

UNITED STATES PATENT OFFICE.

CARL CLAUS, OF PLAINFIELD, NEW JERSEY.

BEARING MATERIAL AND METHOD OF MAKING THE SAME.

No Drawing.

Application filed May 28, 1926. Serial No. 112,404.

This invention relates in general to compressed compositions from which bearings of various kinds are made, and it has particular reference to the type of composite bearing material which is made from a mixture of finely divided metals, of different kinds, such as those known as bearing metals, for example, copper, tin, zinc, lead, antimony and aluminum and so forth.

The selected mixture is compressed with a relatively high degree of pressure and then heated to a comparatively high degree of temperature, to form a consolidated coherent material of a porous character capable of absorbing lubricating oil.

The heretofore known processes by which metallic bearing materials of the above stated type have been made, have required in some instances the reduction of certain of the metallic ingredients from oxide to metallic forms during the performance of the process. In other instances certain precautions had to be observed in order to provide an essential non-oxidizing atmosphere peculiar to that process, and in all of the old processes, the length of time required to make the product has been very long, in some instances being so great as to be practically prohibitive when the questions of cost of production and time were to be considered.

After innumerable experiments and tests, I have discovered that a high grade efficient metallic bearing composition of the self-lubricating type, can be made in a comparatively short period of time, by using a mixture of different metals in a pure state in finely divided condition, to which graphite may or may not be added, compressing the same into a consolidated coherent mass and then finishing it by subjecting it to a high degree of temperature for a few minutes time, without especially providing a non-oxidizing atmosphere. By virtue of my improved process, I have succeeded in overcoming several of the above named drawbacks found to exist in the prior processes, and I thereby produce an efficient product, having the desirable hardness and porosity, both of which characteristics may be varied in degree by regulating the degree of the pressure used in compressing the mixture before subjecting it to the heating step.

In accordance with my invention, I have successfully made bearing material of excellent quality and high efficiency by pro-

ceeding, for example, as follows: I take finely divided copper, tin and zinc, each in a pure state and which have been kept practically free from oxidation, and mix them intimately in any suitable manner with finely divided graphite, approximately in the proportions of parts by weight of from about 80 to about 90 parts of copper, from about 7 to 14 parts of tin, from about 2 to 3 parts of zinc, and from about 2 to 6 parts of graphite. The fineness of the respective ingredients may be such that they will all practically pass through a 150 mesh screen, but the fineness of the ingredients may, of course, be varied as desired, in order to alter by such variation the character of the product, which as well known will respond to a variation in the size of the particles of the ingredients. In some cases I omit the graphite and change the proportions of the powdered metals accordingly. For example, I may use say 88 parts by weight of copper, 10 parts by weight of tin and 2 parts by weight of zinc. In each instance practically 100 parts by weight are used in the total mixture.

A charge of the mixture is placed in a suitable press capable of exerting a heavy pressure, say from 15,000 lbs. to about 50,000 lbs. per square inch, and a degree of pressure approximately within this range of said amounts, is exerted upon the charge in a suitable mold while the charge is in cold condition, although it may be heated during compression, if preferred. This compression which is preferably applied equally from opposite points as hereinafter described, is such that the composition is formed into a relatively hard and compact mass, in which the particles are forced into strong adherence with each other and it may then be handled without risk of fracturing or mutilating it. The fineness of the grain or texture of this product may be made to vary, by employing different degrees of pressure under which the compression is effected and the porosity of the finished product after the subsequent heat treatment is likewise influenced by such variation in pressure.

Upon removing the compressed body from the press, it is then placed in a closed container or box and subjected therein to a heat of from about 1400° F., to about 1500° F., for a period of from about ten to twenty minutes, depending upon the size of the article and the character of the container in which

it is heated. The heat causes the metals, which as before stated are in a pure state practically, to form an alloy or bronze of a porous character, and when the graphite
 5 is used it is distributed throughout the mass and also embedded in the surfaces thereof. The article thus treated is then removed from the heater or container, and I then submerge it in lubricating oil which it
 10 readily absorbs to the extent in some cases of from about 15 percent to 30 percent of its bulk. Being thus saturated with oil, the final product has its self-lubricating quality increased and if preferred the oil
 15 treatment may be deferred until after the material has been finally pressed and sized. However, I prefer to saturate the material with the oil before it is sized in a press, as I find that the oil-soaked material is easier
 20 to work and it is not torn by the dies in sizing the bearing while at the same time the dies are themselves lubricated by the contained oil.

After the heat and oil treatments, the article or bearing is then subjected to a die
 25 operation or any suitable mechanism, by means of which it is given its final shape and at the same time is accurately sized as to its interior and exterior diameters and
 30 also its length, thus finishing the bearing with all its final dimensions.

This porous composition or alloy which I am thus enabled to make in a comparatively brief time is not affected by oxidation during
 35 the process of making it from pure metals and it is a superior product when compared with many products which are made under different conditions than mine. It possesses a hardness greater than many of the porous
 40 bearing bronzes or alloys now on the market; the Brinell hardness of my product being from about 25 to 50, which is a desirable range in degree, and the specific gravity is from about 5.31 to 6.2.

45 As the mixture of pulverized materials which are used in making this type of bearing, does not easily flow or move on itself when compressed with dies, I prefer to employ pressure from opposite points, as set
 50 forth in my copending application for patent, filed October 26, 1923, Serial No. 671,032, of which the present application is in part a continuation. By thus compressing the charge of granulated materials by means of
 55 dies acting from opposite ends or points on the charge, I have succeeded in making the product more homogeneous in structure and more uniformly dense throughout, than in cases where such material is acted upon by
 60 pressure exerted at a single point or side. This is particularly true in producing a bushing or bearing, of say, more than $\frac{3}{8}$ of an inch in length, and especially when such bushing has a thin wall, say about $\frac{1}{8}$ of an
 65 inch thick.

In finishing my improved bearing to size, I prefer to proceed in accordance with the operations set forth in another copending application for patent of mine, filed Oct. 26,
 1923, Serial No. 671,033, and wherein tubular dies co-operate with a sizing mandrel in
 70 such a manner as to give to the bearing all of its final dimensions with accuracy, whereby the bearing when taken from the machine is ready for installation, without further work
 75 thereon. The present application in parts is a continuation of said copending application for the sizing mechanism.

In accordance with my improved method, I have made very efficient and satisfactory
 80 bearings from the following specific mixture of graphite and metals in a practically pure non-oxidized state and finely divided, namely; about 85 parts by weight of copper;
 85 9 parts of tin; 2 parts of zinc and about 4 parts of graphite, which composition after being compressed is heated, then oil treated and finally sized. By thus sizing the bushing or bearing to all of its final dimensions
 90 as to length and diameters, in a single operation in which the material is drawn or moved on itself and compressed to bring its oversize to the proper size, I am able to provide bearings with less work in the sizing
 95 operation than heretofore, and thereby reduce the cost of manufacture.

While I have herein given the specific ingredients and their proportions in composing the mixture which I have herein described, my invention is not limited to the
 100 same, but on the contrary it contemplates various changes and substitutions in the particular ingredients and their proportions as being within the scope of the appended claims. In referring to the product as an
 105 alloy or bronze, while some of the products may be of that character, others may be of a somewhat different character the physical features of which are difficult to define.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:—

1. The method of making self-lubricating bearing material, which consists in intimately mixing together finely divided copper, tin, zinc and graphite with the copper
 115 largely in excess of the other three ingredients taken together, the metals being practically free from oxidation, then compressing from opposing directions the mixture into a
 120 relatively hard consolidated body, then placing it in a closed container and heating it from about 1400° to about 1500° F. for a period from about ten to twenty minutes.

2. The method of making self-lubricating bearing material, which consists in intimately mixing together finely divided copper, tin, zinc and graphite with the copper
 125 greatly in excess of the other three ingredients combined, then compressing from op-
 130

posing directions the mixture with a pressure of from about 15,000 to 50,000 pounds per sq. in., then placing the compressed material in a closed container and subjecting it to a heat of from about 1400° to about 1500° F. for a period of from about ten to twenty minutes.

3. The method of making self-lubricating bearing material, which consists in mixing together finely divided copper, tin, zinc and graphite, in the proportions of approximately 85 parts by weight of copper; 9 parts tin; 2 parts zinc and 4 parts graphite, then compressing from opposing directions the mixture with a pressure of from about 15,000 to 50,000 pounds per sq. in., then placing the

compressed material in a closed container and subjecting it to a heat of from about 1400° to about 1500° F., for a period of from about ten to twenty minutes.

4. The method of producing bearing compositions which comprises the mixing of purely divided copper 85 parts, tin 9 parts, zinc 2 parts and graphite 4 parts, compressing the mixture by pressure applied from opposite directions into the desired form, heating the formed material to 1400° to 1500° F. for 10 to 20 minutes.

Signed at borough of Middlesex in the county of Middlesex, and State of New Jersey, this 26th day of May, 1926.

CARL CLAUS.