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MANUFACTURE OF BODIES FROM METAL POWDER

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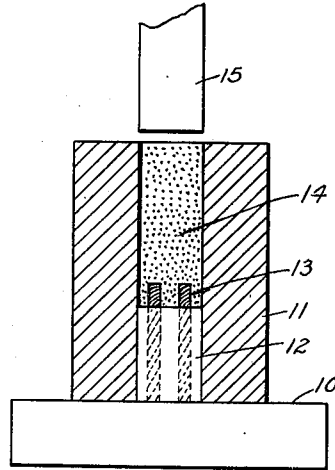


Fig. 1.

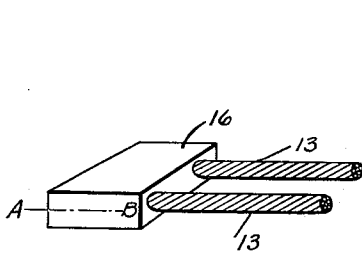


Fig. 2.

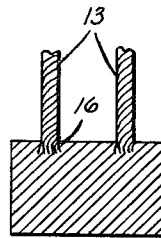


Fig. 3.

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MANUFACTURE OF BODIES FROM METAL POWDER.

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This invention relates to the manufacture of bodies by compressing and sintering finely divided substances including finely divided metals, and particularly to the manufacture of electrically conducting bodies such as brushes for dynamo electric machines.

One of the objects of the present invention is to provide an integral structure comprising a body of sintered powdered materials including powdered metals and a previously formed rod or wire extending therefrom, the structure being such that the metal of said body merges directly into the metal of the rod without any intermediate bond. In respect to the application of this invention to the manufacture of electrical brushes, it is an object to provide a brush of sintered metal and, integral therewith, a flexible conductor or pigtail.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred embodiment of one form of the present invention is clearly shown.

In the drawings:

Fig. 1 is a side elevation, partly in vertical section, showing apparatus for compressing powdered metals while at the same time embedding into the compressed form the end of a flexible stranded conductor or pigtail.

Fig. 2 is a perspective view of the compressed form with two flexible conductors extending therefrom.

Fig. 3 is a longitudinal sectional view of a completed brush showing the conductors or pigtails permanently attached thereto. The sectional view is taken on the plane of line A—B of Fig. 2.

In Fig. 1 of the drawings numeral 10 designates the bed plate of a molding press which supports a die 11 containing an insert block 12. The insert block 12 supports two flexible strand conductors or pigtails 13, the upper ends of which extend above the upper end of the insert block 12 as shown. The die is filled with a predetermined quantity of a mixture 14 of metal powders and graphite or other suitable filler. A briquetting plunger or ram 15 compresses the powder 14 into a briquette of the size desired for a brush. The formed body is shown in Fig. 2 in which numeral 13 designates the pigtails, the numeral 16 the brush body. This body with the pigtails is im-

mersed in a bath of molten salts, preferably the salts of alkaline metals for a time sufficient to sinter the metallic particles and to form a coherent mass. After sintering the body is quenched in water and is ready for grinding its commutator engaging surface.

The present invention is not limited to any particular mixture of powdered materials; but, by way of example, I have found that satisfactory results may be obtained from a mixture of metal powders containing by weight: 87 parts copper, 7 parts lead, 1½ parts tin, 4 parts graphite. The sintering bath should be approximately 1400° F., and for this purpose I prefer to use a bath of sodium cyanide. However, it is possible to use other salts or salt mixtures having approximately this melting point provided the salts do not materially affect the body to be sintered during the time of immersion of the body in the salt bath. The sintering time will of course depend on the size of the body to be sintered. I have found that, for a small brush such as used in electric motors for starting the internal combustion engines of automobiles, the time of sintering may be approximately one minute for satisfactory results.

I have observed upon examining a longitudinal section of a brush constructed in accordance with the present invention, this section being shown approximately or diagrammatically in Fig. 3, that the ends of pigtails 13 which were embedded in the brush body 16 have completely lost their identity and have merged with the metal of the brush to form an integral structure including the brush body and the pigtails. I have found that it is not necessary to fray out the ends of the pigtails which are embedded in the briquetted metal powder form in order to provide means for anchoring the ends of the pigtails in the brush body. The pigtails 13 may be cut off at right angles to their length as shown in Fig. 1. What becomes of the end portions of the pigtails during the sintering operation I cannot definitely state but I presume that these ends may alloy with some of the finely divided metal particles contained in the brush body. It may be that the ends of the pigtails may alloy with the tin particles of the brush specified by way of example and thus form a bronze included in the structure of the brush body.

One important feature is the use of a sin-

tering bath to unite the pigtail and brush body as well as to unite the metal particles of the brush body. In the bath, the parts to be united are maintained so free from metallic oxide that the bond described may
5 take place. If any metallic oxides are present within the briquetted form, these oxides will be reduced in the bath.

While I have used the term "bond" it will be understood that there is no intervening
10 bonding metal joining the pigtails and the brush body. The union of the pigtails and brush body is so perfect that careful examination does not reveal where one part begins and the other ends.

15 By eliminating a joint between the brush body and the pigtail I have greatly prolonged the life of the brush since there is no possibility of corrosion at the joint, as occurs especially when the joint is formed by soldering. Furthermore, by providing an
20 integral structure, I have provided a body which has substantially the same electrical conductivity throughout. In this respect my invention is superior to structures having a
25 joint between the brush body and the pigtail which has greater electrical resistance than the body or the pigtail.

While the form of embodiment of the present invention as herein disclosed, constitutes a preferred form, it is to be understood
30 that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

35 1. The method of making an integral structure including a body of united metallic particles and a preformed metal body which consists in compressing powdered metallic particles with a portion of the pre-
40 formed body embedded in the compressed form, and in heating the whole at a temperature and for a time sufficient to cause the metallic particles to unite, and the embedded portion of the preformed body to
45 unite with a portion of the metallic structure of the other body, the heating taking place in a molten salt bath having a melting

point between 1200° F. and 1500° F. and having a fluxing action which dissolves the
50 oxides on the metal particles thereby facilitating their alloyage.

2. The method of making an integral structure including a body of united metallic particles and a preformed metal body
55 which consists in compressing powdered metallic particles with a portion of the preformed body embedded in the compressed form, and in immersing the whole in a molten salt bath having a melting point between 1200° F. and 1500° F. and having a
60 fluxing action on the metals being sintered, the temperature of the bath and the time of immersion being sufficient to cause the metallic particles to unite and the embedded
65 portion of the preformed body to unite with a portion of the metallic structure of the other body.

3. The method of making a dynamo brush having a preformed conductor integral
70 therewith which consists in compressing about a portion of the preformed conductor a mixture of powdered materials including powdered metals, and in immersing the whole in a bath of molten sodium cyanide
75 maintained at a temperature of about 1400° F., the time being sufficient to cause the metallic particles to unite to form the brush body and the embedded portion of the preformed conductor to unite with the metallic
80 structure of the brush body.

4. The method of making a dynamo brush having a preformed conductor integral therewith comprising: molding powdered
85 metals in the form of a brush with a portion of said preformed conductor molded in place therein, and then sintering said molded unit to form an integral structure in a bath of molten sodium salt having a
90 melting point between 1200° F. to 1500° F. and having a fluxing action on the metals being sintered.

In testimony whereof I hereto affix my signature.

CHARLES FREDERIC SHERWOOD.