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MANUFACTURE OF ALTERNATING ELECTRIC CURRENT RECTIFIERS

Albert Leslie Williams, Leslie Ernest Thompson, and Roger Harry Cubitt, London, England, assignors, by mesne assignments, to The Union Switch & Signal Company, Swissvale, Pa., a corporation of Pennsylvania

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4 Claims. (Cl. 175—366)

This invention relates to the manufacture of alternating electric current rectifiers of the dry surface contact type comprising a body of metal having a compound of the metal formed directly thereon and more particularly rectifiers of the copper oxide type.

Rectifiers of this character, as manufactured by the processes hitherto employed, are found to exhibit during operation a phenomenon as regards the relatively small flow of current through the rectifier in the reverse or blocking direction, this current increasing relatively rapidly under a substantially constant voltage in the reverse direction applied to the rectifier until the current attains an apparently stable value which may be several times that of the initial reverse current when the voltage is first applied. The stable virtual value of the reverse current when an alternating current voltage is applied to the rectifier, is increased due to this effect, which accordingly determines the voltage for which the rectifier is capable of effecting satisfactory rectification in service. The decrease in the apparent resistance of the rectifiers causing this phenomenon which may be termed "reverse creep" is temporary, the apparent resistance gradually increasing to its original value when the voltage is no longer applied.

The decrease in apparent resistance constituting the reverse creep is dependent upon the physical and chemical constitution of the copper or other metal from which the rectifier is manufactured and the object of the present invention is to provide a process of preliminary treatment of the metal body whereby the reverse creep can be wholly or partly eliminated.

According to the principal feature of the invention this result is attained by subjecting the copper or other metal to a preliminary heat treatment at a suitable temperature or temperature cycle prior to the actual process of formation of the rectifier.

In the case of copper, the advantage gained by the preliminary heat treatment increases with an increase in the temperature of treatment, but if the process be carried out in air the temperature range is limited by the formation of excess oxide at higher temperatures, i. e., above 700° C., and by its inefficiency at lower temperatures, i. e., below 400° C. The formation of too much oxide is not in itself a disadvantage but it introduces difficulties in the subsequent oxidation.

If the process be carried out in vacuo, the formation of oxide is avoided and temperatures

up to that of the melting point of the metal can be employed.

The time required for the process to be effective is lessened by increasing temperature. As an example, at 600° C. one hour is sufficient and the majority of the effect occurs during the first ten minutes.

After the completion of the process, the copper may be allowed to cool to atmospheric temperature or passed directly through the main oxidation cycle as desired.

If, after the preliminary heat treatment, the metal is chemically treated in a suitable manner, for example, in the case of copper by etching the surface with an acid or other etching agent, then the rectifier, after completion, exhibits what may be termed "negative creep."

In a rectifier having this negative creep characteristic, the current in the reverse direction, due to an applied voltage instead of gradually increasing with time from its initial value as above described, decreases at first and may slightly rise again with the final result that the stable value of the reverse current may be considerably lower than that of a rectifier formed in the normal manner, and even lower than that of a rectifier which has been subjected to a heat treatment without the subsequent chemical treatment.

It will be understood that a rectifier material heated under suitable conditions in vacuo, where no oxide is formed, will exhibit negative creep without the chemical treatment referred to above.

It will be understood that the invention is not limited to heat treatment at the particular temperatures above referred to by way of example but includes such treatment at any temperature adapted to achieve the result above explained and effected under atmospheric conditions or in vacuo and with or without a subsequent chemical cleaning process.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:

1. The process of manufacture of alternating electric current rectifiers of the kind described which consists in subjecting the body of metal on which a compound of the metal is to be directly formed to a preliminary heat treatment in air at a temperature of between 400° C. and 700° C., and then etching or otherwise chemically treating the surface of the metal, prior to the actual treatment for formation of the compound on the metal, for the purpose specified.

2. The process of preparing a copper oxide

rectifier element to decrease reverse creep which consists in subjecting a copper blank to a preliminary heat treatment in air at a temperature of between 400° C. and 700° C. prior to the treatment of the blank to form the necessary oxide coating thereon.

- 5 3. The process of preparing a copper oxide rectifier element to reduce creep which consists in subjecting a copper blank to a preliminary heat treatment in air at a temperature of approximately 600° C. for about ten minutes, and then treating said blank to form the necessary oxide coating thereon.

4. The process of preparing a copper oxide rectifier element to reduce creep which consists in subjecting a copper blank to a preliminary heat treatment at a temperature of from 400° C. to 700° C. in air for a period ranging up to approximately one hour, chemically treating the blank with an acid or other etching agent to etch the surface of the blank, and then treating the blank to form the usual oxide coating thereon.

10 ALBERT LESLIE WILLIAMS.
LESLIE ERNEST THOMPSON.
ROGER HARRY CUBITT.