July 29, 1947. E. O. OBERDICK 2,424,626

CIRCUIT BREAKER AND CONTACT THEREFOR

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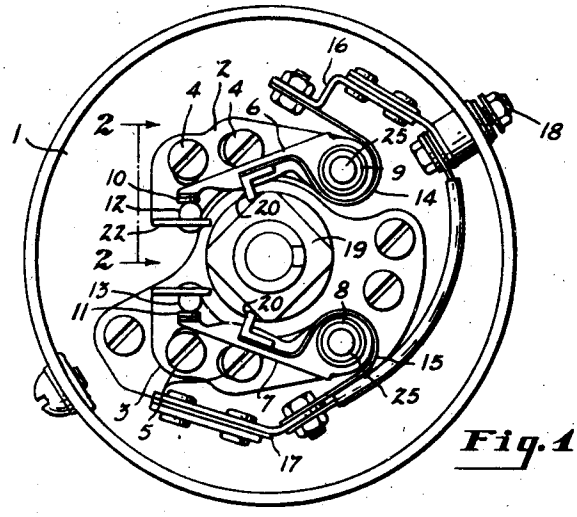


Fig. 1

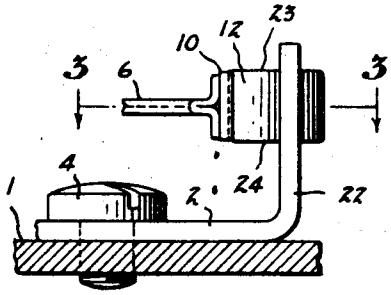


Fig. 2

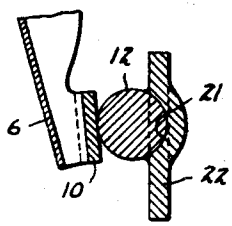


Fig. 3

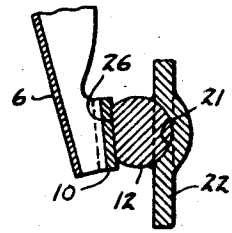


Fig. 4

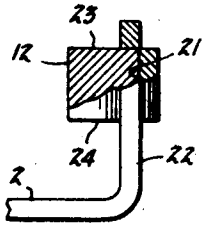


Fig. 5

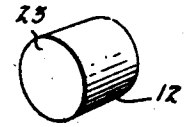


Fig. 6

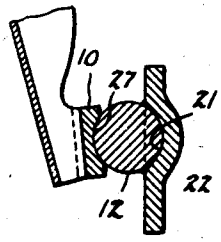


Fig. 7

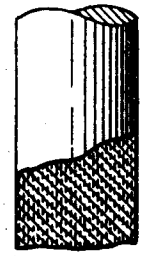


Fig. 8

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CIRCUIT BREAKER AND CONTACT THEREFOR

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7 Claims. (Cl. 200—30)

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My invention relates to circuit breakers and more particularly to improved contacts for the stationary arms of such circuit breakers and to the method of preparing and attaching the contact to the stationary arm.

In electrical systems and particularly in distributing systems utilized in the automotive industry, a circuit breaker is provided including a plurality of stationary arms, each having a contact affixed thereto and a plurality of pivoted arms, each carrying a contact at its free end which is normally maintained in engagement with one of the fixed contacts by suitable means, such as a spring, to establish an electrical circuit which is intermittently interrupted by means of cams upon a rotatable timer shaft that engage the pivoted arms and move their contacts from engagement with the fixed contacts.

Methods which have heretofore been devised for affixing contacts to the stationary arms, however, require a large number of operations and consequently the manufacture of such arms with the contact in place is not only costly but is time consuming. For instance, in such processes, it is customary to saw a flat contact from the end of a round rod, braze or otherwise secure the contact to a screw or rivet, radius grind the flat contact to provide a convex surface having substantially a point contact, and then attach the rivet to the fixed arm by a spinning operation.

It is the aim of the present invention to provide a circuit breaker in which a contact of an improved form is affixed to a stationary arm and to an improved process of attaching the contact to the stationary arm. My invention also contemplates providing an improved circuit breaker including a stationary arm provided with a cylindrical or substantially cylindrical contact in which the grain structure of the metal forming the contact is perpendicular to its end faces and the cylindrical surface of which is adapted to be engaged by a movable contact over substantially its entire length to provide low resistance, quick distribution of the current, and less corrosion due to electrical sparking than when a radius ground contact is utilized on the stationary arm.

It is therefore an object of the present invention to provide a circuit breaker including a stationary arm having affixed thereto a contact of an improved form.

Another object of my invention is to provide an improved process of preparing and affixing a contact to the stationary arm of a circuit breaker.

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A further object of my invention is to provide an improved circuit breaker in which the stationary arm is provided with a contact of substantially cylindrical form and in which the grain structure is substantially perpendicular to its end faces and a second contact which is movable into and from engagement with the cylindrical surface of the contact over substantially its entire length.

Another object of my invention is to provide a circuit breaker having a stationary contact of substantially cylindrical form and a contact having a concave recess therein which is movable into engagement with the cylindrical surface on the stationary contact and which during engagement makes contact therewith over a comparatively large area.

A still further object of my invention is to provide an improved circuit breaker having a stationary arm provided with a contact of substantially cylindrical form with a segment flattened along its entire length to provide a surface of comparatively large area and a movable arm provided with a substantially flat contact which is movable to engage the flattened portion of the cylindrical contact over substantially its entire area.

My invention will be better understood by reference to the accompanying drawings in which:

Fig. 1 is a plan view of a circuit breaker having stationary and movable arms, each of the stationary arms being provided with my improved contact;

Fig. 2 is a view on an enlarged scale taken on a plane passing through the line 2—2 of Fig. 1 looking in the direction of the arrows;

Fig. 3 is a cross sectional view on the line 3—3 of Fig. 2;

Fig. 4 is a view similar to that shown in Fig. 3 but showing a modification of my improved contact;

Fig. 5 is a view partly in elevation and partly in section showing my improved contact attached to the stationary arm;

Fig. 6 is a perspective view of my improved contact;

Fig. 7 is a view similar to those shown in Figs. 3 and 4 but showing a modified form of the movable contact; and

Fig. 8 is a view partly in elevation and partly in section showing diagrammatically the grain structure of the contact.

While stationary arms provided with my improved contact may be utilized in any desired circuit breaking system provided with suitable

means for normally maintaining a movable contact in engagement with a stationary contact to establish an electrical circuit and with means for disengaging the movable contact from the stationary contact to interrupt the circuit, for purposes of illustration, a circuit breaker forming part of a current distribution system is shown comprising a support 1, stationary arms 2 and 3 secured to the support by suitable means, such as screws 4 and 5, and a pair of arms 6 and 7 pivotally mounted upon support 1 but insulated therefrom by tubes 8 and 9 formed of a suitable molded material. As shown, movable arms 6 and 7 are provided with contacts 10 and 11 which are normally maintained in engagement with contacts 12 and 13 on the stationary arms by means of respective springs 14 and 15, the other ends of the springs being attached to arms 16 and 17, respectively, which, in turn, are supported by a terminal 18 leading to a suitable source of electrical energy. The stationary contacts are grounded to the other terminal of the source of electrical energy as in usual automotive practice and means are provided for interrupting the circuit, such as a cam 19 which may be rotated by any suitable means, such as a timer shaft, for intermittently engaging lugs 20 formed of laminated fabric which are attached to and extend inwardly from arms 6 and 7. If desired, it will of course be understood that the positive source of electrical energy may be connected to the stationary arms and the movable contacts may be grounded to the other source of electrical energy.

In accordance with my invention the contact on the stationary arm is formed and is attached to the arm in a manner to provide a comparatively long line or a surface contact between the movable and stationary contacts. The concentration of current per unit surface will therefore be less than when the stationary arm is provided with a radius ground contact and consequently the amount of electrical corrosion will be small.

The stationary contact is also arranged so that the movable contact will engage the stationary contact in a direction which is substantially perpendicular to the fibrous grain structure of the metal constituting the stationary contact, thus reducing the electrical resistance, and while I do not desire to limit the invention to the particular metal of which the contacts are formed, they are preferably formed of tungsten or predominantly of tungsten.

In forming tungsten contacts, tungsten powder which has been rendered coherent at high temperatures is passed through a swaging machine while hot to fabricate it and render it ductile and the contacts are prepared either by cutting portions of the desired thickness from the end of a centerless ground or polished rod, or the rod is hammered or rolled into a substantially flat strip of the desired thickness and the contacts are punched therefrom. During the swaging process, however, a fibrous grain structure is formed and consequently when the contacts are sawed from the end of a rod as in former practice and are attached to the stationary arm, the ends of the grains are engaged by the movable contact.

In accordance with my invention, a cylindrical contact is sawed from the end of a swaged rod that has been centerless ground or polished as in former practice. The contact which is sawed from the end of the rod, however, is of considerably greater length than contacts formed according to prior practice and is cylindrical or substantially cylindrical in shape as shown in

Fig. 6. A concave recess 21 bounded by flat end portions of metal is then pressed in lug 22. As illustrated, this recess has sufficient length and depth to receive a segment of the cylindrical contact with a portion of the upper and lower faces 23 and 24 of the contact being snugly received within the recess and with the major portion of the cylindrical contact extending outwardly from the lug as shown more particularly in Figs. 2, 3 and 5 of the drawings. The cylindrical portion of the contact which is received in recess 21 is then brazed, welded or otherwise secured to lug 22.

By affixing contact 12 to the stationary arm 6 in this manner, it will be noted that the major portion of the cylindrical contact extends outwardly from the recess 21 and consequently there is no danger of the movable contact 10 striking stationary arm 2. The steps in the former process of brazing a flat contact to the head of a rivet or screw, radius grinding the contact to form a convex surface providing substantially a point contact, and securing the opposite end of the rivet or screw to the stationary contact by a spinning operation are therefore entirely eliminated, and although more tungsten is utilized in forming the stationary contact than in prior practice, it is less expensive when assembled because less time and labor are required to attach it to the stationary arm. It will also be noted that the axis of my improved contact which passes through its end faces is parallel to the axis of pivot 25 of the movable arm and consequently the flat face of contact 10, which may be secured to arm 6 by a suitable brazing operation, will strike the sides instead of the ends of the grain fibers during engagement of the contacts, thus providing lower resistance than when the movable contact strikes the ends of the grain structure as occurs when the contact is cut from the end of a round rod and the radius ground side of the contact is engaged by the movable contact. In actual tests, it has been found that when a cylindrical tungsten contact is attached to a stationary arm as shown in the drawings and is engaged by a flat tungsten contact, the resistance is only .008 of an ohm whereas when the flat tungsten contact engages a radius ground tungsten contact as in ordinary practice, the resistance is .05 of an ohm.

During operation of the circuit breaker, it will also be apparent that some wear upon the stationary contact will occur and that the cylindrical portion of the stationary contact may wear down along the line of contact which is being continually engaged by the flat contact or some wear may occur on both contacts. When the cylindrical contact 12 wears down along the line of contact, it will be apparent that the area of contact will be increased and it is within the purview of my invention to provide a flattened segment 26 upon the cylindrical contact to provide a greater area of contact between the fixed and the movable contacts.

To provide a greater area of contact between fixed contact 12 and movable contact 10, I may also form a concave groove 27 in the movable contact 10 which is shaped to correspond with the other surface of contact 12 as illustrated in Fig. 7.

Other modifications of my invention will be apparent to those skilled in the art and it will of course be understood that I contemplate by the appended claims to cover any such modifica-

tions as fall within the true purpose and scope of my invention.

What I claim is:

1. In a circuit breaker, an arm having a concave recess therein, a cylindrically-shaped tungsten contact having a segment received in said recess and secured to said arm with the remainder of the cylindrically-shaped contact extending outwardly beyond the recess and the grain structure of the tungsten in said contact being substantially perpendicular to the end faces of the contact.

2. In a circuit breaker, an arm having a recess therein conforming to the shape of a segment of a cylinder, a cylindrically-shaped tungsten contact having a segment received in said recess and secured to said arm with the remainder of the contact extending beyond said arm and with the grain structure of the tungsten extending substantially perpendicular to the end faces of the contact, a movable arm provided with a flat contact, means for normally maintaining the flat contact in engagement with the arcuate surface of the cylindrical contact to establish an electrical circuit, and means for intermittently moving the flat contact from the cylindrical contact to interrupt the circuit.

3. In a circuit breaker, a support, an arm having a flat portion secured to said support and a lug extending outwardly from said support, a cylindrically-shaped tungsten contact having end faces and being composed of fibrous grain structure extending substantially perpendicular to said faces, said contact being secured to said lug with its end faces arranged substantially parallel to said support, a movable arm having one end pivotally mounted on said support about an axis which is perpendicular to planes passing through the faces of said contact, a substantially flat tungsten contact arranged on the other end of the movable arm, resilient means for normally maintaining the flat tungsten contact in engagement with the arcuate-shaped surface of the cylindrical contact, and means for intermittently disengaging the flat contact from the cylindrically-shaped contact to interrupt said circuit.

4. In a circuit breaker, a support, an arm having a flat portion secured to said support and a lug extending outwardly from said support, said lug having a recess therein conforming to the shape of a segment of a cylinder, a cylindrically-shaped tungsten contact having a segment received within said recess and secured to said lug and being so arranged within said recess that the faces of the cylindrically-shaped contact are substantially parallel to said support and the grain structure of the tungsten contact is substantially perpendicular to said support, a movable arm having one end pivotally mounted on said support about an axis perpendicular to the faces of said tungsten contact, a substantially flat tungsten contact arranged on the other end of the movable arm, resilient means for normally maintaining the flat tungsten contact in engagement with the arcuate-shaped surface of the cylindrical contact, and means for intermittently disengaging the flat contact from the cylindrically-shaped contact to interrupt said circuit.

5. In a circuit breaker, an arm having a concave recess therein bounded by flat end portions which recess conforms in shape to the segment of a cylinder and a cylindrically-shaped tungsten contact provided with end faces and being composed of fibrous grain structure extending substantially perpendicular to the end faces, said contact having an arcuate-shaped segment received within said recess and the remainder extending outwardly beyond said recess, and said contact being of such size that said segment is snugly received in said recess with each of the opposite end faces engaging a flat end portion bounding the ends of said recess and the segment of said contact which rests in said recess being firmly secured to said arm and being prevented from longitudinal movement by the portions of said arm which bound the opposite ends of said recess.

6. In a circuit breaker, a support, an arm having a flat portion secured to said support and a lug extending outwardly therefrom, a cylindrically-shaped tungsten contact having end faces and being composed of fibrous grain structure extending perpendicular to said faces, said contact being secured to said lug with its end faces arranged substantially parallel to said support, a movable arm having one end pivotally mounted on said support about an axis which is perpendicular to planes passing through the faces of said contact, a second tungsten contact mounted on the other end of said arm which second contact has an arcuate-shaped cavity therein which conforms in shape to a segment of the cylindrical contact, resilient means for normally maintaining the arcuate-shaped portion of the movable contact in engagement with the rounded portion of the cylindrically-shaped contact to provide a comparatively large area of contact to establish an electrical circuit, and means for intermittently disengaging said contacts to interrupt said circuit.

7. In a circuit breaker, a support, an arm having a flat portion secured to said support, a substantially cylindrically-shaped tungsten contact having end faces and being composed of fibrous grain structure extending perpendicular to said faces, said contact having a portion secured to said lug with its end faces arranged parallel to said support and the remainder extending outwardly from said lug and the portion of said cylindrically-shaped contact which extends outwardly from said lug being provided with a flat segmented portion, a movable arm having one end mounted on said support about an axis which is perpendicular to planes passing through the faces of said contact and a flat contact mounted on the other end of said arm which normally engages the flat segmented portion of the substantially cylindrically-shaped contact, resilient means for normally maintaining the flat contact in engagement with the substantially cylindrically-shaped contact to provide a comparatively large area of contact to establish an electrical circuit, and means for intermittently disengaging the flat contact from the segmented portion of the substantially cylindrical contact to interrupt said circuit.

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