Patented May 13, 1941 2,241,816

UNITED STATES PATENT OFFICE

2,241,816

SILVER ELECTRIC CONTACT

Franz R. Hensel and Kenneth L. Emmert, Indianapolis, Ind., assignors to P. R. Mallory & Co., Inc., Indianapolis, Ind., a corporation of Delaware

No Drawing. Application January 16, 1940, Serial No. 314,051

2 Claims. (Cl. 200—166)

The present invention relates to electric contacts.

An object of the invention is to improve the characteristics of electric contact elements containing at least 99% silver.

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

The present invention comprises the combination of elements, methods of manufacture and the product thereof, brought out and exemplified in the disclosure 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.

The present invention contemplates an improvement in high silver percentage electric contact elements, generally classified as fine silver contacts. According to the invention, the contacts are improved by the addition of small quantities of nickel. Contacts formed according to the invention may have the following range of compositions:

Nickel	0.05 to 0.6%
Silver	At least 99% and preferably making up the balance of the composition.

Commercial fine silver has been used very extensively for electric make and break contacts. While fine silver has given good performance in many applications, a great disadvantage has been its extreme softness. In order to harden silver, copper has been added to it, but tests have shown that silver base alloys containing copper show an increased contact resistance when used as electric make and break contacts. This increased contact resistance may be objectionable for certain applications. These disadvantages are overcome by adding to fine silver a small percentage of nickel, such as is contemplated in the present invention. Fine silver is very prone to develop extreme grain growth at elevated temperatures and is subject to fail by intercrystalline weakening or breakdown.

By alloying the fine silver with a small percentage of nickel, in the percentage range given above and more preferably in the range 0.1 to 0.3%, the recrystallization temperature of silver is raised and such grain growth is almost completely eliminated. The introduction of nickel into fine silver is connected with certain difficulties, because nickel has a very limited solid solubility in silver. It is therefore necessary to overheat the metal when molten, in order to introduce the nickel, which, during the cooling operation, is dispersed in very fine particles throughout the ingot. When the ingot has been worked down these are distributed throughout the wire, strip or other wrought product, from which the contacts may be manufactured.

Once the nickel has been precipitated in a finely dispersed form, it is hardly affected by the further hot workings which are necessary in the manufacture.

It was found that with as little as 0.1 to 0.2% nickel the strength of the silver can be increased by 10%, the strength at elevated temperature can be increased by 20%, and the yield point can be increased by as much as 100%.

If nickel additions are made above the amount specified in the present disclosure, no further improvements are found as far as grain refining and strengthening effects are concerned.

Extensive tests made with a material described by the present invention have shown the material to be advantageous for use on applications where a more or less straight resistive load is used. It shows improvements over commercial fine silver for thermostatic applications, especially on direct current, as the extent of metal transfer is reduced.

The value of the material on all direct current applications is apparently through its superiority over commercial fine silver from the standpoint of reduction in the amount of build-up or transfer, where critical contact spacing must be maintained for satisfactory equipment operation.

The use of the material of the present invention is of further value in maintaining contact spacing on many applications, wherein commercial silver-copper alloys are at present being used as by the inherent structure of the alloy, the deformation due to recrystallization is eliminated and at the same time, the objectionable contact resistance increases obtained by silver-copper alloys is not present.

The material of the present invention also lends itself very well to the fabrication of all types of contacts on base metal backings, as well as bi-metal and an inlay or overlay strip. The material as covered by the present invention can be applied in any of several methods, such as by direct fusion, brazing, plating, spraying, etc.

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. An electric contact member, composed of 0.1 to 0.3% nickel and the balance substantially all silver.

2. An electric contact composed of 0.05 to 0.6% nickel and the balance substantially all silver.

FRANZ R. HENSEL.
KENNETH L. EMMERT.