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ASYMMETRICAL CONDUCTOR

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FIG. 1

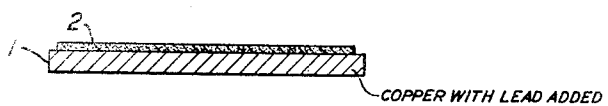
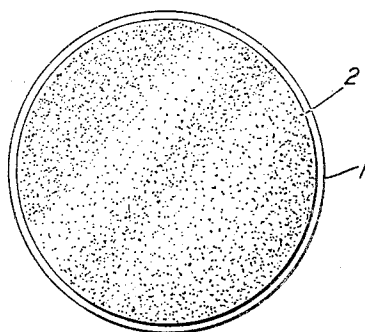


FIG. 2



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## UNITED STATES PATENT OFFICE

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## ASYMMETRICAL CONDUCTOR

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6 Claims. (Cl. 175—366)

This invention relates to electrical current conducting devices that offer a greater resistance to flow of current in one direction than in the opposite direction and more particularly to such devices of the copper-cuprous oxide type.

An object of this invention is to improve the current-voltage characteristics of copper-cuprous oxide rectifiers by increasing the resistance in both the high and low current directions, the increase in the high current direction being for voltages below 0.5 volt.

A feature of this invention comprises making copper-cuprous oxide type conduction devices from commercial copper having a high degree of purity to which has been added a small amount of another metal, more particularly lead.

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

Fig. 1 is a cross-sectional view of a copper-cuprous oxide rectifier 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 totalling about 0.04 per cent. In accordance with this invention there is added to such copper, when in the molten state, a small amount of lead. The resulting material is formed into sheets of suitable thickness and blanks or washers punched therefrom. The blanks may then be treated by various methods to produce metal-metal oxide rectifier units. One such process comprises placing a blank 1 in a furnace having an oxidizing atmosphere at about 1000° centigrade for about eight minutes, then placing it in a second furnace maintained at about 500° centigrade for about five minutes and then quenching in cold water.

The oxide layer 2 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 the addition to copper of lead in an amount up to about 0.4 per cent by weight results in an asymmetrical conductor

which has better characteristics than those made from commercial copper. The result of such addition is an increase in resistance in both the high and low current directions except at voltages of about a half-volt or more in the high current direction. This result has been obtained in rectifiers made from copper melts to which about 0.05 per cent, 0.1 per cent, 0.2 per cent or 0.375 per cent of lead have been added.

It will be understood that this invention has been disclosed with reference to a particular, exemplary form thereof, and is to be considered as limited in scope by the appended claims only.

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 lead to the extent of slightly more than 0.1 per cent.

2. A copper-cuprous oxide rectifier formed from a copper body to which has been added from over 0.1 per cent to 0.4 per cent of lead.

3. A copper-cuprous oxide rectifier formed from a copper body to which has been added approximately 0.3 per cent of lead.

4. The method of making a conductive device comprising a body substantially of copper having a layer of oxide integral therewith, that comprises adding to molten copper a small amount, slightly over 0.1 per cent, of lead, forming a body from the resulting melt and heat treating said body to form the oxide layer thereon.

5. The method of making a conductive device comprising a body substantially of copper having a layer of oxide integral therewith, that comprises adding to molten copper a small amount, up to 0.4 per cent, of lead, forming a body from the resulting melt and heat treating said body to form the oxide layer thereon.

6. The method of making a conductive device comprising a body substantially of copper having a layer of oxide integral therewith, that comprises adding to molten copper from over 0.1 per cent to 0.4 per cent of lead, forming a body from the resulting melt and heat treating said body to form the oxide layer thereon.

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