April 25, 1944. I. W. COX 2,347,172

ELECTRICAL CONTACT TIP AND METHOD OF MAKING SAME

Filed Nov. 12, 1942

Fig. 1

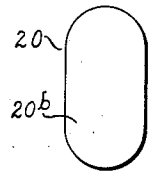


Fig. 2

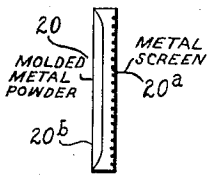


Fig. 3

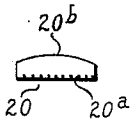


Fig. 4

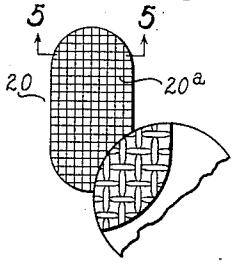


Fig. 5

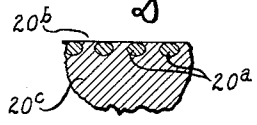


Fig. 6

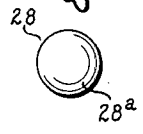


Fig. 7

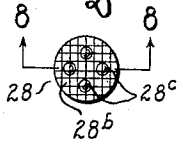


Fig. 8



Fig. 9

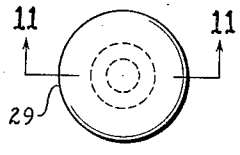


Fig. 10

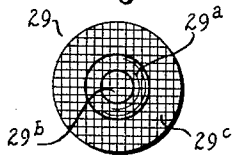


Fig. 11

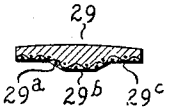


Fig. 12

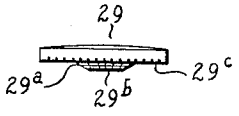


Fig. 13

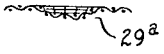
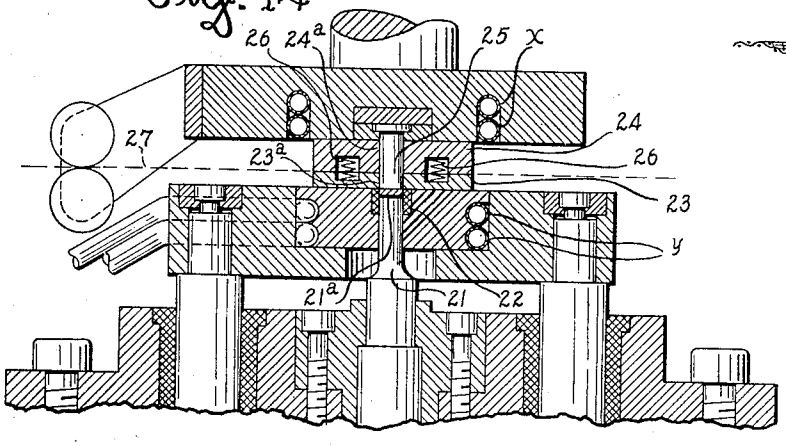


Fig. 14



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UNITED STATES PATENT OFFICE

2,347,172

ELECTRICAL CONTACT TIP AND METHOD OF MAKING SAME

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Application November 12, 1942, Serial No. 465,350

12 Claims. (Cl. 200—166)

This invention relates to improvements in electrical contacts and method of making same, and more particularly to contact tips molded to the desired shape from metallic compositions in powder form.

A primary object of the invention is to provide a molded contact tip of the aforementioned character having a backing member rigidly attached thereto by the molding operation.

Another object is to provide such a contact tip wherein the backing member may be utilized to effect rigid and efficient attachment of the tip to a suitable metallic support by welding or brazing.

Another and more specific object is to provide such a contact tip wherein the backing member consists of a punched or otherwise formed piece of wire cloth or screen composed of any suitable metal.

Another object is to utilize such a backing member as a reinforcement for the material of the contact tip.

Another object is to provide a coating of tin, silver or the like for the backing member or screen to insure a high degree of adhesion of the compressed powder metal thereto.

Other objects and advantages of the invention will hereinafter appear.

The accompanying drawing illustrates certain embodiments of the invention which will now be described, it being understood that the invention is susceptible of embodiment in other forms without departing from the scope of the appended claims.

In the drawing, Figure 1 is an enlarged top plan view of a contact tip of somewhat elliptical contour molded from a powdered metallic composition, and having a screen backing member rigidly united therewith by the molding operation.

Fig. 2 is a side elevational view of the contact tip shown in Fig. 1.

Fig. 3 is an end elevational view of the contact tip shown in Figs. 1 and 2.

Fig. 4 is a bottom plan view of the contact tip of Figs. 1 to 3, showing the manner in which the screen is interlocked or united with the contact tip as an incident to molding of the latter, a small portion of said figure being magnified to show the manner in which the exposed portions of the screen are deformed as an incident to the molding operation.

Fig. 5 is a greatly enlarged fragmentary section on the line 5—5 of Fig. 4.

Fig. 6 is an enlarged top plan view of a modified form of contact tip embodying my invention.

Fig. 7 is a bottom plan view of the contact tip shown in Fig. 6, showing exposed parts of the screen backing and the arrangement of the plurality of integral bosses which facilitate welding of the tip to a suitable support and act to insure a planar relationship of the tip to the support during welding.

Fig. 8 is a sectional view on the line 8—8 of Fig. 7.

Fig. 9 is an enlarged top plan of another modified form of contact tip embodying my invention, the contour of the relatively large, centrally located, welding boss being shown by dotted lines.

Fig. 10 is a bottom plan view of the tip shown in Fig. 9, showing exposed parts of the embedded backing screen and the aforementioned welding boss.

Fig. 11 is a sectional view on the line 11—11 of Fig. 9.

Fig. 12 is a side elevational view of the contact tip shown in Figs. 9 to 11.

Fig. 13 is a further enlarged view of the preformed backing member or screen which is employed in the tip of Figs. 9 to 12, and

Fig. 14 is a fragmentary view, partly in section and partly in elevation, of one form of molding press which may be employed to produce contact tips embodying my invention.

Referring first to Figs. 1 to 4, the numeral 20 designates a contact tip of approximately elliptical contour which is molded under heavy pressure from powdered silver, or a metallic composition in powdered form including silver and another ingredient or ingredients. For example, the contact material in powdered form may be of the character disclosed in my prior Patent No. 2,288,122, granted June 30, 1942, for Metallic composition for electrical contacts and the like. In the preferred form of the invention disclosed in said Patent No. 2,288,122 I employed the following ingredients in the proportions given, by weight:

	Per cent
Merck's precipitated silver powder	67
Crystalline silver powder of 80 mesh and finer	22
Cadmium sulphide	11

Obviously, however, I may employ any other suitable metallic molding powder or composition. The gist of my invention resides in the provision of a metal backing member or screen which is integrally united with or connected to the con-

tact tip formed of powdered metal as an incident to molding of the latter.

Accordingly, I prefer to employ a metal backing member which is in the form of a relatively fine mesh wire screen, which is designated in general by the numeral 20a in Figs. 2, 3 and 4. As shown in Figs. 2, 3 and 4, the screen backing member is embedded in the material of the contact tip 20 at the flat rear face of the latter, the embedding being effected as an incident to the molding operation. The arrangement is such that at least portions of the screen are exposed, or are located very closely adjacent said rear face of the contact tip, whereby said rear face may be readily attached by the usual welding or brazing operation to a suitable support (not shown). In practice the support may be composed of bronze, brass, copper, steel, stainless steel, or other suitable metal having the required current carrying capacity, and accordingly the wires of said backing screen are likewise preferably composed of bronze, brass, copper, steel, stainless steel, or other suitable metal having good electric welding or brazing characteristics with respect to the metal support.

Heretofore great difficulty has been encountered in effecting a proper welded or brazed connection between contact tips molded from metallic powders and the metal supports therefor; whereas by employment of my screen-backed contact tips the aforementioned difficulty has been eliminated. Moreover, said backing screen acts as a reinforcement for the molded powdered material of the contact tip, which feature is of greatest importance where the molded material of the contact tip is inherently of relatively low tensile strength. The manner in which such screen-backed contact tips may be attached to their supports by electric spot-welding or brazing will be apparent to those skilled in the art.

As best illustrated in Figs. 2 and 3 the contacting face 20b of tip 20 is preferably of transversely curved or convex form throughout the length thereof. Fig. 5 shows the manner in which the powdered metallic composition 20 is adapted to flow through the openings between the wires of the screen 20a and around portions of the wires to provide the desired interlocking connection between said composition, when in finally molded or compressed form, and the wires of the screen.

Alternative ways of preparing the screen backing member 20a for attachment thereof to the contact tip as in incident to molding of the latter may, of course, be employed. Thus I may preform the screen by punching the same from a strip of wire cloth and deposit the screen within a molding cavity, against the flat bottom wall of the latter. Thereafter a suitable charge of the powdered contact material may be deposited in the mold cavity, and a pressure die member then operated to compress the powdered material to unite the same with the screen and to form a contact face of the desired shape.

Preferably, however, I employ a molding machine of the character illustrated in Fig. 14, wherein the initial size of the stationary die cavity is defined by the member 21 (whose upper end 21a is shaped to form the contacting face of the contact tip 20), and by the member 22 and metal plate 23, the height of the opening 23a in member 23 preferably being such that the charge of powdered contact material will extend to a plane flush with the upper end thereof. A second metal plate 24 is superimposed upon plate 23, and plate 24 is provided with an opening 24a alined with opening 23a to accommodate the male die member 25. Male die member 25 is initially positioned above plate 23, and the plate 24 is biased upwardly from plate 23 by a plurality of sets of coiled compression springs 26. It is to be understood that the springs 26 of the respective pairs (only one spring of each pair being illustrated) are spaced from each other laterally to provide clearance for a strip 27 of wire cloth or screen which is adapted to be moved in a step by step manner between plates 23 and 24.

Thus, with the required charge of powdered material within the die cavity, the male die member 25 is moved downwardly, the flat lower end of said die member cooperating with the upper edges of the walls of opening 23a to shear from strip 27 a backing screen of a size corresponding to the contour of said end of the die member. The section of screen thus punched or sheared from strip 27 then acts as a part of the male die member to effect compression of the powdered material, such powdered material during compression thereof being adapted to flow around and about the wires of the screen, so that upon complete compression or molding of the contact tip the screen backing will be rigidly united therewith for the purposes hereinabove set forth.

After completion of the molding operation the contact tip is ejected from the die cavity, a new charge of powdered material is deposited thereinto, and another portion of the screen strip 27 is positioned over opening 23a. As aforeindicated the contact tips are molded under relatively high pressure; say, 40,000 pounds per square inch; and preferably at a temperature of about 400 degrees F., which is much below the melting point of the silver or other ingredients, if any, of the powdered metallic molding material. In practice the aforementioned heating of the molding dies may conveniently be effected by use of embedded tubular electric heating elements of well known form, as shown at x and y in Fig. 14. Although such heating of the molding dies is preferred, it is not absolutely necessary, especially with certain forms of metallic molding powders. The structural details of the molding machine illustrated in Fig. 14 form no part of the present invention, and further description thereof is believed to be unnecessary.

In Figs. 1 to 4, inclusive, the contact tip 20 has been drawn to twice normal scale, whereas in the aforementioned portion of Fig. 4 and in Fig. 5 the size of the component element is very greatly exaggerated.

In Figs. 6 and 7 the circular contact tip 28 has been drawn to slightly more than twice normal scale, and Fig. 8 is on a still larger scale. The contact face 28a thereof is preferably of convex form in all directions, as indicated in Figs. 6 and 8; and the same has embedded or molded into the rear face thereof a screen backing member designated by numeral 28b in Figs. 7 and 8. Although the major portion of the rear face of tip 28 is preferably flat, I have shown the same as provided with four integral bosses or projections 28c, which are adapted to facilitate welding of the tip to a suitable metal support, the projections 28c acting in a well known manner to concentrate the flow of electric welding current at the respective points or spots at which said bosses are located.

Also, as indicated, each boss will normally have, at or adjacent its surface, one or more portions of the wires of the backing screen 28b,

wherefore said screen acts as aforedescribed to insure a good welded connection between the contact tip and its support. Normally during the welding operation both the contact material and the screen wires included in the bosses 28c will be fused, to bring the main portion of the rear face of the contact tip against the surface of the support, thus bringing the remaining area of the backing screen into engagement with said surface to afford a relatively large welding area, as in the contact tip of Figs. 1 to 5.

As will be understood, the main body portion of the contact tip 28 will be formed from powdered silver or a powdered composition including silver, and the screen backing 28b will preferably consist of wires composed of a metal having good electric welding or brazing characteristics, as aforedescribed.

Although I have shown four bosses 28c it is to be understood that any number of such bosses greater than two may be employed, three or more thereof when properly spaced and positioned in the manner illustrated being adapted to steady or stabilize the contact tip during application of pressure thereto by a welding electrode at any point within the area defined by said bosses.

The contact tip 28 of Figs. 6 to 8 may be formed in the manner and by means substantially like that described in connection with the contact tip of Figs. 1 to 5.

In Figs. 9 to 13 I have shown a further modified form of contact tip 29, which is quite similar in form and size to that of Figs. 6 to 8. Thus Figs. 9 to 12 have been drawn to approximately four times normal scale, whereas Fig. 13 is drawn to a still larger scale to better illustrate the backing screen 29a, which is preferably punched from a strip of wire cloth of suitable composition and preformed or stamped to the form thereof illustrated in section in Fig. 13. Thus in practice the screen backing member 29a may be inserted into a mold cavity whose bottom wall corresponds in shape to that of the lower face of member 29a. Thereafter a suitable charge of powdered metallic contact material is deposited in the mold and the male die member is brought down to compress or mold the powdered material and to form the contacting face of the contact tip, the molding pressure acting in the manner aforedescribed to effect a rigid connection between the material of the contact tip 29 and the screen backing 29a. Obviously, however, the contact tip of Figs. 9 to 13 may be formed in substantially the same manner as the other tip aforedescribed.

As best illustrated in Figs. 11 and 12 the relatively small, flat, concentric lower end portion 29b of contact 29 is adapted to be initially fused upon application of the electric welding current, so that upon completion of the welding operation the annular portion 29c of the contact tip and screen rests against the flat surface of the support (not shown) and is welded thereto. The powdered metal of the contact tip and the metal of screen backing 29a will be chosen to provide the desired characteristics thereof set forth in the description of the other contact tips aforementioned.

In practice I prefer to plate or coat the wire cloth (or the wires thereof) with tin, silver or the like prior to punching of the backing screens therefrom. This plating serves to improve the adhesive characteristics of the compressed powdered metal with respect to the backing screen. Where the backing screen is preformed (as in the device of Figs. 9 to 13) the preformed screen may itself be plated or coated for the purpose specified. Although I prefer to provide a plating of tin or silver, platings of other similar metals or alloys may be employed to provide for accomplishment of the result aforedescribed.

Although I have herein disclosed the use of backing screens of a size to cover the entire rear face of the contact tip, it will be apparent to those skilled in the art that the advantage in respect of facilitating and improving the attachment of the tip to a metal support may be attained by use of a screen backing of smaller size than the rear face of the contact tip, provided that such screen backing is properly positioned, centrally or otherwise, for this purpose.

While I have herein disclosed the use of backing screens composed of sections or punchings of woven wire cloth, it is to be understood that, if desired, the backing screens may be punched and/or formed from strips of expanded metal of the desired composition, such as brass, bronze, etc., aforementioned.

I claim:

1. A pressure molded electrical contact member composed of a metal powder, said member having a metal screen embedded in and rigidly united with the rear face thereof, said screen being adapted to facilitate proper welding or brazing of said member to a metal support.

2. A contact member composed of metallic powder molded under relatively high pressure directly onto a backing of metal wire cloth, said backing serving as an intermediate element to facilitate electrical welding or brazing of said member to a suitable metal support.

3. A pressure molded electrical contact member composed of a metal powder, said member having a metal screen embedded in and rigidly united with the rear face thereof, said screen being adapted to facilitate proper welding or brazing of said member to a metal support, and said backing also serving as a mechanical reinforcement for the material of said member.

4. As an article of manufacture, an electrical contact tip composed of a metallic powder the major ingredient of which is silver, said tip being molded to the desired form under high pressure and having a metal wire screen embedded in one face thereof by the molding pressure, said screen being adapted to afford a good electrically welded connection between said tip and a suitable metal support.

5. As an article of manufacture, a metal powder composition electrical contact tip molded to the desired form under relatively high pressure, said tip having a punched metal screen member embedded in one face thereof by the molding pressure, said screen being formed of wires composed of a metal of the group consisting of bronze, brass, copper, steel, and stainless steel, and said screen being adapted to afford a good electrically welded or brazed connection between said contact tip and a suitable metal support.

6. As an article of manufacture, a metal powder composition electrical contact tip molded to the desired form under relatively high pressure, said tip having a punched metal screen member embedded in one face thereof by the molding pressure, said screen being formed of wires composed of a metal of the group consisting of bronze, brass and copper, and said screen being adapted to afford a good electrically welded or

brazed connection between said contact tip and a suitable metal support.

7. As an article of manufacture, an electrical contact tip composed of a metallic powder including silver molded to the desired form under relatively high pressure, said tip having a bronze wire backing screen section embedded in one face thereof, and said screen section being adapted to facilitate proper electrical welding of said tip to a suitable metal support.

8. As an article of manufacture, an electrical contact tip composed of a metallic powder including silver molded to the desired form under relatively high pressure, said tip having a bronze wire backing screen section embedded in one face thereof, said screen section being adapted to facilitate proper electrical welding of said tip to a suitable metal support, and said screen section also serving to mechanically reinforce the body of said contact tip material.

9. As an article of manufacture, an electrical contact tip composed of a metallic powder including silver molded to the desired form under relatively high pressure, said tip having a bronze wire backing screen section embedded in one face thereof, said screen section being adapted to facilitate proper electrical welding of said tip to a suitable metal support, and said screen being silver plated to increase the adhesive characteristics of the material of said tip with respect thereto.

10. As an article of manufacture, an electrical contact tip composed of a metallic powder including silver molded to the desired form under relatively high pressure, said tip having a bronze wire backing screen section embedded in one face thereof, said last mentioned face of said tip having a multiplicity of equally spaced integral bosses formed thereon adjacent the peripheral edge thereof, said bosses being adapted to stabilize said tip during application of pressure thereto as an incident to electric welding thereof to a suitable support, and said bosses and said screen acting to expedite the welding connection and improve the character thereof.

11. The method of forming an electrical contact tip, which comprises completely filling a stationary molding die cavity with powdered metallic contact tip material to provide a predetermined charge, positioning upon the top of said charge a section of metal wire screen, and effecting downward movement of a movable die member against said screen section and said charge to provide for compression of the latter to the desired form and embedding of said screen section in one face thereof, whereby said screen section is adapted to facilitate attachment of said contact tip to a suitable metal support by electric welding or brazing.

12. The method of forming an electrical contact tip, which comprises completely filling a stationary molding die cavity with powdered metallic contact tip material to provide a predetermined charge, positioning a strip of metal wire screen above said charge, effecting downward movement of an upper male die member to shear a section of said screen, the downward movement of said male die member being continued to effect a high degree of compression of said charge and embedding of said screen section in one face of the contact tip when molded, said screen section acting to provide a mechanical reinforcement for said contact tip and to facilitate attachment thereof to a suitable metal support by electric welding or brazing.

IRVIN W. COX.