April 28, 1931. O. S. JENNINGS 1,802,718

CIRCUIT BREAKER CONTACT

Filed Nov. 30, 1927

Fig. 1.

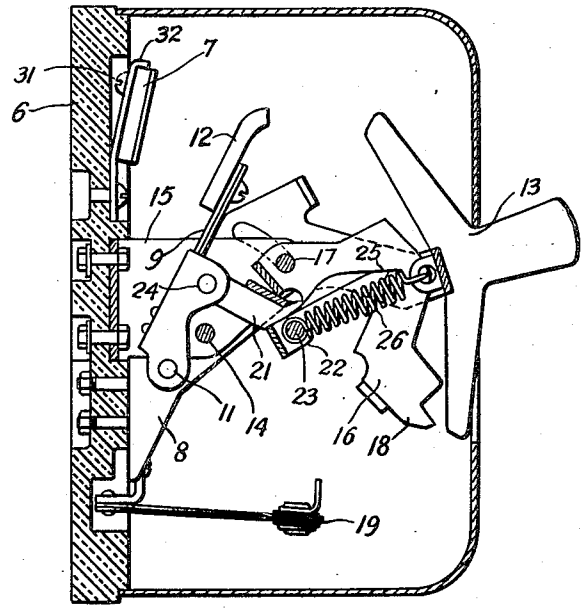


Fig. 2.

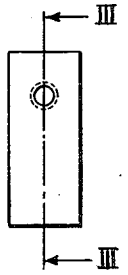


Fig. 3.

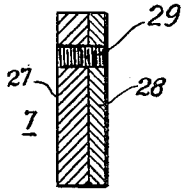


Fig. 4.

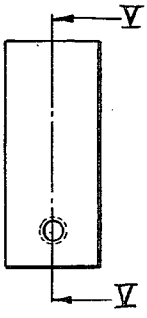
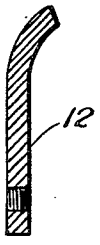


Fig. 5.



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Patented Apr. 28, 1931 1,802,718

UNITED STATES PATENT OFFICE

OLIVER S. JENNINGS, OF MANSFIELD, OHIO, ASSIGNOR TO WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA

CIRCUIT-BREAKER CONTACT

Application filed November 30, 1927. Serial No. 236,758.

My invention relates to circuit interrupter contacts and particularly to contacts for circuit breakers that are adapted to interrupt a circuit under load and short circuit conditions.

An object of my invention is to provide a circuit interrupter contact having a relatively low contact resistance or potential drop, and therefore, a relatively low operating temperature, thereby increasing the operating capacity of contacts of given dimensions.

A further object of my invention is to provide circuit interrupter contacts that do not weld together as the result of arcing at the time the contacts are engaged or disengaged.

A further object of my invention is to provide circuit interrupter contacts that withstand the arcs incident to operation of the contacts.

A further object of my invention is to provide a method of producing contacts having the above-noted characteristics.

These and other objects that will be made apparent throughout the further description of my invention are attained by means of the apparatus hereinafter described and illustrated in the accompanying drawings, wherein

Figure 1 is a longitudinal section through a circuit breaker having contacts embodying features of my invention, the circuit breaker apparatus being shown in side elevation.

Figures 2 and 3 are plan and longitudinal sectional views, respectively, of a composite terminal embodying features of my invention, the section shown in Fig. 3 being taken on the line III—III of Fig. 2.

Figs. 4 and 5 are plan and sectional views, respectively, of a contact that cooperates with the contact shown in Figs. 2 and 3, the section being taken on the line V—V of Fig. 4.

Referring to the drawings, the circuit breaker apparatus shown in Fig. 1 is similar to that disclosed in the copending application of Fred G. Von Hoorn, Serial No. 212,289, filed August 11, 1927, and assigned to the Westinghouse Electric and Manufacturing Company. Briefly, the circuit breaker comprises an insulating base 6 which supports a stationary composite terminal contact plate 7 embodying features of my invention and a bracket 8 to which a switch arm 9 is pivoted by means of the pin 11. A contact plate 12 embodying features of my invention is attached to the free end of the switch arm 9 which consists of a flexible laminar conductor that permits of a slight rolling action of the contact plate 12 upon the contact plate 7, when the switch arm is moved to closed position. The switch arm is actuated by the operating lever 13 pivoted for rotation about a shaft 14 that is secured to a frame 15 mounted on the base 6.

A toggle carrier 16 is pivoted upon a shaft 17 mounted in the frame 15 and the carrier is provided with an extension 18 that is held in an operating position by means of a bimetal thermal element that is connected in series with the switch contacts and which is mounted on the base 6.

The switch arm 9 is actuated by means of toggle links 21 and 22 that are provided with a knee pivot 23. The link 21 is pivoted at 24 to the switch arm 9 and the link 22 is pivoted upon the carrier 16, the outer end thereof being mounted in a notch 25 of V-shape. The knee pivot 23 of the toggle and the outer end of the operating lever 13 are connected by means of a spring 26.

When the carrier is in the "set" position indicated in dotted lines in Fig. 1, movement of the operating lever 13 causes the toggle to be moved to the "made" or "broken" positions with a snap action by reason of the movement of the outer end of the spring 26 over the center of the toggle link. Since the operating mechanism of the circuit breaker apparatus described does not contain any part of my invention, it is believed unnecessary to go into further details of the specific construction thereof.

It has been found that contacts made of material usually employed for contacts are unsatisfactory for the reason that the contact resistance is too high and causes heating of the contacts to destructive temperatures. Critical current densities in the parts actually in contact often locally heat the contacts until fusion occurs which subsequently welds the contacts to one another.

Ordinary contacts also become welded together by the arc incident to the operation of the contacts when they rebound as the result of a rapid closure of the circuit breaker. When the contacts weld together, the circuit is held closed thereby, even though the switch arm is released by the current responsive thermal elements, with the result that the thermal element is usually destroyed.

Many combinations of metal contacts have been tried in the endeavor to obtain contacts that have a low contact resistance and which will not weld the contacts together under severe heating or arcing conditions incident to operation and interruption of the circuit under severe load and short circuit conditions.

Silver is a low resistance metal having an oxide also of relatively low resistance and the presence of graphite or other forms of carbon prevents any molten silver fused by the heat of the arc from adhering or welding to the cooperating contact. The graphite serves as an anti-flux agent as well as a binder for the fine particles of silver.

It has been found that a contact that very effectively cooperates with the silver graphite contact is one made of nickel or which has been heavily nickel plated. Nickel is a relatively low oxidizing metal that fuses at a higher temperature than silver and it has been found that under severe short circuit conditions, the silver of the conglomerate contact does not adhere or weld to the nickel and, therefore, the contact members remain intact after repeated short circuit operations of the circuit breaker. It has also been found that the contact resistance of metal having the characteristic of nickel cooperating with a conglomerate contact made of silver and graphite or materials having like physical characteristics have a low contact resistance and therefore are very satisfactory for carrying relatively heavy currents without overheating.

It has also been found that two cooperating contacts made of silver and graphite produce a non-welding low resistance contact and may be used to advantage when under certain operating conditions.

The silver and graphite conglomerate contact member is made by finely dividing the silver and the graphite and thoroughly mixing them so that the graphite is uniformly distributed throughout the mass of silver dust. The mixture is then placed in a mold and subjected to extremely high pressure, thus producing a solid conglomerate contact bar or plate which is of sufficient solidity to withstand the shocks incident to the rapid engagement of the contact members. The conglomerate bar or plate has the appearance of solid metal and may be machined in the same manner that the solid metal may be manipulated. The material may be bored and threaded for receiving an attaching screw. Since silver is a rare metal and more expensive than a metal, such as copper which has a non-conductive oxide, it has been found desirable and economical to reduce the amount of silver required, to a minimum.

It has been found that a plate of silver one thirty-second of an inch in thickness is sufficient to provide a contact surface that will remain intact throughout the life of a circuit breaker. A plate of this thickness, however, made under the process above described is of insufficient strength to withstand the shocks incident to operation of the contacts. Since the silver and graphite contact plate cannot be fused to the other metals, it has been found that a solid composite block of two dissimilar metals may be made of sufficient thickness and strength to withstand operating conditions. By forming a composite block comprising a portion made of a mixture of copper dust and powdered graphite, and a portion containing silver dust and a powdered graphite, a block of any desired dimensions may be produced. To produce such a block, the mixtures are placed in a mold, one on top of the other, then compressed with extremely high pressure, thus forming a composite block having a relatively thick copper-graphite portion 27 and a relatively thin silver-graphite portion 28. The composite contact blocks thus formed apparently have uniform tensile strength and the point of joinder of one metal to the other is as strong as any portion of either conglomerate mass. Contact members of any desired shape may thus be formed and the thickness of the silver-graphite portion may be varied to suit operating conditions.

It has been found that when, due to a great number of operations under short circuit conditions, the silver-graphite portion of the contact member has been reduced to the thickness of a metal plating, the contacts surface contains sufficient silver to maintain the original low contact resistance. Under ordinary usage, the silver-graphite portion of the contact will never be reduced to the thickness mentioned.

As indicated in Figs. 2 and 3, the composite contact plate 7 is provided with a threaded hole 29 for receiving a screw 31, which serves to attach the contact plate to the contact terminal 32, mounted on the base 6.

The Figures 4 and 5 illustrate the nickel contact plate 12 which is designed to engage the contact plate 7 with a sliding and rolling action, which causes the contact surfaces to be cleaned at each closing operation of the circuit breaker. Figs. 4 and 5 are drawn in a slightly larger scale than is used in Figs. 2 and 3.

From the foregoing, it is apparent that

the contacts are highly efficient and durable and will not become welded to one another, and therefore are well adapted for use in circuit breakers of a number of types, and particularly for small circuit breakers, such as are used as interior circuit breakers for house-wiring and for small motor circuit interrupters.

While I illustrated but one embodiment of my invention, it will be apparent to those skilled in the art that various changes, modifications, substitutions, additions and omissions may be made in the apparatus illustrated without departing from the spirit and scope of my invention, as set forth in the appended claims.

I claim as my invention:

1. A circuit interrupter contact comprising finely divided particles of silver and graphite.

2. A circuit interrupter contact comprising finely divided particles of graphite and a metal having a highly conductive oxide.

3. A circuit interrupter contact comprising finely divided particles of graphite and a metal having a highly conductive oxide, the said elements being thoroughly intermixed and compressed into a solid mass.

4. A circuit interrupter contact comprising finely divided particles of an anti-flux material and a metal having a high conductive oxide.

5. A circuit interrupter contact comprising a composite contact member made of a layer of finely divided particles of an anti-flux and copper and a layer of finely divided particles of an anti-flux and silver compressed into a solid composite mass.

6. Cooperating contacts for a circuit breaker comprising a conglomerate contact of silver and carbon, and a contact of nickel.

7. Cooperating contacts for a circuit breaker comprising a conglomerate contact of a metal having a low boiling point and an anti-flux binder, and a contact of metal having a higher melting point than the metal of the first contact.

8. Cooperating contacts for a circuit breaker comprising a conglomerate contact of metal having a conductive oxide and an anti-flux binder, and a contact of relatively non-oxidizing metal.

9. A conglomerate circuit interrupter contact made of a metal having a conductive oxide and a binder of anti-flux material.

10. A circuit-interruper contact comprising finely divided particles of an anti-flux material and a metal having a relatively low boiling point.

11. A circuit-interrupter contact comprising finely divided particles of graphite and a metal having a relatively low boiling point.

12. Cooperating contacts for a circuit interrupter comprising a conglomerate contact of metal having a relatively low boiling point and an anti-flux binder, and a contact of relatively non-oxidizing metal.

In testimony whereof, I have hereunto subscribed my name this 23d day of November, 1927.

OLIVER S. JENNINGS.