May 18, 1943 E. I. LARSEN ET AL 2,319,240

ELECTRIC CONTACT AND THE LIKE

Filed March 19, 1940

Fig. 1

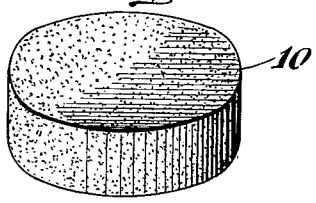


Fig. 2

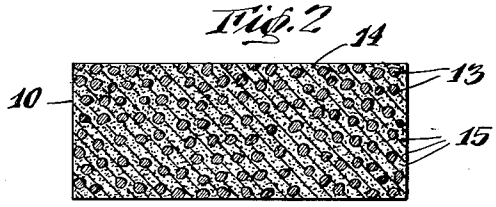


Fig. 3

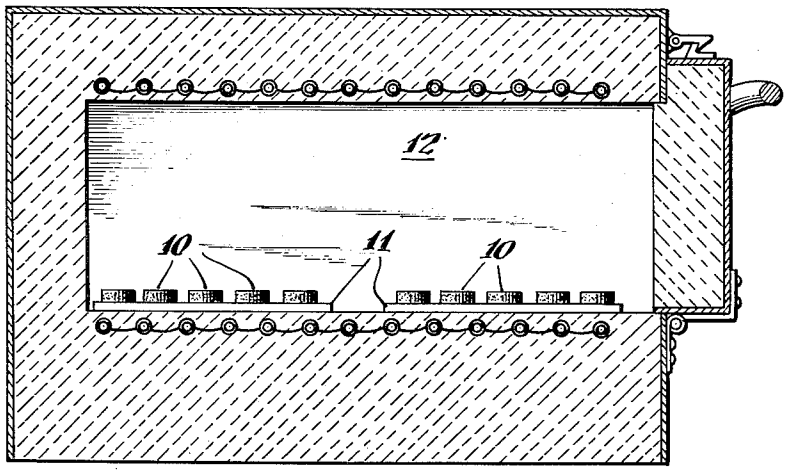


Fig. 4

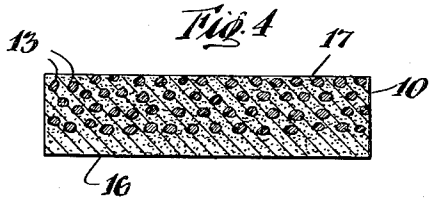


Fig. 5

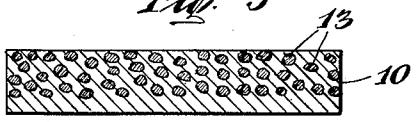


Fig. 6

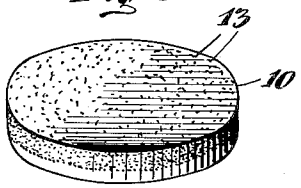
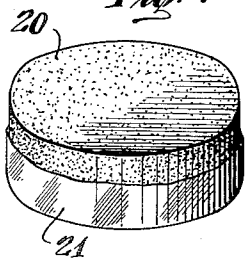


Fig. 7



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ELECTRIC CONTACT AND THE LIKE

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Application March 19, 1940, Serial No. 324,742

2 Claims. (Cl. 75—22)

This invention relates to facing elements such as electric contacts and the manufacture thereof.

An object of the invention is to improve such elements and the methods of manufacture thereof.

Other objects of the invention will be apparent from the following description taken in connection with the appended claims.

The present invention comprises a combination of elements, methods of manufacture and the product hereinafter set forth, the scope of the invention being indicated in the appended claims.

While a preferred embodiment of the invention is described herein, it is contemplated that considerable variation may be made in the method of procedure and the combination of elements, without departing from the spirit of the invention.

In the drawing:

Figure 1 illustrates a contact disc during a preliminary stage of its manufacture;

Figure 2 is a cross section of the contact disc illustrated in Figure 1;

Figure 3 illustrates the furnacing or sintering of the contacts;

Figure 4 is a cross section of a contact after furnacing;

Figure 5 is a cross section of the contact after a subsequent pressing operation;

Figure 6 is a perspective view of the repressed contact; and

Figure 7 illustrates a contact during a preliminary step in its processing according to a modified procedure.

The present invention relates to improvements in face plates or surfacing elements, particularly of the type formed of mixtures of metals and carbon or graphite particles, or other carbonaceous material. In its preferred embodiment the invention contemplates electric contact plates, or discs, formed of a mixture of powdered contact metal and graphite, pressed into suitable form and sintered.

A feature of the invention resides in the improved structure and composition of the face plate or contact disc wherein carbon or graphite is present in the metal composition at one face and substantially absent at the other face of the plate. Another aspect of the invention resides in the improved method of manufacture wherein the plate or disc is first formed with graphite present throughout and the graphite is subsequently removed from one surface by a degraphitizing process.

The metal used will depend upon the application intended. It is apparent that any metal which is not substantially deleteriously affected by the process will be suitable. For contact purposes a metal having desirable characteristics for contacts is preferred, such as silver, copper, nickel, cadmium, tungsten and molybdenum or alloys or mixtures containing one or more of these elements. The metal or alloy is preferably mixed, in powder form, with the graphite or other carbonaceous material. The preferred composition for contact purposes is a pressed and sintered mixture of silver and graphite powders.

One of the principal objections, heretofore, to a contact composed of silver and graphite is the fact that it is extremely difficult to attach a backing member thereto. It can not be riveted, staked, screwed or otherwise mechanically attached to the backing material in an efficient manner. Therefore, it is necessary that the silver graphite pressed material be soldered or brazed to the supporting or current carrying backing. It has been found that when the usual solders are used to perform this brazing operation, that a very weak joint or bond between the silver graphite material and the backing, is obtained. This appears to be due to the fact that when the silver graphite material is heated, the graphite is not tinned or wetted by the soldering. Furthermore, it appears to be very gassy and does not allow the silver to tin or solder properly. This objection or deficiency is entirely overcome when contacts of, for example, silver and graphite, are manufactured according to the present invention.

Following is a description of a preferred method of preparing silver graphite contacts according to the invention, reference being made to the accompanying drawing:

A powder mixture comprising approximately 95% by weight of silver powder and 5% graphite powder is prepared by mixing the powder thoroughly. The mixed powders are then pressed into the desired shape, for example, the contact disc 10 illustrated in Figure 1 of the drawing. The pieces are then laid on a graphite slab 11 with one face directly in contact with the graphite slab. The graphite slab 11 carrying the contacts 10 is then placed in a heated chamber such as electric furnace 12 of Figure 3, the chamber having an oxidizing atmosphere.

The cross section of the pressed contact discs, prior to sintering, may appear somewhat as illustrated in Figure 2 of the drawing wherein the

graphite particles 13 are interspersed with the silver 14 in which there may also be present at this time a few voids 15.

The contact discs are allowed to remain in the heated chamber for a time sufficient to sinter the silver particles together and to degraphitize the exposed surfaces of the contacts. With a furnace temperature of 900 degrees C. a period of ½ hour is generally satisfactory.

The degraphitizing, which comprises an important aspect of the present invention, is believed to take place in the following manner: The oxidizing atmosphere, for example air, reacts with the graphite particles at and adjacent to the exposed surface of the contacts to form gaseous carbon monoxide or carbon dioxide or both, thereby denuding the pressed mixture of graphite adjacent to the surface. However, the opposite face of the contact which is resting against the graphite slab is protected from oxidation by the graphite slab and hence the graphite particles remain substantially undiminished in quantity at the latter surface.

While air is a satisfactory oxidizing atmosphere, other oxidizing atmospheres may be used such as pure oxygen or even hydrogen, containing a small percentage of oxygen or water vapor. The water vapor reacts with the graphite to form carbon monoxide with the release of pure hydrogen.

Upon removal from the furnace the contact disc may have a cross section such as illustrated in Figure 4. It will be noted that the graphite particles 13 are removed from the surface 16 and for a substantial depth below the surface, while the surface 17 which was in contact with the graphite slab still contains graphite in substantially undiminished quantity. It will also be noted that the contact disc 10 has shrunk somewhat in thickness. In order to increase the density of the contact disc and substantially eliminate the voids it is generally preferred, although not essential, to apply a subsequent repressing or coining operation which further reduces the thickness of the contact disc and substantially eliminates the voids. A cross section of the repressed contact disc 10 is illustrated in Figure 5 and a perspective view thereof in Figure 6.

The depth of the degraphitized layer of the contact will depend upon the temperature at which the sintering operation is carried out and the length of time the piece is held at that temperature. Hence if a degraphitized layer of greater thickness is desired the time of sintering will be correspondingly extended.

Figure 7 illustrates another method of producing a contact of the type described. According to this method the surface of the pressed powder disc 20, similar to disc 10 previously described, at which it is desired to retain the graphite, is painted or otherwise coated with a protective layer 21 such as a paint formed from refractory material with a suitable binder. The refractory paint protects one face of the disc from the oxidizing atmosphere allowing the other surface of the disc to be degraphitized. The refractory material may subsequently be removed.

While the invention has been described in its preferred form as applied to silver graphite contact compositions, the invention also contemplates other compositions for contact purposes and other uses. For example, a mixture of copper powder with various amounts of graphite may be used; likewise a mixture of copper, silver and graphite powders is suitable. Other powder mixtures which are suitable, particularly for contact purposes, are silver plus tungsten plus graphite, silver plus molybdenum plus graphite, copper plus tungsten plus graphite, silver plus nickel plus graphite, silver plus nickel plus cadmium plus graphite. Any of these metals may likewise be used with other forms of carbon instead of graphite as well as certain carbonaceous compounds, particularly the type which decompose leaving a residual carbon deposit upon sintering. It will also be understood that while a composition of 95% silver and 5% graphite is mentioned by way of illustration various other proportions of the materials may likewise be used.

Although the invention has been described as applied to electric contacts it is also contemplated that other types of face plates or surfacing elements, such as bearings, clutch facings and the like come within the purview of the invention.

While the present invention, as to its objects and advantages, has been described herein as carried out in specific embodiments thereof, it is not desired to be limited thereby but it is intended to cover the invention broadly within the spirit and scope of the appended claims.

What is claimed is:

1. The method of making electric contacts which comprises mixing graphite and contact metal powders, pressing the mixture into a body of suitable shape, coating the contact face of said body with a protective layer of refractory paint and then sintering said body in an oxidizing atmosphere, whereby to produce a sintered contact body having graphite at and adjacent the contact face thereof and substantially devoid of graphite at the back face thereof.

2. The method of making a weldable silver-graphite electric contact element, comprising coating a surface of said element with a refractory paint and then oxidizing the graphite from the exposed surfaces of said element to thereby leave a readily weldable silver face substantially free of graphite.

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