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METALLIC PACKING AND METHOD OF MAKING THE SAME

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This invention relates to a self-lubricating metallic packing comprising a conventional base material, such as lead, impregnated with a conventional lubricating material, such as graphite, and to the method of producing such a packing.

The art has long known that if such materials could be permanently combined they would furnish the ideal packing, and has constantly sought some practicable method of combining them as a substantially homogeneous, ductile packing which once installed in service would not soon become separated and therefore useless under actual service conditions.

According to my invention, I provide a self-lubricating packing which is substantially homogeneous but yet of high ductility and in which the graphite or similar lubricant is permanently bonded to the entire surface of the lead or other base metal flakes and remains intact under the severest conditions of use to which the packing may be put.

My packing may be used for any and all purposes of any type of unit. It may be used either as loose packing or it may be formed to ring or other shape.

Whether used loose and compressed to conforming shape by pressure of the tightening nut or gland in a stuffing box or the like, or whether first formed to ring or like shape and then further compressed in use, my packing nevertheless maintains its quality of ductility and exhibits considerable capacity for "take-up" after it has been installed, without danger of the graphite lubricant becoming separated from the lead flakes due either to the compression to which the packing may be subjected or to the frictional heat generated in service.

Although procedure will vary according to the qualities most wanted in the packing and the materials used, my preferred procedure, using lead as the base metal and graphite as the lubricant, is substantially as follows:

Lead, preferably pure pig lead, is heated to its melting point (around 620° F.) in an elevated melting pot. The pot and the burner for heating the same, are preferably encased in sheet metal to prevent heat losses. The molten lead is discharged by gravity into a heated quenching vat containing water. The rate of discharge, the distance of drop, and the temperature of the quenching water are accurately determined and regulated.

Preferably the discharge outlet is equipped with a regulator valve by means of which the rate of flow of the molten lead may be accurately adjusted and controlled. Preferably also the construction of the melting pot and its casing is such that this discharge outlet and its regulating valve may be maintained at a substantially constant temperature so that there will be no appreciable change in the temperature of the molten lead as it discharges therethrough into the quenching water.

The distance of drop is a determined distance and the quenching water is maintained at all times at a substantially constant temperature, preferably between 85° F. and 95° F., approximately.

By accurately controlling these several factors, I reduce the base metal to flakes of substantially uniform shape, size and texture.

The quenching water is then drained off and the flakes dried in any convenient manner, as by placing them in pans or containers (preferably having foraminous bottoms to permit air circulation) and drying in any suitable oven or drier until substantially all the moisture is driven off.

The dried flakes are now ready to be coated with an adhesive binder by means of which the graphite or other lubricant is permanently bonded thereto.

This step in my procedure may be varied accordingly as the medium used for the binder is varied.

For purposes of ready illustration, and using a carbonizable binder, such as common foundry molasses as the binder, I prefer to divide the coating step into two separate phases. The first phase is to place the dry metallic flakes in a heated mixer or tumbling barrel in which they are given a preliminary warming prior to mechanically mixing them with the molasses which has likewise been heated in any suitable manner to reduce it to a thin free-running state. While in this state, it is introduced into the mixer and blended into the flakes by agitation until the flakes are thoroughly covered with a thin film of the molasses. During this operation, the mix is kept sufficiently warm to prevent the molasses from unduly thickening.

The adhesively coated metal flakes are now ready to receive the graphite or other lubricant.

In this phase of my procedure, the adhesively coated metal flakes are transferred to a second mixer containing graphite, preferably flaked graphite, and the graphite flakes are mechanically mixed with the adhesively coated metal flakes in substantially the same manner as outlined for the first phase of the mixing step.

Being tacky, due to their adhesive covering, the

metal flakes pick up and hold the graphite flakes and at the same time take on a complete and adequate coverage of graphite flakes.

In this condition they are ready to have the graphite flakes bonded thereto in situ.

Before proceeding to do this, however, the metal-graphite mix is preferably, although not necessarily, transferred to a third mixer (preferably of foraminous-wall type) wherein all excess graphite is separated from the mix on rotation of such mixer and collected in a suitable receptacle for re-use.

Thereafter the metal-graphite mix is placed in any suitable pans or containers and baked in an oven or drier at a temperature and for a time sufficient to drive off the water in the molasses and concentrate the molasses residue as a viscous sticky film which during this operation hardens on and is baked fast to the metal flakes thereby binding the graphite to the metal flakes.

Where molasses is employed as the bonding medium the baking temperature preferably ranges from between 130° F. to 150° F. approximately, and is continued for one hour, more or less.

As a result of this treatment, the graphite flakes are permanently and inseparably bonded to the individually-coated metal flakes.

The binder is inert towards the basic materials constituting the packing and is likewise inert towards the metals in which the packing is installed.

After the packing has cooled, it is ready for use in loose form.

Where desired, however, it may be compressed, by means of suitable dies, into rings, part-rings, or other fabricated shapes and in any desired sizes.

Unlike other packing where the lubricant is not permanently bonded in situ to the metal flakes by a heat-developed bonding film, my packing is characterized in that neither the compression necessary to shape the packing into ring or other desired form, nor the compression exerted by the tightening nut or gland on such ring (or on the packing when used in loose form) destroys the bond. To the contrary, the tendency of such compression is to distribute the graphite more uniformly throughout the mass.

Nor does the frictional heat encountered in service re-melt the binder and cause separation of the graphite and metal flakes, but actually such heat has the tendency to further harden the binder.

Although I have described my coating step as a two-stage step, it may obviously be carried out as a single step by simultaneously mixing the metal flakes, the graphite flakes and the binder.

The following tests have been made upon packing produced in accordance with my invention.

Packing rings fabricated from my packing were submerged for a period of approximately eight months in the following solutions:

#1 plain water
#2 salt solution, 20 B. E., 22% NaCl
#3 mineral oil
#4 gasoline
#5 glacial acetic acid, 99.8% CH_3COOH
#6 caustic soda 50% concentration

At the end of such tests, the packing rings exhibited no visible evidence of deterioration or separation of the metal and graphite flakes.

Packing rings fabricated from my packing were also submerged for approximately the same period of time in the following solutions:

#7 concentrated hydrochloric acid, specific gravity 1.19, 36% HCl
#8 phosphoric acid 85% concentration
#9 sulphuric acid, specific gravity 1.84

At the end of such tests in these harsher solutions, the packing rings showed some slight loosening of the binder but the base materials were not affected in any way.

As previously indicated, the base materials and the binder employed may be varied, if desired.

For example, materials other than lead may be used as the base metal, as for example, soft Babbitt-metal or any non-abrasive soft metals.

Similarly, materials other than graphite may be used as the base lubricant, as for example, soapstone, etc.

Although the binder is preferably any carbohydrate leaving a coke-like residue when its moisture or volatile content is driven off by heat, such binder may be any of the following:

(1) A water soluble binder, such as sodium silicate, or the like.

(2) A spirit soluble, such as shellac or other spirit soluble gums.

(3) A mineral thinner soluble, such as phenol-formaldehyde or any other synthetic or natural gums.

(4) A glue or starch.

The baking temperature and time will likewise vary according to the particular base metal, lubricant, and binder used, although in general, it may be said that the baking is carried out at the proper temperature and over the necessary period of time to dissipate the solvent and obtain the proper consistency of the base material of the binder.

In certain instances and with certain types of binder, however, it may be possible to air-dry the binder to accomplish dissipation of the solvents and development of the binding film.

In all cases, I obtain a solidified binding film which completely envelopes and is locked fast to the metal flakes. Hence the resultant packing is one in which the graphite flakes are uniformly distributed throughout the metal flakes and bonded thereto by a bond which loses none of its effectiveness either because of the compression forces or the frictional heat to which the packing is subjected in service.

Such packing does not depend for its effectiveness upon the metal being first reduced to a loculate condition and the graphite being imprisoned in the cells of the metal, either by compression alone, or by means of a heated and chilled waxy filler for such cells which will re-melt and release the graphite if it encounters in service frictional heat at or near its melting point.

Nor does it depend for its effectiveness upon heating the metal and graphite to a temperature which will fuse them together as a hard-cast mass.

Instead, my packing, although practically indestructible in service, yet possesses the necessary ductility or "take-up" to enable it to be closely conformed to the surfaces which are to be packed and lubricated.

When compressed in dies to ring shape, my packing may be given various forms. For example, it may be in the form of a solid ring; a half-ring with a square joint; a half-ring with a beveled joint (the bevel preferably but not necessarily being symmetrical with the center line of

the ring); a ring with a male and female joint, either in solid and half-ring form, the male and female wedges having a spreading effect; or a beveled face ring having a wedge effect when installed in a stuffing box.

Various other modifications in method and materials may obviously be resorted to within the spirit and scope of my invention as defined by the appended claims.

What I therefore claim and desire to secure by Letters Patent is:

1. The method of producing a self-lubricating packing, which comprises coating flakes of soft metal with a carbonizable binder, mixing the binder-coated metal flakes with particles of lubricating material of the class consisting of graphite and soapstone and in an amount sufficient to completely coat the flakes, and baking the mixture at a temperature and for a time sufficient to carbonize the binder but insufficient to destroy the identity of the metal flakes as flakes, the carbonized binder furnishing a thin binding film which permanently binds the particles of lubricating material to the metal flakes, and the metal flakes maintaining their individuality as flakes whether the packing is used in loose form or is molded into ring or other shapes.

2. The method of claim 1, the binder being molasses.

3. The method of claim 1, the binder being molasses and the baking temperature ranging from approximately 130° F. to 150° F. and being continued for approximately one hour.

4. A self-lubricating metallic packing, comprising flakes of soft metal and particles of lubricating material of the class consisting of graphite and soapstone and in an amount sufficient to completely coat the flakes, the lubricant being bonded to the flakes by a thin carbonized binding film carbonized by baking said binder-coated metal flakes while in contact with said particles of lubricating material at a temperature and for a time sufficient to carbonize said binder but insufficient to destroy the identity of the metal flakes as flakes, and the metal flakes maintaining their individuality as flakes whether the packing is used in loose form or is molded into ring or other shapes.

5. The packing of claim 4, the metal being lead.

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