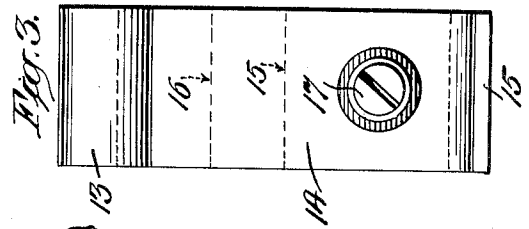
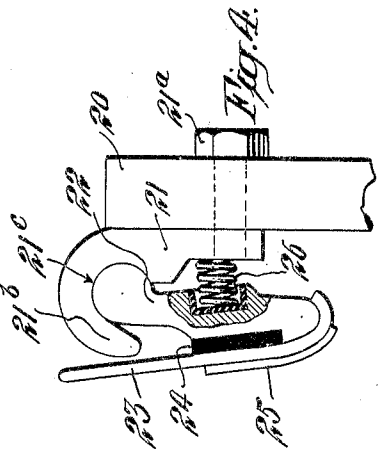
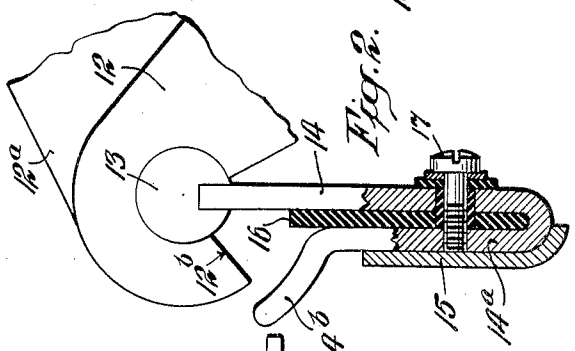
Aug. 31, 1943. J. D. WOOD 2,328,318

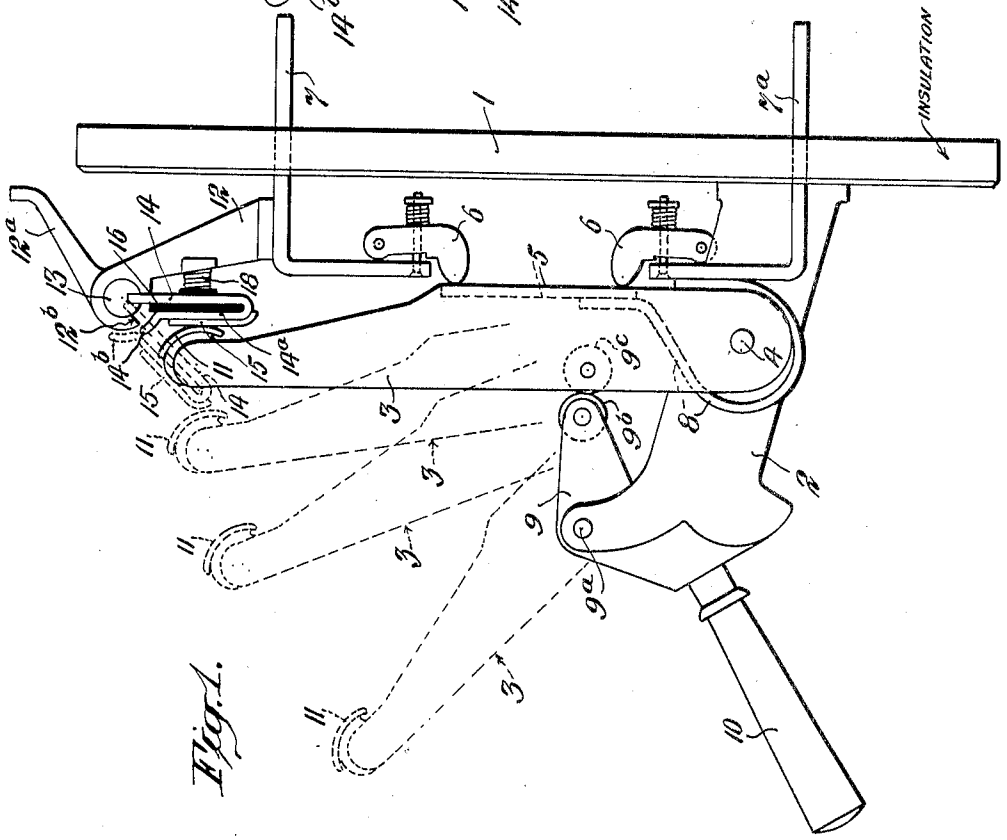
CIRCUIT BREAKER CONTACT

Filed April 3, 1942









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Patented Aug. 31, 1943 2,328,318

UNITED STATES PATENT OFFICE

2,328,318

CIRCUIT BREAKER CONTACT

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Application April 3, 1942, Serial No. 437,503

3 Claims. (Cl. 200—147)

This invention relates to improved contacts for circuit breakers and the like which may be manually or otherwise operated and is applicable to many various forms and types of circuit breakers.

The main object of the invention is to provide an improved construction of the arcing contacts at which the circuit is finally broken and wherein the electrodynamic action will tend to maintain the contacts closed and also tend to force the arc away from the adjoining parts of the switch. Another object is to accomplish this purpose with contacts of a comparatively simple form which may be conveniently and economically manufactured. Another object is to prolong the durability or life of the contact parts. Another object is to reduce the amount of care and attention required for maintaining them in proper operable condition. Other objects and advantages will be understood from the following description and accompanying drawing illustrating preferred embodiments thereof.

Fig. 1 is a side view of a conventional form of circuit breaker showing one form of the improved contact incorporated therewith; Fig. 2 is an enlarged sectional view of the contact; Fig. 3 is a rear view of the contact; and Fig. 4 is a side view of a modified form of contact.

The prior so-called inverted type of contact has the advantage that the electrodynamic forces tend to force the contacts together which aids in maintaining good electrical connection between them. However, it has the objection that when the contacts are separated, the arc is blown inwardly toward other portions of the circuit breaker instead of being blown outwardly and away from the circuit breaker parts whereby the arc may be more effectively extinguished. Thus the so-called inverted type although desirable for maintaining good contact engagement, is objectionable with reference to extinguishment of the arc and protection of the adjoining parts. In the prior type of switch having non-inverted arcing contacts, the opposite conditions occur because the electrodynamic forces tend to separate the contacts. This not only decreases the contact pressure but results in the electrodynamic forces separating the contacts before the movable element of the breaker has moved sufficiently to insure the arc being formed at the most desirable portions of the contacts for the formation of the arc. On the other hand, the non-inverted type of contacts has the advantage of tending to force the arc outwardly and away from the adjoining portions of the breaker. The present invention obtains the advantages over each of these prior forms and likewise overcomes their objections.

In Fig. 1, a supporting panel 1 of insulating material is shown which supports a pair of forwardly extending brackets 2 on the face thereof. A movable conducting member in the form of a pair of contact arms 3 are pivotally mounted on the pin 4 carried by the brackets 2. Between the contact arms and at their inner portions is carried a conducting contact plate 5 engaged by the spring pressed contacts 6 which are in turn electrically connected with and mounted upon the leads 7 and 7a respectively. These leads are connected to the circuit controlled by the breaker. A flexible lead 8 is connected between the contact plate 5 and the lead 7a for maintaining good electrical connection between the lead 7a and the contact arms when the breaker is opened. The breaker may be closed or opened by any means desired and in the present case manual means is indicated. This is in the form of a pair of plates 9 pivotally mounted on a pin 9a supported by the brackets 2. The arms 9 carry between them a roller 9b which is adapted to engage a roller 9c carried between the arms 3. An insulated handle 10 is secured to the arms 9 for forcing the contact arms by a downward movement of the handle to the closed position by a common form of toggle and locking action. When the handle 10 is moved upwardly the contact arms are free to move outwardly for interrupting the circuit.

The contact arms carry at their inner upper ends an arcing contact 11 which engages the arcing contact carried by a fixed conducting member or support 12 electrically connected with and supported by the lead 7 and extending upwardly or outwardly therefrom. This conducting metal member is provided with an upwardly or outwardly extending arcing horn 12a and with a cylindrical opening. Within this cylindrical opening is fitted a rotatable conducting cylinder 13 having fixed thereto and downwardly extending therefrom, or inwardly with reference to the breaker, a conducting metal plate 14. This plate is bent on itself and then extends upwardly, or outwardly with reference to the breaker, in a portion 14a and terminates in an upwardly or outwardly extending horn 14b. The side portions 14 and 14a with their inner connected ends form a conducting element of general U form. On the front face of the side portion 14a is secured a plate 15 of arc-resisting metal which engages the arcing contact 11 carried by

the contact arms. This improved form of contact is more clearly shown in Figs. 2 and 3. The conducting plate side portion 14 is in good electrical connection through the cylinder 13 with the conducting member 12 which forms a pivotal support for the outer end of the portion 14 of the conducting element. A sheet of insulation 16 is introduced between the side portion or plate 14 and the side portion 14a of the U-shaped conducting element. An insulated screw bolt 17 is passed through the rear portion of the plate and through the insulation 16 and has a threaded engagement with the front portion 14a of this U-shaped contact finger for the purpose of holding these parts firmly together. The arcing contact 15 is brazed or otherwise secured to the conducting portion 14a. As shown in Fig. 1, a spring 18 is supported by the bracket 12 and engages the head of the insulated bolt 17, being thereby insulated from the conductor 14. This spring forces the conductor 14 outwardly for assisting in maintaining good contact between the contact surfaces. The lower portion of the cylindrical opening is cut away to permit a rotary movement of the cylinder 13 and the pivoted conducting element, the outer face 12b of this opening serving as a stop to limit the outward movement of the element.

When the breaker is brought to the closed position shown in Fig. 1 by moving the handle 10 downwardly, the main path of the current is from the lead 7a to the lower contacts 6 and plate 5 and then to the upper contacts 6 and lead 7. In the opening movement of the breaker, the first effect is to open the connection between the plate 5 and upper contacts 6. This causes the current to pass through a path from the lead 7a upwardly through the contact arms 3 of the breaker, through the arcing contacts 11 and 15 and then downwardly or inwardly through conducting portion 14a and then upwardly or outwardly through the conducting plate 14 to the cylinder 13 and downwardly or inwardly through the conducting member 12 to lead 7. As the contact arms move outwardly, the spring pressed conducting element moves outwardly on its pivot formed by the cylinder 13 following the contact face 11 and maintaining engagement therewith. During this action the contact area between the surfaces 11 and 15 moves downwardly on the face of metal contact 15 and the current then passes inwardly to the lower portion of the contact 15 and then upwardly or outwardly through the conductor 14 to the cylinder 13 and downwardly or inwardly through the conducting member 12 to the lead 7. This forms a loop in which the current passes in opposite directions in the two sides of the loop formed by the conductor 12 and the conductor 14 creating an electrodynamic force against the conductor 14 which serves to force it towards the contact 11 and thereby maintain good electrical contact therewith. This electrodynamic pressure is maintained as long as any current passes through the breaker giving the advantage of the inverted contact in this respect.

When the contact 11 is about to separate from the contact 15, the conductor 14 has engaged the stop formed by the surface 12b and the parts are then in the first dotted line position shown. The arc between the contacts 11 and 15 is now about to form and at this time the current passes upwardly or outwardly through the conducting member 3 to the arcing contact 11 and arcing contact 15 and then through the contact 15 and side portion 14a of the U shaped conducting element to the side portion 14. This creates a magnetic field localized at the arc tending to blow the arc outwardly from the current path and outwardly along the arcing contacts. This secures the advantage of non-inverted contacts in forcing the arc away from the conducting parts of the breaker and outwardly. When the contacts separate, the arc is driven outwardly more and more as the separation continues and in the second dotted line position the arc will extend from the contact 11 to the upper portion of the contact 15 and will be driven up the horn 14b to the horn 12a. The arcing is finally interrupted before the contact arm 3 reaches the third dotted line position which is the final open position.

In Fig. 4 another form of arcing contact is shown which is supported by the downwardly or inwardly extending fixed conducting member 20 which is electrically connected with and supported by the lead 7 of the former figures. A metal casting 21 is secured to the conductor 20 as by the bolt 21a and extends upwardly and forwardly with a downwardly extending hook 21b forming a cylindrical bearing 21c. A conducting block 22 which may preferably be in the form of a series of plates mounted side by side, has its upper cylindrical end journaled in the bearing 21c. This block or series of plates extends downwardly and supports from its lower end an upwardly extending horn 23 or a plurality of horns side by side which pass in front of the hook 21b. A layer of insulation 24 is introduced between the main portion of the horn or horns 23 and the block or plates 22 but this may sometimes be omitted and the space left as an air space. The front lower portion of the horn or horns is faced with a strip or strips 25 of arc resisting metal. The conductor 22 or series of conducting plates is forced outwardly by one or more springs 26 seated between the casting 21 and the conductor 22 and insulated from the conductor 22. The arcing contact 11 of the contact arm engages the contact 25 in the same manner as shown in Fig. 1 where it engages the contact 15. The action is similar to that described with reference to Fig. 1 when the breaker is opened, the electrodynamic forces serving to maintain good electrical contact between the surfaces of the engaging contacts up to the time of the separation of the contact 11 from the contact 25. The outward movement of the conductor 22 is limited by its engaging the inside of the hook 21b and when the contacts separate, the electrodynamic action forces the arc upwardly and outwardly along the contact 25 and to the upper portion of the horn 23. The final interruption of the arc takes place between the contact 11 of the contact arm and the upper portion of the horn 23 before the contact arm arrives at its fully open position.

Although preferred embodiments of the invention have been described various modifications may be made without departing from the scope thereof.

I claim:

1. A circuit breaker comprising a movable conducting member, a fixed conducting member, one of said members having an arcing contact surface, a conducting element of general U form having one side portion of the U extending inwardly with reference to the breaker and pivotally mounted at its end on the other of said members and the other side portion of the U extending outwardly with reference to the breaker and having an arcing contact surface engaged by said first named arcing contact surface when

the breaker is closed, the first named side portion forming a loop circuit with the member on which it is pivotally mounted for electrodynamically forcing said conducting element against said first named arcing surface when the breaker is closed and during its opening movement, and the second named side portion forming a circuit through said engaging contact surfaces for electrodynamically forcing the arc outwardly along the contact surfaces upon the separation of said contacting surfaces.

2. A circuit breaker comprising a movable conducting member, a fixed conducting member, one of said members having an arcing contact surface, a conducting element of general U form having one side portion of the U extending inwardly with reference to the breaker and pivotally mounted at its end on the other of said members and the other side portion of the U extending outwardly with reference to the breaker and having an arcing contact surface engaged by said first named arcing contact surface when the breaker is closed, the first named side portion forming a loop circuit with the member on which it is pivotally mounted for electrodynamically forcing said conducting element against said first named arcing surface when the breaker is closed and during its opening movement, and the second named side portion forming a circuit through said engaging contact surfaces for electrodynamically forcing the arc outwardly along the contact surfaces upon the separation of said contacting surfaces, said second named side portion having an arcing horn extending outwardly with reference to the breaker from its contact surface.

3. A circuit breaker comprising a movable conducting member, a fixed conducting member, one of said members having an arcing contact surface, a conducting element of general U form having one side portion of the U extending inwardly with reference to the breaker and pivotally mounted at its end on the other of said members and the other side portion of the U extending outwardly with reference to the breaker and having an arcing contact surface engaged by said first named arcing contact surface when the breaker is closed, the first named side portion forming a loop circuit with the member on which it is pivotally mounted for electrodynamically forcing said conducting element against said first named arcing surface when the breaker is closed and during its opening movement, and the second named side portion forming a circuit through said engaging contact surfaces for electrodynamically forcing the arc outwardly along the contact surfaces upon the separation of said contacting surfaces, the said member which pivotally supports the conducting element having an arcing horn extending outwardly with reference to the breaker.

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