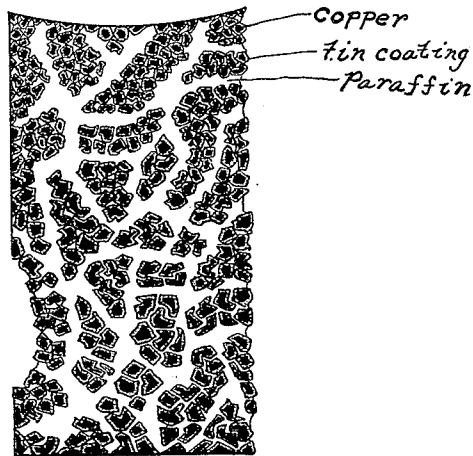


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PROCESS OF MANUFACTURING POROUS METAL BLOCKS.
APPLICATION FILED NOV. 11, 1909.

1,051,814.

Patented Jan. 28, 1913.



Witnesses.

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UNITED STATES PATENT OFFICE.

VICTOR LÖWENDAHL, OF STOCKHOLM, SWEDEN.

PROCESS OF MANUFACTURING POROUS METAL BLOCKS.

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Specification of Letters Patent.

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Application filed November 11, 1909. Serial No. 527,555.

To all whom it may concern:

Be it known that I, VICTOR LÖWENDAHL, a subject of the King of Sweden, and resident of Stockholm, Sweden, have invented
5 a new and useful Improved Process of Manufacturing Porous Metal Blocks, of which the following is a specification.

This invention relates to an improved process of manufacturing porous metal blocks.

- 10 Substances composed of a mixture of metal and carbon and used for instance as brushes for electric machines suffer from the disadvantage that the carbon which in the form of natural graphite is added partly
15 as lubricant and partly to effect a suitable electric conductive and contact resistance, wears off quicker than the metal, so that the contact surface becomes almost purely metallic and thus will be devoid of both lubricant and contact resistance, whereby the
20 purpose of the admixture of the carbon is rendered ineffectual. This is for instance sometimes the case with the material described in the German Patent No. 154287
25 and the British Patent No. 17002 of the year 1902 which consists of a coherent bronze body with graphite particles incased and uniformly distributed therein.

- The object of the present invention is to
30 avoid such disadvantage by using, instead of carbon, other substances, hereinafter referred to as impregnating substances, that neither reduce the prominent qualities of the said bronze-carbon material, nor are influenced
35 by the sparking. Among the substances, which can be used for this purpose, are specially remarkable some lubricants, for instance oil, paraffin and others.

- The invention will be fully understood
40 from the following description and claim when the same are read in connection with the accompanying drawing in which the figure is a side view of a block manufactured in accordance with my invention.

- 45 A body, made according to the present invention, consists of a porous metallic substance, which incloses small, closely disposed quantities of lubricants, the amount of which can be regulated within wide limits, according to the different qualities of the
50 substance. To produce a body of this kind a metallic body is first made, pierced by fine pores or communicating cavities, and this metallic body is then treated with the im-

pregnating substance in question in such a way that the pores or cavities wholly or partly are filled with it. By pressing, hammering, grinding, coppering, tinning or the like the surface can be prepared in such a way, that its pores become closed so that the impregnating substance can emerge only through the contact surface.

The porous metal body is produced in the following way: Powdered metal, especially copper powder, which by well known procedures is covered with thin tin coats, is mixed with a suitable quantity, for instance 10%, of one or more substances (for instance ammonium nitrate) which by heating, easily can be removed. The mixture is pressed to blocks of desired shape and these blocks are then subjected to a sufficiently high temperature, about 600° to 1100° F., in order that the tin shall solder together the copper particles or, without melting the whole, weld or alloy with the copper to bronze. Hereby or even at lower temperature the volatile substance, escapes and leaves in its place cavities in the metallic body. The escaping gases may under circumstances also form other pores and cavities. The body thus produced consists of metal grains, adhering to each other and taking up their original places, but partly separated by capillary cavities. The volatile substance may eventually be removed before the said heating by the blocks being heated to a lower temperature, or if not wholly removed thereby, by a following or continued heating. For special purposes the blocks may, in some cases, be used without being heated to the said higher temperature.

In the practice of the preferred embodiment of the invention the process is carried out as follows: 100 kg. copper powder coated with tin are mixed thoroughly with 5 kg. ammonium nitrate, whereupon the mixture is placed in hydraulic press molds of a shape corresponding to the shape of the article desired. In said molds the mixture is pressed to form solid blocks which are then placed in a furnace and heated to about 850 degrees C. By the heat the volatile substance, in this case the ammonium nitrate, is driven out from the blocks leaving in the latter very fine or capillary pores, while the copper particles are soldered together or the copper and tin are alloyed to bronze. The

blocks are then placed aside to cool, and are then immersed in a bath of molten paraffin which they are left one or two hours or till their pores have been filled by the paraffin. The blocks are then ready for use. Instead of the copper-tin powder mentioned above, other metal powders may be used, for instance powders the grains of which contain three or more metals, such as copper, tin and zinc, alloyed or one coated with the others, or mixtures of single metal powders, such as copper powder mixed with zinc powder or zinc powder or both or antimony powder mixed with one or more of the others, or the like, or, finally, powder one or more alloys. Certain metals may possibly be used without being mixed with others. The powder mixture must consist of such metal or metals, that the grains by heating solder, weld or fuse together, or alloy without melting and without changing their places, in order that the block, with the remaining cavities, maintains its shape. To facilitate the forming of the blocks the powder may be mixed with an additive, for instance glue or viscous substances.

The volatile substance, which is added in varying quantities according to the degree of porosity desired, should preferably be of such kind that it is vaporized and thus escapes completely at a lower temperature than is necessary for the soldering or alloying. Still better is a substance such as ammonium nitrate. But also substances, which evaporate only, or such that burn without the admission of air, may sometimes be used. As a rule such substances are used when they can be powdered, or divided in fine threads. It is, however, not excluded that sometimes substances of other nature can be used with advantage, for instance liquid substances of suitable consistency: single fluids, solutions, emulsions (gelatinous substances, colloids), and so on.

The introduction of the impregnating substance into the pores or cavities may be effected in several ways before or after the mechanical treatment of the blocks, according as these should more or less thoroughly absorb the substance. The blocks or objects may simply wholly or partly be immersed in the substance in question, if this is in a liquid or molten condition or is dissolved in a liquid so that it can be absorbed by capillary action. Or the blocks may first be filled with a more volatile fluid of less viscosity, for instance water, spirits, benzine or the like, and then, immersed in the substance in question, be heated above the boiling point of the more volatile fluid, or the substance may be forced into the pores of the blocks under pressure or in other way.

As will be easily understood, the impregnating substance, in the aforesaid cases

should be in liquid form or at least be so pliant that it can be forced into the cavities. Suitable substances of this kind are the heavier mineral oils, and paraffin, the latter preferably in liquid or dissolved state. The impregnating substance may be a single one in liquid or molten condition, or a solution of a (solid) substance in a liquid or molten substance, or contain suspended finely divided particles such as grinding substances, carbon and so on.

When necessary the blocks may be made with larger holes or cavities, either in the pressing or in the mechanical finishing. These cavities serve as reservoirs for larger quantities of the impregnating substance, especially if this is liquid or if the block in the use attains a temperature high enough to make an otherwise solid substance liquid. If a larger supply of the impregnating substance to the contact surface is necessary than what the wearing of this surface allows, the lateral surfaces of the blocks may be left partly unfinished as shown, or in the pressing of the blocks recesses may be made in those surfaces, where the surface is left raw, in order that the impregnating substance through and over these partly unfinished lateral surfaces may run down to the contact surface, the raw surface easier letting through the substance than the finished one with its partly closed pores.

The above described porous metal has several prominent qualities. With little less strength, at least as regards capacity of sustaining pressure, it has much lower specific gravity and also less hardness than the compact metal, and it may be given a considerable capacity of absorbing liquid substances. These properties may moreover by pressing, hammering and so on be increased to nearly the same amount that they have in the compact metal, while the last-mentioned property by the same means, and also by the mechanical finishing of the surface, may be reduced at will. Thus in the manner described a metal body may be produced, that in regard to specific gravity and hardness may be varied within wide limits, and which can absorb just the quantity of another substance, that in every instance is desirable, or is required to reduce the frictional resistance to a minimum or to keep the electric conductive and contact resistance at a suitable amount. At the same time the metal may be made so yielding that the same, if used as dynamo brushes or in shaft-boxes only by the pressure against the collector (commutator) or the shaft can be given a shape corresponding to the latter without being ground or scraped. The choice of impregnating substance, of metal or metals and of the volatile substance, and further of the proportions of the different substances and of the grade of mechanical finishing ren-

ders it possible to vary within wide limits the properties of the metal body so as to suit widely different requirements.

5 Having now described my invention what I claim as new and desire to secure by Letters Patent is:

10 The process of manufacturing porous metal blocks which consists in pressing into block form, metallic powder commingled with ammonium nitrate, heating the mixture to eliminate the ammonium nitrate and

render the block adequately porous, and impregnating the block with substance capable of penetrating to and occupying the pores thereof.

In testimony whereof I have signed my name to this specification in presence of two subscribing witnesses.

VICTOR LÖWENDAHL.

Witnesses:

JOHN DELMAR,
EDW. DELMAR.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."
