have been made in the past to eliminate such flexible conductors by carrying current directly through the contact arm pivot, such prior art constructions have been subject to damage by arcing or "spitting" due to arcing when high currents are carried, and sometimes

to consequent welding together of the parts, especially when subjected to high short-circuit currents.

It is an object of the present invention to provide a current-carrying contact arm pivot assembly for a circuit breaker of substantial current-carrying capacity which is simple, reliable, and relatively inexpensive to manufacture.

Another object of the present invention is to provide a contact arm pivot assembly for such circuit breakers which includes means for preventing arcing or "spitting" from occurring between the structural elements of the assembly when the contacts open.

A still further object of the present invention is to provide a contact arm pivot assembly which is compatible for use in a variety of different circuit breakers without the necessity for extensive modifications therein.

In accordance with one form of the invention, there is provided a contact arm pivot assembly for a circuit interrupter comprising a current-carrying support means having at least one pair of projections defining a slot therebetween. At least one elongated contact arm segment is supported within the slot and is movable about a fixed pivot passing transversely therethrough. A biasing means is supported within the slot in juxtaposed relation to the contact arm segment and at least one of the pair of projections. The contact arm segment therefore continuously bears against the other of the pair of projections and thereby prevents arcing between the elongated contact arm segment and its pivot. A movable contact is carried by the contact arm segment and is movable in a predetermined path between an open circuit position in which the movable contact is out of engagement with a stationary contact and a closed circuit position in which the movable contact is in engagement with a stationary contact.

The invention will be more fully understood from the following detailed description, and its scope will be pointed out in the appended claims.

In the drawings,

FIGURE 1 is a side elevation view of an electrical circuit breaker incorporating the invention, a portion of the side casing being broken away;

FIGURE 2 is a side elevation view of one contact arm assembly portion of the circuit breaker of FIGURE 1;

FIGURE 3 is a plan view of the contact arm pivot assembly of FIGURE 2;

FIGURE 4 is a view similar to FIGURE 2, on enlarged scale, side portions thereof being removed to show the interior construction, the contact also being shown in closed position in dotted lines;

FIGURE 5 is a sectional view of a portion of the contact arm pivot assembly of the present invention taken substantially along the line 5—5 of FIGURE 4; and

FIGURE 6 is an exploded perspective view of a portion of the contact arm pivot assembly of the present invention.

Referring now to FIGURE 1, the invention is shown as incorporated in a multipole circuit breaker having an insulating casing or housing comprising an upper portion 12 and a lower portion 13 and an external handle 11 reciprocally operable from the "OFF" position as shown by the solid lines to the "ON" position as illustrated by the dash lines.

An incoming or line terminal 15 is supported at one end of the lower portion 13 of the circuit breaker and is electrically connected to one end of a conductive strap 16. At its other end, the strap 16 supports a stationary arcing contact 17, and a plurality of stationary main contacts 18 (only one of which is shown in FIGURES 1 and 2). The stationary main contacts 18 are suitably spaced in side-by-side relation on the conductive strap 16. A load terminal 19 is supported at the other end of the lower portion 13 of the circuit breaker, and is electrically connected to a conventional circuit breaker trip

unit 20, the latter being supported in close proximity to the load terminal 19.

As best seen in FIGURE 1, a pivoted contact arm assembly indicated generally by the reference numeral 21 is supported in the lower portion 13 of the circuit breaker between the trip unit 20 and the stationary contacts 17, 18. The pivoted contact arm assembly 21 includes a current-carrying support block 22 having a plurality of pairs of projections 23 formed integrally therewith at one end thereof, each pair of projections defining a slot 24 therebetween. An elongated contact arm segment 25 is pivotally supported in each of the slots 24 and carries at its free end a movable main contact 26.

Referring now to FIGURE 6, it can be seen that portions 27 of the end 28 of each of the contact arm segments 25 (only one of which is shown in FIGURE 6 for purposes of clarity) are cut away to permit the end 28 to be inserted into a slot 24. Also as shown therein, one side of the end 28 is also provided with a recess 29 which receives a circular dished washer 30. A pivot pin 31 is received in the holes 32 in the projections 23 and the opening 33 in each contact arm segment 25, thereby allowing each of the arm segments 25 to pivot about the pin 31 independently of the other arm segments 25.

In the assembled condition as best seen in FIGURE 5, each of the washers 30 is supported on the pivot pin 31 in juxtaposed relation to the side wall of the recess 29 of each contact arm segment 25 and a side wall of one of the projections 23. By virtue of this construction, the washers 30 press each of the contact arm segments 25 sidewise against an adjacent projection 23 of the support block 22 for a purpose to be described.

One of the contact arm segments designated in the drawings by reference numeral 34 comprises an "arcing contact" and is preferably made substantially longer than the other contact arm segments and thereby extends into the area occupied by the arc extinguishing structure 35.

The contact arm pivot assembly 21 also includes a U-shaped bracket member 37 which overlies the contact arm segments 25, 34 and is also pivotally supported on a pivot pin 31. Any suitable retaining means which will not interefere with the pivoting of the U-shaped bracket member 37 may be utilized to hold the latter on the pivot pin 31. As best shown in FIGURE 3, the bracket member 37 is provided with a series of indentations 38 on the top surface thereof. On the inner surface of the bracket member 37 opposite each indentation 38 there is provided a protuberance 39 which serves as a means of properly positioning and holding a contact spring 40, the other end of which is held in a seat 41 provided on the top surface of each contact arm segment. In the preferred embodiment of the invention, a pair of contact springs 40 is provided for each contact arm segment 25, as well as for the contact arm segment 34.

Underlying each of the contact arm segments 25 is a pivot member 42 which is received in openings 43 of the U-shaped bracket member 37 and held therein by any suitable retaining means. As best shown in FIGURE 4, the pivot member 42 also passes through a hole 44 in contact arm segment 34, the hole 44 being enlarged for a purpose to be more fully discussed hereinbelow. Pivotally supported on the pivot member 42 are a plurality of lower links 45 of a toggle link mechanism indicated generally by reference numeral 46. The upper links 47 of the toggle link mechanism 46 are spring loaded by a plurality of springs 48 (only one of which is shown in the drawings) in a manner well known in the art. The springs 48 are interconnected between the operating handle 11 and the respective knee points of the toggle linkage mechanism 46. Thus, when the handle 11 is in the "off" position as shown in FIGURE 1, the contacts are in open position, and when the handle is moved clockwise from this position, toward the right end of the breaker as viewed in FIGURE 1, the contacts are moved to the closed circuit position, the latter condition being illustrated in FIGURE 2.

As noted earlier, the contact springs 40 constantly bias the contact arm segments 25, 34 from the U-shaped bracket member 37. This ensures that when the movable main contacts 26 and the arcing contact 36 are brought into engagement with the stationary main contacts 18 and the stationary arcing contact 17, respectively, sufficient contact pressure will exist therebetween. The hole 44 in contact arm segment 34 has been enlarged in order to allow for this movement by the contact arm segment 34 under the influence of contact springs 40. For if a tight fit existed between pivot member 42 and the hole 44, this biasing function would be nullified.

Referring now to the manner in which current passes from the stationary contacts through the contact arm pivot assembly 21 to the trip unit 20, it can be seen that with the contacts closed, the current will pass from the contacts into the contact arm segment 25, 34 and from there into the pivot pin 31. This is because in the closed condition of the breaker, each contact arm segment 25, 34 is pressed against the pivot pin 31 by means of the contact springs 40, which as noted earlier also ensure that sufficient pressure will exist between the engaged contacts. Once the current enters the pivot pin 31, it goes from there into the support block 22 through any contacting current bearing surface between the pin 31 and the block 22. Theoretically, the pin 31 is in contact with all of the projections 23 of the block 22, and presumably the current from each contact arm segment 25, 34 would enter the pin 31 and then divide and go into the block 22 through the nearest two projections 23. It is of course not critical, however, as to what particular projections the current enters. From support block 22, the current passes through connectors 49 to the terminal 50 of trip unit 20. The openings 51 in the block 22 are utilized to receive the connectors 49 while the openings 52 in the block 22 receive bolts 53 for mounting the contact arm pivot assembly 21 in the lower portion 13 of the circuit breaker.

When the contact arm pivot assembly 21 is moved toward open position, the pressure on the springs 40 is relieved and therefore the force pressing the contact segments against the pivot pin 31 ceases. Since current continues for a short time as the contacts are opening, after the aforesaid spring pressure is relieved, some arcing or "spitting" might occur between the contact arm segments 25, 34 and the pivot pin 31 if this were the only current path available. However, in addition to this path, in accordance with the present invention there is provided a lateral pressure means, namely the dished washers 30, which press each of the contact arm segments 25, 34 sidewise against an adjacent projection 23 of the support block 22. Since this pressure is always in existence, the current path directly from each of the contact arm segments 25, 34 to one of the adjacent projections 23 is always effective, and this serves to prevent arcing or "spitting." It should be noted, however, that the dished washers 30 cannot exert a sufficiently high pressure laterally to provide the normal continuous current path, since this would create too much friction, impeding pivotal movement of the contact arm segments. Just sufficient sidewise pressure is maintained to avoid the undesirable arcing referred to during opening. It should also be noted that since the projections 23 are integral with the support block 22, the current can directly enter the block 22 from any one of the projections 23 without having to go through any of the other projections 23 or any of the inter-face resistance barriers which would otherwise be involved.

Although the contact arm pivot assembly 21 has been illustrated as including six contact arm segments 25 as well as the elongated contact arm segment 34, it is contemplated that more or less contact arm segments could be employed without departing from the spirit of the invention. In the preferred, illustrated, embodiment of the invention, each of the contact arm segments 25, 34 is pro-

vided with bosses 54 (see FIG. 6) to ensure the proper positioning and spacing of the contact arm segments relative to each other and to minimize friction. The contact arm segments may of course take other specific forms.

Thus, while the invention has been shown in only one particular embodiment, it will be apparent that many modifications other than those noted above may be made, and we therefore intend by the appended claims to cover all such modifications as fall within the true spirit and scope of the invention.

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

1. An electric circuit interrupter including a pivoted current-carrying contact arm assembly comprising:

(a) an electrically conductive support having a plurality of aligned spaced projections defining slots therebetween;

(b) a plurality of elongated contact arms each having a portion extending into one of said slots;

(c) electrically conductive bearing means carried by and electrically connected to said support and supporting said portion of each of said contact arms within said one of said slots for rotation about an axis extending transversely of said contact arms, said electrically conductive bearing means providing a first current path between each of said contact arms and said support; and

(d) a plurality of biasing means supported by said support, each of said biasing means biasing said portion of one of said contact arms in a direction parallel to said axis against one of said projections at all times to thereby maintain a continuous current path between each of said contact arms and said support electrically in parallel with said first current path, whereby arcing between each of said contact arms and said electrically conductive bearing means is prevented.

2. An electric circuit interrupter as defined in claim 1 including:

(a) a plurality of stationary contacts supported within said circuit interrupter;

(b) a movable contact carried by each of said elongated contact arms at the outer end thereof and movable into and out of engagement with one of said plurality of stationary contacts respectively, and

(c) means applying contact-closing force to each of said elongated contact arms intermediate the ends thereof.

3. An electric circuit interrupter including a pivoted current-carrying contact arm assembly comprising:

(a) an electrically conductive support having a plurality and projections defining slots therebetween;

(b) a plurality of elongated contact arms each having a portion extending into one of said slots;

(c) electrically conductive pivot pin means carried by said support and supporting said portion of each of said contact arms within a corresponding one of said slots for rotation about an axis etxending transversely of said contact arms, said conductive pivot pin means providing a first current path between each of said contact arms and said support; and

(d) a plurality of biasing means supported by said support, each of said biasing means biasing said portion of one of said contact arms in a direction parallel to said axis against one of said projections at all times to thereby maintain a continuous current path between each of said contact arms and said support electrically in parallel with said first current path, whereby arcing between each of said contact arms and said electrically conductive pivot pin means is prevented.

4. An electric circuit interrupter as defined in claim 3 including:

(a) a bracket supported on said electrically conductive pivot pin means, said bracket overlying all of said plurality of elongated contact arms; and

(b) spring means interposed between said bracket and each of said elongated contact arms respectively, said spring means applying contact-closing force to each of said plurality of elongated contact arms intermediate the ends thereof.

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