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SIMULTANEOUS INFILTRATING AND OBTAINING A BRAZABLE SURFACE

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My invention relates to improvements in infiltrated type powdered metals and more particularly to an improved method for manufacturing electrical contacts. The improvement consists of preparing one surface of such a contact so that it is more easily and readily welded or silver soldered to its supporting arm.

The conventional steps in one method of manufacture of electrical contact materials comprising a refractory metal such as tungsten, molybdenum, or their carbides and a lower melting point conducting metal such as silver are as follows:

The refractory powders are either pressed alone or mixed with a comparatively small percentage of silver before pressing. The pressed or green compact is then sintered in a furnace using a hydrogen or other reducing atmosphere. The sintering temperature may be either above or below the melting point of the lower melting point constituent. After sintering, the percentage of porosity is calculated and from this is determined the weight of silver or copper (whichever the case may be) that is to be infiltrated. One of the more common methods of infiltrating a porous compact is to place the infiltrant on top of the compact, the compact being generally supported by a graphite boat. The infiltrating temperature is somewhat above the melting point of the infiltrant. To be certain of complete infiltration an amount of infiltrant in excess of that which can be absorbed by the compact, is used. Thus, a small amount of excess infiltrant generally remains in the form of a lump or mound on the surface of the infiltrated compact. Such residual infiltrant serves no useful purpose and, the usual procedure is to remove this lump and then solder-flush the surface of the contact which is to be welded or silver-soldered to a contact carrying arm. I have found that by applying a small amount of a fine powder from the group consisting of iron, cobalt or nickel to the infiltrating surface of the sintered compact prior to the infiltration step, the subsequent solder-flushing step may be eliminated. In any event, the excess infiltrant is spread over the surface of the compact, and the more uniform coating of infiltrant which results provides a surface which is more readily welded or silver-soldered to the contact arm of the switch, circuit breaker or other electrical device to which the contact is to be secured.

Accordingly, it is an object of my invention to provide a method for producing a refractory-base material having a surface which is more readily welded or silver-soldered.

It is another object of my invention to provide an improved and more economical method of manufacturing electrical contacts which are readily welded or silver-soldered to a contact carrying means and which comprises a pressed and sintered refractory metal and a lower melting point conducting metal.

These and other objects of my invention will become more apparent from the following description.

Essentially my invention involves, in the infiltration of the compacted refractory, the application, to the infiltrat-

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ing surface thereof, of a small amount of a powdered metal which in effect acts as a wetting agent for the surface of the compact and allows excess infiltrant to spread evenly over the surface.

Such a wetting agent may alleviate or even eliminate the need for applying a solder-flush or other coating to the external surface of the infiltrated compact in order to make it readily weldable or more easily silver-soldered to another metallic surface. Even if a solder-flush is required, it may eliminate the necessity of removing excess silver before solder-flushing. In any event, it has a marked tendency to cause the infiltrant to spread evenly over the infiltrating surface without leaving unsilvered areas on the said surface. This is particularly important in the case of electrical contacts wherein it is necessary to obtain a secure joint between the contact and the contact carrying arm of the particular switch or circuit breaker to which the contact is attached.

By applying a finely divided powder of iron, cobalt, or nickel to the surface of the compact to which the infiltrant is to be applied prior to the infiltration step, the excess infiltrant is spread evenly over the surface of the refractory and in itself provides a surface which may be readily welded or silver-soldered when the contacts are attached to a metallic member.

The powder which I used in my invention is of approximately 200 mesh fineness but may vary generally between 100 and 300 mesh. Although I prefer to use nickel, cobalt and iron may also be employed.

The use of this finely divided powder prior to applying the infiltrant to the pressed and sintered compact may eliminate the necessity of using serrations or corrugations on the surface of the contact for the purpose of spreading the excess infiltrant. This is advantageous, particularly in those instances where serrated contacts are not acceptable. It should be noted, however, that my invention may also be used in connection with serrated contacts, if desired.

The electrical contacts to which I refer, generally comprise tungsten, molybdenum, tungsten carbide, molybdenum carbide or mixtures thereof. The infiltrating material is normally either copper or silver, generally present in amounts of twenty to sixty percent.

As hereinbefore stated it has been found that copper or silver type electrical contacts braze or weld more effectively to another metallic member (such as a contact carrying arm of a circuit breaker) either when the surface has been previously solder-flushed or a coat of silver is otherwise applied thereto. The necessity for such a coating operation is eliminated by virtue of the formation of the uniform layer of the excess infiltrant resulting from the use of my novel wetting agents. Moreover, my wetting agent also assures uniform overall thickness of the contact provided that the floor of the furnace is flat at the time of infiltration.

The nickel or other finely divided powder is spread over the surface of the compact to be infiltrated in any suitable fashion, such as by the use of a small artists type brush. The nickel powder may be mixed with CCl_4 or other volatile vehicles so that the application is made more quickly and easily. This allows generally for a more uniform distribution of the nickel. The vehicle volatilizes quickly and does not interfere in any way with the subsequent infiltration. A spraying technique may be used if desired.

The amount of powder used for any given compact generally is one percent of the weight of the infiltrant, but may vary generally between 0.2 and 2 percent. The powder does not impede the infiltrant from permeating into the interconnected pores of the compact. It causes a wetting of the refractory surface which makes the infiltrant, silver or copper, spread more easily and cover that

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surface. The thickness of the brazable backing material may be varied by increasing or decreasing the amount of excess infiltrant used. The excess infiltrant surface then is ready to be attached to a backing member, contact carrying arm or other surface.

Specific example

A mixture of silver and tungsten powders containing about 15 grams of tungsten and 5 grams of silver are intimately mixed. The powders are then pressed in powder metal presses using a pressure of 25 tons per square inch. The pressed compacts are then sintered in a reducing atmosphere maintained at 2000° F. for about 30 minutes. The sintered compact is then infiltrated with silver, using about 6 grams of silver, at about 2000° F. This is sufficient to infiltrate the pores of the compact.

Prior to the infiltration, .06 gram of a 200 mesh nickel powder is brushed on the surface of the sintered compact. The temperature is then raised to 2200° F. for fifteen minutes and the silver infiltrates into the compact, the surface thereof having an even layer of excess silver.

The same procedure, when followed without the addition of the nickel powder to the infiltrated surface produces a surface having a localized lump of excess silver.

In the foregoing, I have described my invention only in connection with preferred embodiments thereof. Many variations and modifications of the principles of my invention within the scope described herein are obvious. Accordingly, I prefer to be bound not by the specific

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disclosure herein, but only by the appending claims.

I claim:

1. In the manufacture of an electrical contact comprising a pressed and sintered refractory compact from the group consisting of tungsten, molybdenum and carbides thereof and infiltrated with from 20 to 60 percent, by weight, of a lower melting point conductive metal from the group consisting of copper and silver, the improvement which comprises applying to only the infiltrating surface of the pressed and sintered refractory compact 0.2 to 2 percent by weight of a finely divided metallic wetting agent from the group consisting of iron, cobalt and nickel, and subsequently impregnating the said compact through the said coated infiltrating surface with the said lower melting point conductive metal, thereby causing the excess infiltrant to spread evenly over the said surface.

2. The method as set forth in claim 1 in which the metallic wetting agent is in the form of a powder of from 100 to 300 mesh particle size.

3. The method of claim 2 in which the powder is nickel.

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