Dec. 29, 1953 F. J. POKORNY 2,664,479

BLOW-ON CONTACT STRUCTURE

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FIG. 1

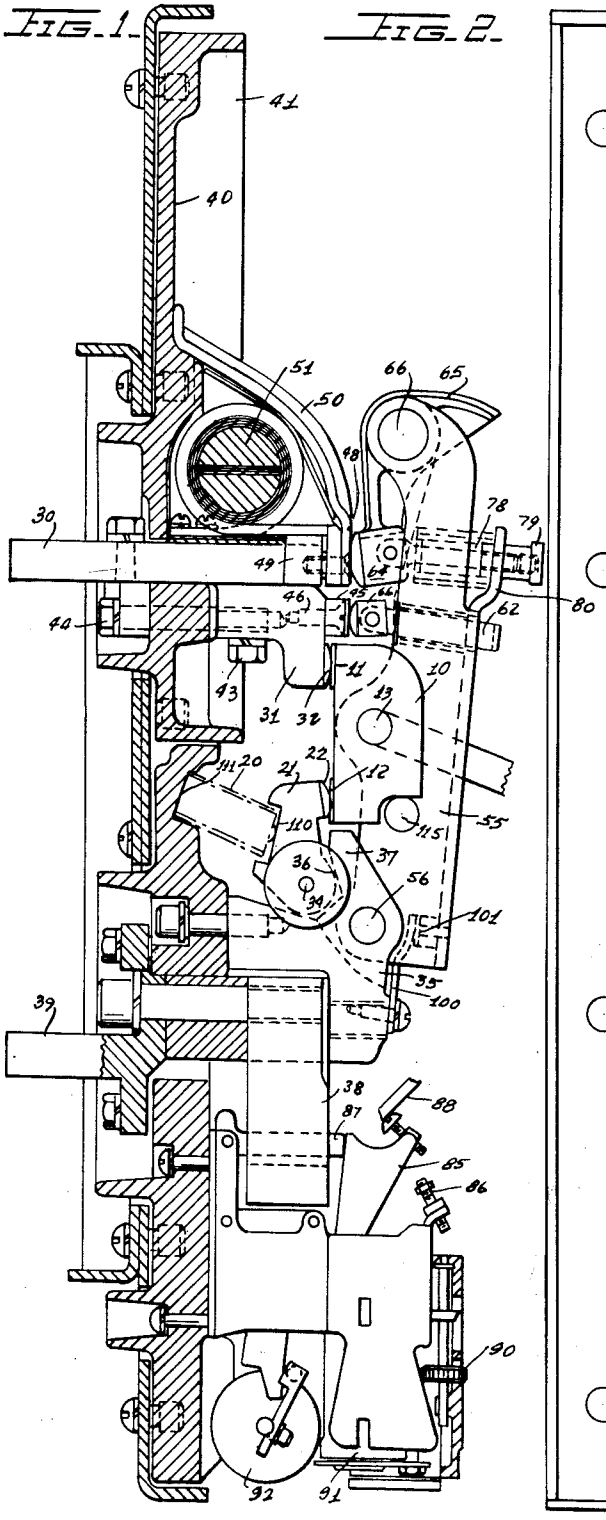
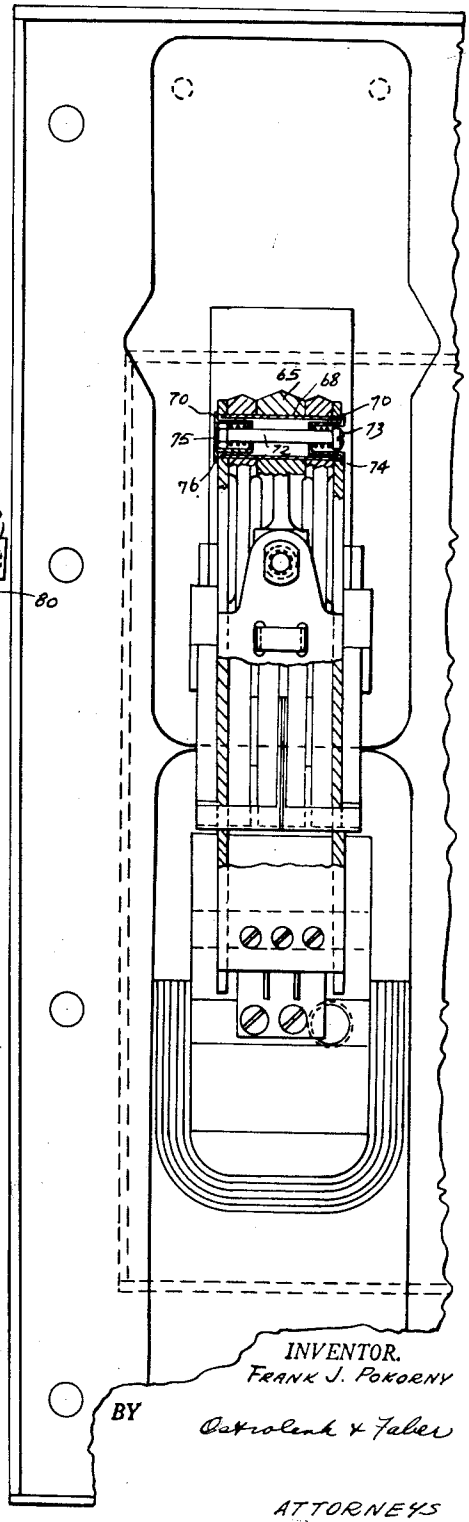


FIG. 2



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BLOW-ON CONTACT STRUCTURE

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9 Claims. (Cl. 200—87)

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My present invention relates to circuit breakers, and more particularly to a contact arrangement for circuit breakers wherein the electromagnetic forces which arise owing to an angular or U-shaped current path which is provided in the circuit breaker around the contacts are utilized to create a blow-on effect; that is, a net electro-motive force tending to increase the contact pressure.

Essentially, my invention contemplates a circuit breaker contact having an upper contact element adapted to engage an upper stationary contact element and a lower contact element adapted to engage a lower complementary contact. This principal contact member is pivotally mounted on a movable contact arm in such manner that the lever arm from the pivot to the upper contact element is shorter than the lever arm from the pivot to the lower contact element.

The current path forms essentially two right angles, one on each of the contact elements so that the current path through the main contact is U-shaped. The electromagnetic forces owing to the bend in the current path tend, as is well known, ordinarily to effect separation of contacts at the bend. However, since the portion of the contact member below the pin is longer than the portion of the contact member above the pin, the blow-off effect at the lower end of the contact member has a net force not only overcoming the blow-off effect at the upper end of the contact member, but also increasing contact pressure at the upper end of the contact member.

The opening spring for the entire contact assembly is so arranged that it acts through the lower complementary contact on the lower end of the contact member so that the blow-off effect at this point is compensated for entirely by this opening spring which, therefore, acts also as a contact pressure spring.

By this means, therefore, the electromagnetic forces created by the U-shaped current path produce a blow-on effect at the contact and increase contact pressure.

The primary object of my invention, therefore, is the provision of novel means for utilizing the electromagnetic forces present in a circuit breaker structure owing to the conformation of the current path therethrough to create additional contact pressure.

Another and complementary object of my invention is the utilization of the opening spring for the contact arm as a contact pressure spring for the lower complementary contact so that appropriate contact pressure may be created for this end of the contact.

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The foregoing and many other objects of my invention will become apparent in the following description when taken in connection with the drawing in which:

Figure 1 is a side view partly in cross-section of my novel circuit breaker structure embodying my blow-on contact.

Figure 2 is a front view partly broken away showing my novel circuit breaker in a three pole housing.

As previously pointed out, the essence of the invention is the blow-on contact arrangement provided for contact 10 and its contact elements 11 and 12, achieved by the formation of contact 10 so that the lever arm from pivot pin 13 of contact 10 to contact element 11 is shorter than the lever arm from pivot pin 13 of contact 10 to contact element 12. Thus, blow-off tendency at contact element 11 is counteracted by a greater similar tendency at contact element 12, which latter contact element, as hereinafter described, is subject to the direct action of opening spring 20 acting on contact 21 and its contact element 22.

In the circuit breaker structure shown, the main current path is from upper back connection stud 30 to the upper main stationary contact 31 to the main stationary contact element 32 to contact element 11 of contact 10 to contact element 12 of contact 10 to contact element 22 of pivoted contact 21. The current path then divides in parallel paths through the bearing 34 of contact 21 to the terminal 35 and also through contacting surface 36 of contact 21 and contacting extension 37 of terminal 35 to the terminal 35. From terminal 35 current flows to series trip coil 38 and then to lower back connection stud 39.

As above mentioned, the essence of the invention is the blow-on arrangement of contact 10, achieved by the right angle arrangement of the current path at contact elements 11 and 32 at one end and contacts 12 and 22 at the other end and by the fact that the lever arm from pin 13 to contact element 12 is greater than the lever arm from pin 13 to contact element 11; but, for a full understanding of the operation of my invention, the complete circuit breaker structure will now first be described.

The entire circuit breaker structure is supported on an insulating back panel 40 suitably shaped to receive and position the parts and having side extensions 41 providing some interphase protection where the circuit breaker is used as a multi-pole circuit breaker. The main stationary contact 31 is secured to stud 30 by bolt 43 and to panel 40 by bolt 44. Intermediate contact 45 is also secured to main contact 31 by bolt 46. The

arcing contact 48 is spaced from stud 30 by insulation 49 and is extended into back arcing horn 50 which in turn is connected through blow-out coil 51 to back connection stud 30.

The movable contact carrying arm 55 is mounted for rotation on pin 56 carried by lower terminal 35 and is rotatable about said pin 56 between the closed position (shown in Fig. 1) and the open position.

The operating mechanism (not shown) for moving the arm 55 to closed position and maintaining it there is connected by link 58 to pin 13, which in turn is carried by arm 55. The movable intermediate contact 60 is mounted on U-shaped strap 62 carried by the arm 55.

The movable driving contact element 64 is mounted on the end of arcing contact 65 which in turn is pivotally mounted at 66 at the upper end of arm 55 on sleeve 68 and is in current carrying engagement with arm 55 by reason of flanged end cups 70 and bolt 72.

The head 73 of bolt 72 compresses the spring 74 between it and the base of one of the end cups 70. The nut 75 at the other end of bolt 72 compresses the spring 76 between it and the base of the other end cup 70, thereby permitting the flanges of the end cups 70 to exert a strong contact pressure.

The lower end of the arcing contact 65 is moved toward the stationary arcing contact 48 by compression spring 78 compressed between adjustable nut 79 carried by the front wall 80 of the movable arm 55 and the contact element 64.

When the trip coil 38 is appropriately energized the armature 85 is attracted from its back-stop 86 to engage the magnet 87, and at that point operates a tripper bar 88 for the operating mechanism so that the link 58 no longer holds the contact arm 55 in the closed position.

Thereafter, the opening spring 20, hereinafter described, will move the contact arm 55 clockwise about the pin 56 to the open position.

The elements shown below the back-stop 86 are conventional calibrating elements 90 for the pick-up value of the armature and time delay elements 91 and 92 for various operations of the armature. These are now well known and require no further description here.

The terminal 35 carries the spring contact member 100 engaging contact element 101 at the lower end of the movable contact arm 55 providing for a connection between the lower terminal 35 and the movable contact arm 55 so that the intermediate contact 60 and the arcing contact element 64 are provided with an appropriate current path for formation and extinguishment of the arc even after the movable contact arm 55 opens. The contact element 100 replaces the flexible shunt or pigtail, which previously has been used for this purpose.

The complementary contact 21, as previously pointed out, is mounted on pin 34 carried by terminal 35. The opening spring 20 is compressed between the recess 110 on the back side of complementary contact 21 and the recess 111 in the lower back panel 40. Thus, the opening force on the movable contact arm 55 is transmitted from recess 111 through compression spring 20, through recess 110 of complementary contact 21 to the contact element 12 of the main movable contact 10, through back-stop pin 115 for contact 10, the said pin 115 being fixedly mounted on the arm 55, thereby urging the arm 55 in a clockwise direction around its pivot pin 56. The spring 20 thereby creates appropriate contact pressure between contact elements 22 and 12.

At the same time, by biasing the contact member 21 in a clockwise direction about its pivot 34, the contact surface 36 which is above the pin 34 is pressed against contact element 37 of the terminal 35 to provide an efficient current carrying path.

The important aspect of my present invention is that when the circuit breaker is closed the contact arrangement is such that a blow-on occurs, thereby utilizing the U-shaped current path from contact element 32 through contact 10 to contact element 22 to assist in maintaining the contact in firm engagement. The movement of the contact arm 55 to closed position brings contact element 11 of contact member 10 against the contact element 32 to rotate the contact 10 away from its back-stop pin 115 and further compress the spring 20, thereby creating an efficient contact pressure not only between contact elements 11 and 32, but also between contact elements 12 and 22.

Since the lever arm from pin 13 to contact element 12 is longer than the lever arm from pin 13 to contact element 11, the blow-off effect which occurs by reason of the angular current path at contact element 12, thereby serving to drive the contact member 10 in a counterclockwise direction, overcomes the opposite blow-off effect at contact element 11 to create additional contact pressure at contact element 11 and thereby create a net electromagnetic force driving contact elements 11 and 32 into firmer engagement.

The location of the compression spring 20 so that it drives contact 21 toward contact element 12 serves directly to maintain a firm contact at the lower end of the contact member 10. By this means, therefore, a simplified circuit breaker contact arrangement is provided whereby a net blow-on effect is achieved and the electromagnetic forces which ordinarily tend to separate the contacts or weaken the contact pressure are instead utilized to increase contact pressure.

In the foregoing I have described my invention solely in connection with specific embodiments thereof. Since many variations and modifications of my invention will now be obvious to those skilled in the art, I prefer to be bound not by the specific disclosures herein contained but only by the appended claims.

I claim:

1. A blow-on contact structure for electrical switch gear comprising a movable pivoted contact carrying arm; a contact member pivotally carried by said contact arm; said contact member having a first contact element and a second contact element located on opposite sides of the pivotal mounting of said contact member; a first complementary contact engageable with said first contact element; a second complementary contact engageable with said second contact element said first contact and said second contact in an electrical series circuit, the first contact element being closer to the pivotal mounting of said contact member than the second contact element; and biasing means for said second complementary contact urging it toward said second contact element.

2. A blow-on contact structure for electrical switch gear comprising a movable pivoted contact carrying arm; a contact member pivotally carried by said contact arm; said contact mem-

ber having a first contact element and a second contact element located on opposite sides of the pivotal mounting of said contact member; a first complementary contact engageable with said first contact element; a second complementary contact engageable with said second contact element; the first contact element being closer to the pivotal mounting of said contact member than the second contact element; and biasing means for said second complementary contact urging it toward said second contact element; the line of contact between said contact elements and their respective complementary contacts being substantially parallel to the major axis of said contact member, a single current path through each contact element and its complementary contact being at a substantial angle to the current path through the contact member.

3. A blow-on contact structure for electrical switch gear comprising a movable pivoted contact carrying arm; a contact member pivotally carried by said contact arm; said contact member having a first contact element and a second contact element located on opposite sides of the pivotal mounting of said contact member; a first complementary contact engageable with said first contact element; a second complementary contact engageable with said second contact element; the first contact element being closer to the pivotal mounting of said contact member than the second contact element; and biasing means for said second complementary contact urging it toward said second contact element; the line of contact between said contact elements and their respective complementary contacts being substantially parallel to the major axis of said contact member, a single current path through each contact element and its complementary contact being at a substantial angle to the current path through the contact member, and creating, when the circuit breaker is closed, electromagnetic opening forces at said contact elements.

4. A blow-on contact structure for electrical switch gear comprising a movable pivoted contact carrying arm; a contact member pivotally carried by said contact arm; said contact member having a first contact element and a second contact element located on opposite sides of the pivotal mounting of said contact member; a first complementary contact engageable with said first contact element; a second complementary contact engageable with said second contact element; the first contact element being closer to the pivotal mounting of said contact member than the second contact element; and biasing means for said second complementary contact urging it toward said second contact element; the line of contact between said contact elements and their respective complementary contacts being substantially parallel to the major axis of said contact member, the current path through each contact element and its complementary contact being at a substantial angle to the current path through the contact member, the current path through said contact elements and said contact member being U-shaped and creating, when the circuit breaker is closed, electromagnetic opening forces at said contact elements.

5. A blow-on contact structure for electrical switch gear comprising a movable pivoted contact carrying arm; a contact member pivotally carried by said contact arm; said contact member having a first contact element and a second contact element located on opposite sides of the pivotal mounting of said contact member; a first complementary contact engageable with said first contact element; a second complementary contact engageable with said second contact element; the first contact element being closer to the pivotal mounting of said contact member than the second contact element; and biasing means for said second complementary contact urging it toward said second contact element; the line of contact between said contact elements and their respective complementary contacts being substantially parallel to the major axis of said contact member, the current path through each contact element and its complementary contact being at a substantial angle to the current path through the contact member, the current path through said contact elements and said contact member being U-shaped and creating, when the circuit breaker is closed, electromagnetic opening forces at said contact elements, the greater distance of the second contact element from the pivotal mounting translating said electromagnetic opening force at that contact into a mechanical closing force at the first contact element exceeding the electromagnetic opening force at said first contact element.

6. A blow-on contact structure for electrical switch gear comprising a movable pivoted contact carrying arm; a contact member pivotally carried by said contact arm; said contact member having a first contact element and a second contact element located on opposite sides of the pivotal mounting of said contact member; a first complementary contact engageable with said first contact element; a second complementary contact engageable with said second contact element; the first contact element being closer to the pivotal mounting of said contact member than the second contact element; and biasing means for said second complementary contact urging it toward said second contact element; the line of contact between said contact elements and their respective complementary contacts being substantially parallel to the major axis of said contact member, the current path through each contact element and its complementary contact being at a substantial angle to the current path through the contact member, the current path through said contact elements and said contact member being U-shaped and creating, when the circuit breaker is closed, electromagnetic opening forces at said contact elements, the greater distance of the second contact element from the pivotal mounting translating said electromagnetic opening force at that contact into a mechanical closing force at the first contact element exceeding the electromagnetic opening force at said first contact element and driving said first contact element into firmly closed position.

7. A blow-on contact structure for electrical switch gear comprising a movable pivoted contact carrying arm; a contact member pivotally carried by said contact arm; said contact member having a first contact element and a second contact element located on opposite sides of the pivotal mounting of said contact member; a first complementary contact engageable with said first contact element; a second complementary contact engageable with said second contact element; the first contact element being closer to the pivotal mounting of said contact member than the second contact element; and biasing

means for said second complementary contact urging it toward said second contact element; the line of contact between said contact elements and their respective complementary contacts being substantially parallel to the major axis of said contact member, the current path through each contact element and its complementary contact being at a substantial angle to the current path through the contact member, the current path through said contact elements and said contact member being U-shaped and creating, when the circuit breaker is closed, electromagnetic opening forces at said contact elements, the greater distance of the second contact element from the pivotal mounting translating said electromagnetic opening force at that contact into a mechanical closing force at the first contact element exceeding the electromagnetic opening force at said first contact element and driving said first contact element into firmly closed position; the biasing means at the second complementary contact having a component of force in the same direction as the electromagnetic opening force at said second contact element and exceeding the electromagnetic opening force at said second contact element.

8. A blow-on contact structure for electrical switch gear comprising a movable pivoted contact carrying arm; a contact member pivotally carried by said contact arm; said contact member having a first contact element and a second contact element located on opposite sides of the pivotal mounting of said contact member; a first complementary contact engageable with said first contact element; a second complementary contact engageable with said second contact element; the first contact element being closer to the pivotal mounting of said contact member than the second contact element; and biasing means for said second complementary contact urging it toward said second contact element; the line of contact between said contact elements and their respective complementary contacts being substantially parallel to the major axis of said contact member, the current path through each contact element and its complementary contact being at a substantial angle to the current path through the contact member, the current path through said contact elements and said contact member being U-shaped and creating, when the circuit breaker is closed, electromagnetic opening forces at said contact elements, the greater distance of the second contact element from the pivotal mounting translating said electromagetic opening force at that contact into a mechanical closing force at the first contact element exceeding the electromagnetic opening force at said first contact element and driving said first contact element into firmly closed position; the biasing means at the second complementary contact having a component of force in the same direction as the electromagnetic opening force at said second contact element and exceeding the electromagnetic opening force at said second contact element, said biasing means acting through said second contact element and said contact member also to drive said first contact element into firm contact engagement with said first complementary contact.

9. A blow-on contact structure for electrical switch gear comprising a movable pivoted contact carrying arm; a contact member pivotally carried by said contact arm; said contact member having a first contact element and a second contact element located on opposite sides of the pivotal mounting of said contact member; a first complementary contact engageable with said first contact element; a second complementary contact engageable with said second contact element; the first contact element being closer to the pivotal mounting of said contact member than the second contact element; and biasing means for said second complementary contact urging it toward said second contact element; the line of contact between said contact elements and their respective complementary contacts being substantially parallel to the major axis of said contact member, the current path through each contact element and its complementary contact being at a substantial angle to the current path through the contact member, the current path brough said contact elements and said contact member being U-shaped and creating, when the circuit breaker is closed, electromagnetic opening forces at said contact elements, the greater distance of the second contact element from the pivotal mounting translating said electromagnetic opening force at that contact into a mechanical closing force at the first contact element exceeding the electromagnetic opening force at said first contact element and driving said first contact element into firmly closed position; the biasing means at the second complementary contact having a component of force in the same direction as the electromagnetic opening force at said second contact element and exceeding the electromagnetic opening force at said second contact element, said biasing means acting through said second contact element and said contact member also to drive said first contact element into firm contact engagement with said first complementary contact, said biasing means acting also through said second complementary contact and said second contact element and the contact member as an opening spring for the contact arm.

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