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G. O. SMITH
ASYMMETRICAL CONDUCTOR
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FIG. 1

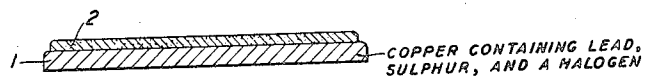
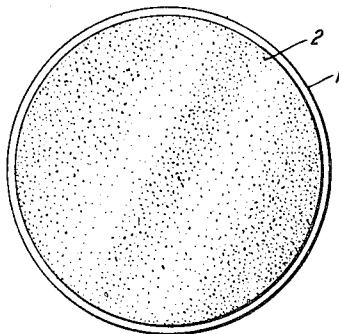


FIG. 2



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ASYMMETRICAL CONDUCTOR

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5 Claims. (Cl. 175—366)

1

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 rectifier devices of the cuprous oxide-copper type.

An object of this invention is to improve the current-voltage characteristic of cuprous oxide-copper rectifiers by increasing their stability at relatively high reverse voltages.

A feature of this invention comprises making cuprous oxide-copper conduction devices from commercial copper having a high degree of purity to which has been added a small amount of other material, more particularly a halogen, sulphur and either lead or lead oxide.

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

Fig. 1 is a cross-sectional view of a cuprous oxide-copper 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 cuprous oxide-copper 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 this invention, there is added to such copper, when in the molten state, a small amount each of a halogen, sulphur, and either lead or lead 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 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.

The lead, sulphur, and halogen may be added to the melt in various forms and at such time as is most suitable to the melting and casting process being employed. For example, a small batch may be handled in the following manner: the copper is melted in a furnace at about 1250° C. in a non-oxidizing atmosphere; nitrogen is suitable. While the melt is in the furnace, small amounts of lead or lead oxide, a halogen as a copper or lead halide, and sulphur as a sulphide, are added. The melt is removed from the fur-

2

nace and stirred. The casting is done at about 1125° C. The cooled casting is then mechanically worked, as by rolling, to a sheet of the proper thickness. Discs or washers of the required size are then stamped or otherwise formed from the sheet.

In the case of large batches, it may be more convenient to make the additions after removal of the melt from the furnace and while it is cooling to casting temperature, for example, in the pouring ladle. Other methods of addition to the melt, suitable to the particular casting process employed, may be used.

It has been found that asymmetrical conductors made from copper to which has been added up to about 0.3 per cent by weight of lead as metallic lead or lead oxide, about 0.01 per cent sulphur as a sulphide, and about 0.15 per cent halogen as a copper or lead compound of chlorine, iodine, bromine, or fluorine, have better characteristics than those made from commercial copper. These additions to the copper result in such an improvement in the stability of the rectifier unit that reverse voltages as high as 60 volts may be safely applied thereto. This improvement decreases by a large factor the number of rectifier elements required in a given assembly.

It will be understood that this invention has been disclosed with reference to particular illustrative embodiments, and it 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 consisting of copper containing small amounts of lead, a halogen, and sulphur.
2. A cuprous oxide-copper rectifier formed from a copper body containing small amounts of lead, sulphur, and chlorine, up to 0.3 per cent lead, up to 0.01 per cent sulphur, and up to 0.15 per cent chlorine.
3. A cuprous oxide-copper rectifier formed from a copper body containing small amounts of lead, sulphur, and iodine, up to 0.3 per cent lead, up to 0.01 per cent sulphur, and up to 0.15 per cent iodine.
4. A cuprous oxide-copper rectifier formed from a copper body containing small amounts of lead, sulphur, and bromine, up to 0.3 per cent lead, up to 0.01 per cent sulphur, and up to 0.15 per cent bromine.
5. A cuprous oxide-copper rectifier formed from a copper body containing small amounts of

lead, sulphur, and a halogen, up to 0.3 per cent lead, up to 0.01 per cent sulphur, and up to 0.15 per cent halogen.

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10

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