

June 10, 1952

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2,600,211

CIRCUIT INTERRUPTER HAVING FINGER CONTACTS

Filed April 15, 1950

2 SHEETS--SHEET 1

Fig. 2.

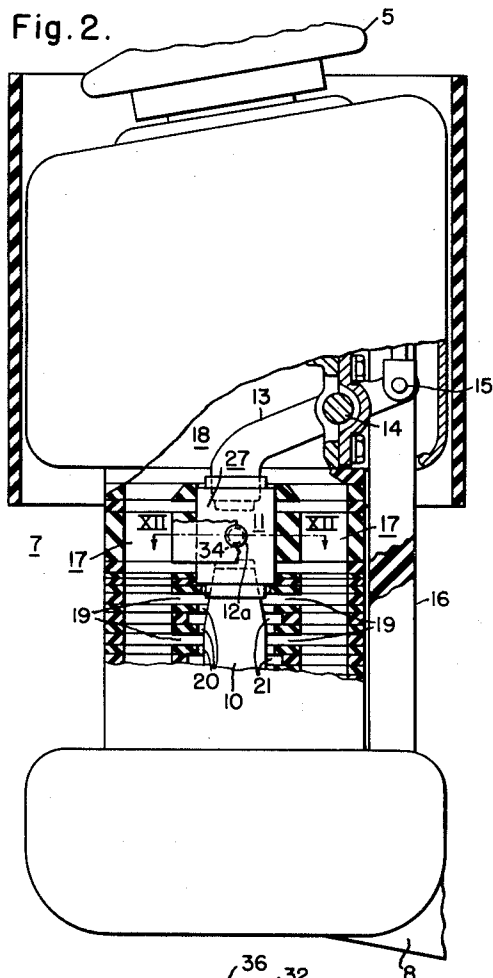


Fig. 4.

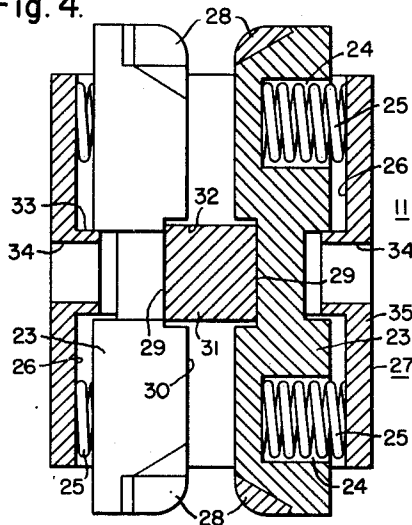


Fig. 5.

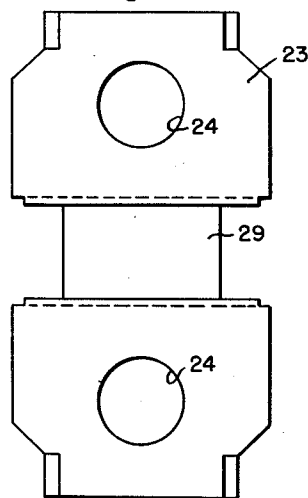
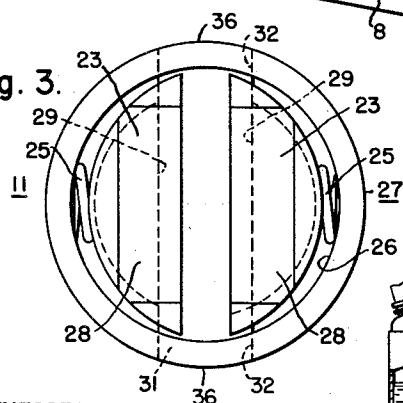


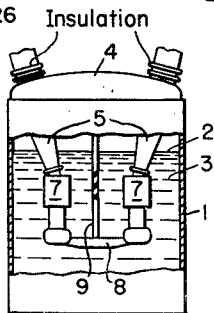
Fig. 3.



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Fig. 1.



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2 SHEETS—SHEET 2

Fig. 6.

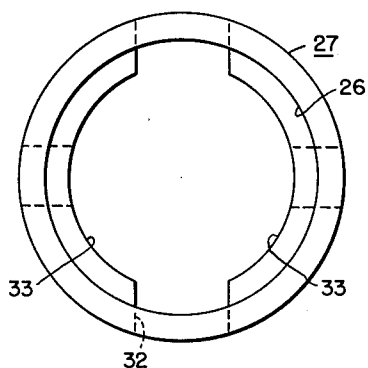


Fig. 7.

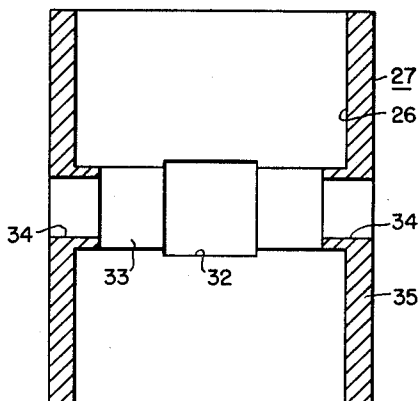


Fig. 10.

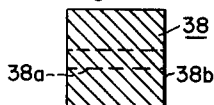


Fig. 8.

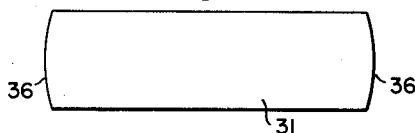


Fig. 11.

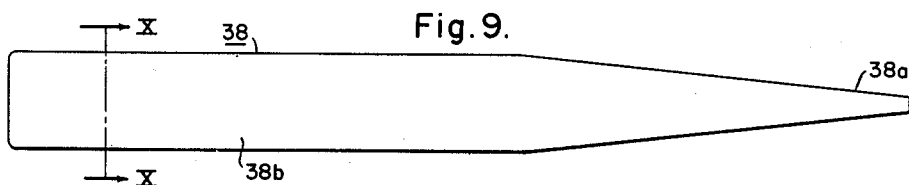
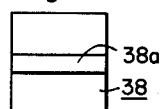
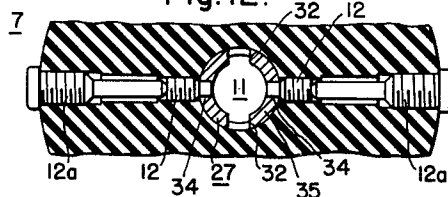


Fig. 12.



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2,600,211

CIRCUIT INTERRUPTER HAVING FINGER CONTACTS

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Application April 15, 1950, Serial No. 156,092

4 Claims. (Cl. 200-163)

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This invention relates to finger contact constructions, and more particularly to an intermediate finger contact construction for a circuit interrupter.

The general object of my invention is to provide an improved circuit interrupter, particularly one adapted to draw two serially related arcs.

A more specific object of my invention is to provide an improved intermediate contact finger construction adapted for use with a cooperable pair of moving contacts, which separate in substantially opposite directions from the intermediate contact arrangement.

Still a further object is to provide an improved intermediate contact finger construction which will not only be simple and easy to assemble, but will contain few parts, be preferably of symmetrical design, and which will embody an improved pivoted construction.

Yet a further object of my invention is to provide an improved intermediate finger contact construction disposed intermediate a pair of movable contacts which will prevent the flow of fluid directly through the intermediate finger contact construction.

Further objects and advantages will readily become apparent upon reading the following specification taken in conjunction with the drawings, in which:

Figure 1 is a side elevational view, partially in vertical section, of a circuit interrupter embodying my invention and shown in the closed circuit position;

Fig. 2 is an enlarged side elevational view, partially in vertical section, of the left-hand arc extinguishing unit of Fig. 1, the contact structure being shown in the closed circuit position;

Fig. 3 is a plan view of the intermediate contact construction shown in Fig. 4;

Fig. 4 is an enlarged vertical sectional view through my improved intermediate contact finger construction, one of the double-ended finger contacts being shown in side elevation;

Fig. 5 is an end elevational view of one of my improved double-ended finger contacts;

Figs. 6 and 7 are, respectively, plan and vertical sectional views through the retainer tube of my improved intermediate contact finger construction;

Fig. 8 is a plan view of the elongated key utilized in my intermediate contact finger construction;

Fig. 9 is a side elevational view of a tool, which is utilized to facilitate the assembly and dis-

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assembly of my improved intermediate finger contact construction;

Fig. 10 is a sectional view taken on the line X—X of Fig. 9;

Fig. 11 is a view in end elevation of the tool of Fig. 9; and

Fig. 12 is an enlarged fragmentary view in section, taken along the line XII—XII of Fig. 2, showing means for maintaining the retainer tube in position.

Referring to the drawings, and more particularly to Fig. 1 thereof, the reference numeral 1 designates a tank filled to the level 2 with a suitable arc-extinguishing fluid 3, in this instance, circuit breaker oil. Depending from the cover 4 of the tank 1 is a pair of terminal bushings 5, to the lower ends of which are appended arc-extinguishing units, generally designated by the reference numeral 7.

Electrically interconnecting the two arc-extinguishing units 7 is a conducting bridging member 8, actuated reciprocally in a vertical direction, as shown in Figure 1, by an insulating lift rod 9. The lift rod 9 is operated by any suitable mechanism, not shown, which forms no part of my invention.

Referring to Figure 2, which shows on an enlarged scale the left-hand arc-extinguishing unit 7 of Fig. 1, it will be observed that there is provided a lower movable interrupting contact 10, preferably of blade-like configuration, which is secured to and movable with the conducting bridging member 8. The lower movable interrupting contact 10 separates downwardly away from an intermediate contact assembly, generally designated by the reference numeral 11, and fixedly secured in position.

A pivotally mounted pressure-generating contact 13 separates upwardly away from the intermediate contact assembly 11 to establish a pressure-generating arc, not shown, therebetween. As shown in Fig. 2, the pressure-generating contact 13 is pivotally mounted at 14, and is connected externally of the unit 7, as at 15, to a vertically extending operating rod 16. Preferably the connection between the operating rod 16 and the pressure-generating contact 13 is such as to allow a certain "wiping" action, or will permit a certain flexibility therebetween.

The functioning of the arc-extinguishing unit 7 is such as to establish the pressure-generating arc between the contacts 11, 13 at substantially the same time as the establishment of an interrupting arc between the contacts 10 and 11. This occurs inasmuch as the operating rod 16 is biased

downwardly in an opening direction by suitable biasing means, not shown, and the lower end of the operating rod 16 engages in abutting relationship with the upper portion of the conducting bridging member 8. Consequently, during the closing operation, the upward closing movement of the bridging member 8, not only raises the lower movable interrupting contact 10 into engagement with the intermediate contact 11, but also near the end of the closing stroke, it strikes the lower end of the side operating rod 16 to carry the latter therewith upwardly and thereby effect closing counterclockwise rotative motion of the pivotally mounted pressure-generating contact 13. The result is that there is a substantially simultaneous closing of both contacts 10, 13 into engagement with the intermediate contact 11 to thereby complete the electrical circuit through the unit 7.

Further details of the operation of the interrupting unit 7, and the manner in which the pressure-generating arc forces oil under pressure downwardly through the vertical flow passages 17 away from the pressure-generating chamber 18 and through the inlet passages 19 into engagement with the interrupting arc are more fully brought out in United States Patent No. 2,467,760, issued April 19, 1949, to Leon R. Ludwig, Benjamin P. Baker and Winthrop M. Leeds, and assigned to the assignee of the instant application.

As set forth in the aforesaid patent, after the oil has passed through the inlet passages 19 and has struck the interrupting arc drawn between the contacts 10, 11, it passes through orifices 20 and thence laterally out of the unit 7 by means of a plurality of opposed vent passages 21. Reference may be had to the aforesaid patent for the particular configuration of the plate details and for a more full explanation of the theory of arc interruption. For the purpose of understanding my invention, it is only necessary to know that oil under pressure is forced out of the pressure-generating chamber 18 by the pressure-generating arc, established between the contacts 11, 13, and is forced downwardly into engagement with the interrupting arc to effect the latter's extinction.

Following arc interruption, the bridging member 8 continues its downward opening motion withdrawing the lower movable interrupting contact 10 completely out of the unit 7 to an isolating position. The biasing means, not shown, which causes the downward opening motion of the side operating rod 16, maintains the pivotally mounted pressure-generating contact 13 in its raised position in the open circuit position of the interrupter.

Conventional intermediate contact constructions have generally been equipped with butt contacts. However, a butt-type contact has several disadvantages, as compared to a finger-type contact; i. e., the conducting path is through the arcing surface, the arc surface must absorb high impact when the breaker is closed, and adjustment of the breaker moving contact is critical. On the contrary, a finger contact permits copper-to-copper contact with the arcing surfaces removed from the circuit, and wiping action on closing tending to burnish the surfaces and thereby improve conductivity. Also with the use of finger contacts, there is a greater latitude of adjustment before loss of contact and less impact on the closing operation. It is, therefore,

very desirable to incorporate the finger contact where possible in the interrupter.

Referring to Figs. 3 and 4, it will be observed that in my improved intermediate contact assembly 11, I have provided a pair of double-ended finger contacts 23, the configuration of which is more clearly shown in Figs. 4 and 5. Each finger contact 23 has a pair of recesses 24 formed therein to provide seats for compression springs 25, the outer ends of which seat against the inner wall 26 of a retainer tube 27.

Each finger contact 23 preferably has an arc-resisting tip portion 28 composed of a suitable arc-resisting alloy, such as an alloy of silver and tungsten. Referring to Fig. 4, it will be observed that a recess 29 is also milled out of the inner surface 30 of the contact 23 to accommodate an elongated key 31, preferably of square cross-section. The key 31, therefore, forms a pivotal fulcrum point for slight rotation of the contact fingers 23. The key 31 has its ends seated in square apertures 32 formed in the retainer tube 27, as shown more particularly in Figs. 6 and 7.

It will be noted that the retainer tube 27 is provided with a broken internal flange 33, as more particularly shown in Figs. 6 and 7. The internal flange 33 prevents the fingers 23 from being displaced longitudinally out of the retainer tube 27 when the contact assembly 11 is positioned within the unit 7. In other words, the key 31 and the broken internal flange 33 lock the finger contacts 23 into their proper position, in which position they are biased inwardly by the compression springs 25 to a central position, as shown in Fig. 4.

To fixedly secure the intermediate contact assembly 11 into position, as shown in Figs. 2 and 12, a pair of relatively short metallic screws 12 are provided, one end of each of which is inserted into an aperture 34 drilled through the side wall 35 of the retainer tube 27, as shown more clearly in Fig. 7. Then a pair of elongated fiber screws 12a (Fig. 12) is provided to lock the aforementioned metal screws 12 into position.

To prevent the passage of fluid, for instance oil, directly through the interior of the assembly 11, it will be observed that there is an interlocking construction between the key 31, the fingers 23, and the broken internal flange 33 of the retainer tube 27. Thus, since each contact finger 23 is substantially of semi-circular shape, as shown in Fig. 3, the fingers 23 cooperate with the inner wall 26 of the retainer tube 27 to fill up most of the space therein. The remaining space is blocked by the key 31 and by the internal flange 33.

Referring to Fig. 8, it will be observed that the ends 36 of the square key 31 are rounded so that when the key 31 is in its assembled position, the external periphery of the retainer tube 27 is circular in configuration with no jutting edges of the key 31 protruding, as more clearly shown by an inspection of Fig. 3.

Preferably an elongated wedge-shaped tool 38 is provided, as shown more clearly in Figs. 9-11, to facilitate the assembly and disassembly of the several component parts of the intermediate contact assembly 11. Referring to Figs. 9 and 11, it will be observed that the right-hand end of the tool 38 is of wedge-shaped cross-section, whereas the left-hand portion thereof is of square cross-section or substantially the same dimensions as the key 31, as shown in Fig. 10. Consequently, to assemble the contact assemblage 11, it is only necessary to first insert the contacts 23 within

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the interior of the retainer tube 27 with their compression springs 25, in place, and then by inserting the wedge-end 38a of the tool 38 within one aperture 32 of the retainer tube 27, force the fingers 23 laterally apart against the opposition of their compression springs 25 until the square portion 38b of the tool 38 is within the apertures 32. The key 31 is then driven along with the tool 38 until finally the tool 38 emerges out of the apertures 32 with the key 31 in its wake. Thus, the key 31 will then be in proper position locking the finger contacts 23 into proper place.

To disassemble the finger construction 11, it is merely necessary to drive the key 31 out of the retainer tube 27 by means of the wedge tool 38. When this is done, the compression springs 25 will force the two contacts 23 together within the tube 27. By moving one finger contact slightly laterally within the tube 27, and moving the other finger contact 23 longitudinally until one of the springs 25 associated therewith is exposed, the latter may readily be removed. When this is done, the last-mentioned finger contact 23 is moved longitudinally in the opposite direction until the other compression spring 25 may, in similar manner, be removed. When this is done, the finger contact 23 may be slipped out of the tube 27, and then it is an easy matter to slide the other cooperable finger contact 23 lengthwise out of the retainer tube 27. To assemble the finger contacts 23, the reverse order of operation is utilized.

From the foregoing description, it will be apparent that my improved finger-type contact arrangement 11 possesses all of the advantages of a finger-type contact, but yet has the simplicity approaching that of a butt-type contact. It will be noted that there are only four different items—a retainer tube, a key, four identical springs, and a pair of identical fingers. Its symmetry permits inversion and rotation in the grid assembly, minimizing the possibility of misassembly. It will also be noted that in addition to performing as a conductor when the breaker is closed, the finger contact assembly 11 is an effective seal, blocking oil flow directly down from the pressure-generating chamber 13 through the tube 27 and into the interrupting region. The retainer tube 27 forms a housing which contains the assembly and supports it within the unit 7. The key 31 locks the fingers 23 in assembly, maintains the fingers 23 in position when the breaker is open, blocks oil flow through the assembly, initially compresses the springs 25, and finally provides a fulcrum for pivoting of the fingers 23.

The fingers 23 provide a conducting path from the pressure contact 13 to the interrupting contact 10, and interlock with the tube 27 and the key 31 to block oil flow through the assembly 11. The springs 25 maintain contact pressure when the contacts of the breaker are closed, and center the fingers 23 when the contacts are open. The removal of the square key 31 unloads the springs 25 and permits their removal in the manner heretofore described.

Moreover, it will be observed that the improved intermediate contact assembly 11 has other advantages than simplicity. It is self-contained and compact, yet provides large contact area, protected with large alloy arcing tips. The conducting sections are also relatively large, making maximum use of the available space. Assembly and disassembly can be accomplished with the single tool 38 of Fig. 9. Contact faces are in a common uninterrupted plane facilitating dress-

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ing of areas roughened from use. Each finger 23 is allowed sufficient freedom to permit it to align with the pair of blade-type contacts. It will be observed that the parts are few in number and easily manufactured.

Although I have disclosed a specific structure, it is to be clearly understood that the same was merely for the purpose of illustration, and that changes and modifications may be readily made by those skilled in the art without departing from the spirit and scope of the appended claims.

I claim as my invention:

1. A circuit interrupter including a movable contact, an intermediate contact finger assembly, a second movable contact, the intermediate contact finger assembly including a housing having an internal flange portion intermediate the ends of the housing, a pair of opposed double-ended finger contacts having recesses at their back sides, the flange portion extending within the recesses, and a removable locking key extending across the housing between the opposed finger contacts and furnishing a fulcrum point for rocking motion of the finger contacts.

2. Intermediate contact structure for a circuit interrupter including a housing, a pair of opposed double-ended finger contacts disposed within the housing, a removable locking key extending across the housing between the opposed finger contacts, spring means biasing the finger contacts toward each other, and interlocking means between the back sides of the finger contacts and the inner wall of the housing to prevent substantial fluid flow through the housing at the back sides of the finger contacts.

3. A circuit interrupter including a movable contact, an intermediate contact finger assembly, a second movable contact, the intermediate contact finger assembly including a housing having an internal flange portion intermediate the ends of the housing, a pair of opposed double-ended finger contacts having recesses at their back sides, the flange portion extending within the recesses, a removable locking key extending across the housing between the opposed finger contacts and furnishing a fulcrum point for rocking motion of the finger contacts, and spring means biasing the finger contacts toward each other.

4. Intermediate contact structure for a circuit interrupter including a retainer tube having a broken internal flange midway between the ends thereof, a pair of double-ended finger contacts having recesses at their back sides, the flange fitting into the recesses to provide a substantially fluid-tight passage through the tube at the back sides of the finger contacts, an elongated removable locking key extending across the tube between the finger contacts to provide a fulcrum therefor, and spring means biasing the finger contacts toward each other.

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REFERENCES CITED

The following references are of record in the file of this patent:

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Number	Name	Date
2,123,631	Koehler	July 12, 1938
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