

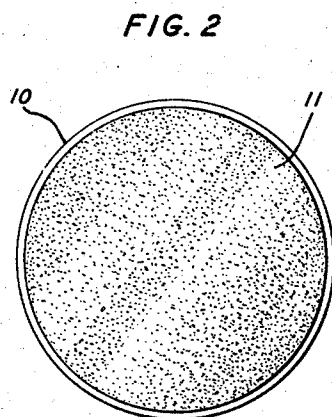
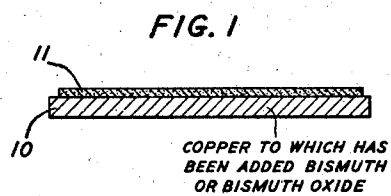
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ASYMMETRICAL CONDUCTOR AND METHOD OF MAKING THE SAME

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ASYMMETRICAL CONDUCTOR AND METHOD
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7 Claims. (Cl. 175—366)

This invention relates to asymmetrical conductors, that is, electrical conducting devices which offer a greater resistance to flow of current in one direction than in the opposite direction, and to methods of making such conductors. More particularly, this invention relates to electrical conducting devices of the copper-cuprous oxide type and to methods of making such devices.

One general object of this invention is to improve the current-voltage characteristic of asymmetrical conductors. More specifically, one object of this invention is to decrease the resistance, in the high current direction, of copper-cuprous oxide rectifiers, whereby an increase in the rectification ratio is obtained.

In accordance with one feature of this invention, an asymmetrical conductor of the metal-metal oxide type comprises a body of commercial copper of a high degree of purity having a small percentage of bismuth therein. The bismuth may be introduced into the copper by adding to molten copper either bismuth or a bismuth oxide.

Other and further objects and features will be apparent from the following detailed description taken in conjunction with the accompanying drawing in which:

Fig. 1 is a cross-sectional view of a copper-cuprous oxide rectifier made in accordance with this invention; and

Fig. 2 is a top plan view of the device of Fig. 1.

In the manufacture of copper-cuprous oxide rectifiers and the like, it is considered good practice to employ commercial copper having a high degree of purity. Such copper may have traces of metallic impurities totaling about 0.04 per cent.

In accordance with one feature of this invention, there is added to such copper, when in the molten state, a small amount of bismuth or a bismuth oxide. The resulting material is formed into sheets of suitable thickness, and blanks or washers formed therefrom. The blanks may then be treated by various methods to produce metal-metal oxide rectifier units. One such process comprises placing a blank in a furnace having an oxidizing atmosphere at about 1000° C., for about ten minutes, then placing it in a second furnace maintained at about 500° C. for about three minutes and subsequently quenching in cold water.

The oxide layer 11, which has been formed on the blank, is then suitably treated to provide a low ohmic electrical contact surface thereon.

It has been found that asymmetrical conductors made from copper to which has been added up to about 0.04 per cent by weight of bismuth or 0.045 per cent of bismuth trioxide have better characteristics than those made from commercial copper. Such addition results in a decrease in resistance in the high current direction with no appreciable change in the resistance in the low current direction thereby materially increasing the rectification ratio. Rectifiers having the above-noted characteristics have been made from copper melts to which have been added the following percentages of the indicated materials: Bismuth from 0.01 to 0.04 per cent or a bismuth oxide in sufficient amount to supply the foregoing range of bismuth to the melts, for example, up to 0.045 per cent bismuth trioxide.

Although specific embodiments of this invention have been shown and described, it will be understood that modifications may be made therein without departing from the scope and spirit of this invention as defined in the appended claims.

What is claimed is:

1. An asymmetrical conducting device comprising a metallic body having an integral layer of an oxide of said body thereon, said body comprising copper to which has been added one of the materials of the group comprising bismuth and bismuth oxides.
2. A copper-cuprous oxide rectifier formed from a copper body to which has been added up to 0.04 per cent of bismuth.
3. A copper-cuprous oxide rectifier formed from a copper body to which has been added up to 0.045 per cent of bismuth trioxide.
4. A copper-cuprous oxide rectifier formed from copper containing one of the materials from the group comprising bismuth and bismuth oxides.
5. A copper-cuprous oxide rectifier formed from copper containing bismuth.
6. A copper-cuprous oxide rectifier formed from copper containing bismuth oxide.
7. A copper-cuprous oxide rectifier formed from copper containing bismuth trioxide.

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