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POLYETHYLENE OXIDES AS BINDERS IN ASBESTOS PACKINGS

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This invention relates to a novel composition of matter which composition is particularly adapted for the manufacture of molded flexible packings. More particularly, this invention relates to a novel flexible and ductile packing core comprising an inorganic lubricant composition and a nominal amount of organic matter. Specifically, this invention relates to a highly desirable temperature-resistant packing composed of a heat-resistant fiber and dry lubricant composition bonded by an organic material.

Heretofore, various materials and compositions have been employed to form molded packings for rotary or reciprocating rods and the like. As a result, several different types of packings have been developed and generally such packings are provided in the form of strands of circular or polygonal cross-sections. Normally the strands are packed in coil or spiral form, and for use, the sections are cut from the package and positioned around the shaft to form a ring packing therefore; often a plurality of such rings is used.

Of the several types of packings, some have been made comprising one or more cords formed of resilient, knitted, corrosion-resistant fabrics generally composed of relatively thin narrow metal ribbons. The knitted metal mesh is preferably twisted into a cord and a plurality of these cords is braided to form a packing. The packings preferably contain sealing media which may be of different types dependent upon the purpose for which the packing is to be employed. Still other packings have been produced whereby inorganic and organic fibers form the outer fabric or shell.

With regard to the core composition per se, many different combinations have been devised to serve as many different uses. For instance, where high temperatures are encountered, the media has taken the form of a fibrous core strand around which the metal mesh is compacted, the core strand preferably being an asbestos roving so as to seal the mesh of the fabric.

Conventionally the core is formed from a binder matrix containing inert fillers and solid and/or liquid lubricants such as graphite and mineral oil. The binder for such conventional packings normally has comprised an elastomer such as a synthetic or natural rubber. However, these packings formed from the elastomer binder cores have proven somewhat disadvantageous in that they have exhibited poor shelf-life, i.e., they have generally hardened substantially before being put into service.

In order to overcome that difficulty, a polychloroprene palm oil packing composition was devised. Such a packing is disclosed in U.S. Letters Patent No. 2,813,084. This particular molded composition generally comprised the same ingredients as the previous compositions except that elastomeric material was replaced by the polychloroprene composition. By utilizing the polychloroprene elastomer, it was possible to obtain extended shelf-life without deleteriously affecting any of the other desirable properties.

However, even with this new composition a distinct disadvantage arose when the packing was employed in various uses and particularly in high temperature applications. Since the binder composition was organic in nature, it was subject to loss when exposed to high temperatures

and the loss ranged as high as 10% or greater. Accordingly, the art has sought a packing composition which, while retaining the desired properties, such as flexibility, plasticity and softness, necessary to allow proper seating of the packings in service and preserve the sealing function while in use, might be possessed of a low amount of organic constitutents to overcome these disadvantages.

It is therefore a principal object of this invention to provide a new and useful composition of matter capable of overcoming the above-mentioned disadvantages.

It is another object of this invention to provide a new and useful composition of matter particularly adaptable as a packing core composition and possessed of a low percentage of organic material and characterized by all of the heretofore desirable properties.

Another object of this invention is the provision of a new and useful low organic content packing composition possessed of desirable flexibility, plasticity and softness to render the composition useful in packing service.

Still another object is to provide a new packing composition of low organic content characterized as in the above objects and additionally possessed of good shelf-life properties.

It is a further object of this invention to provide a composition for molded plastic packings which has good shelf-life and good lubricating characteristics which will not tend to harden during service.

A further object of this invention is to provide a new method of manufacturing molded flexible packings so as to limit the organic ingredients thereof to a minimum and thereby reduce the loss when the packing is exposed to elevated temperatures.

Other objects and further scope of applicability of the present invention will become apparent from the detailed description given hereinafter.

It has now been discovered that the foregoing objects may be satisfied by preparing a molded packing composition comprising a dry lubricant, fiber reinforcement and an organic binder or thickener of ethylene oxide polymer i.e., poly(ethylene oxide). More specifically, a core composition of asbestos fiber, graphite and a poly(ethylene oxide) binder may be prepared wherein it is only necessary to utilize a normal amount by weight of the composition of organic material. A core of such composition may be extruded and the resulting article retains its shape while being braided. A more significant feature of the invention is the use of only a nominal amount, on the order of 1 to 2% by weight, of organic matter used, while maintaining all the desired characteristics. Subsequently, when the composition is subjected to heat, the heat loss amounts to much less than the loss of about 10% when conventional elastomeric binders are utilized.

The preferred flexible molded composition packings formed in accordance with this invention generally comprise the same ingredients as used heretofore save for the replacement of the rubber binder by the thickener. That is, a substantial proportion of inert fillers and lubricants are combined in a matrix with the thickener. The inert fillers and lubricant employed are similar in composition to, and used in amounts comparable to, those conventionally employed for such products. The important feature of this invention does not necessarily reside in the specific fillers and lubricants used in the composition, but rather in the provision of a new binder matrix.

Packings embodying the instant invention may be formed of a plurality of interrelated cords formed primarily of a knitted, corrosion-resistant material such as asbestos but may be of metallic threads depending on the desired product. In the case of asbestos or similar fibrous

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material, several cords are interrelated or associated together preferably with additional stiffer cords such as reinforcing metallic threads. The wire reinforcement may be of the same metal usable for the knitted mesh. The packing is fabricated preferably by a braiding operation, and the braid is molded or compressed into the desired cross-sectional configuration of the completed packing.

The inert fillers which may be employed in molded packings of the type herein defined may comprise stable reinforcing fibers, such as asbestos, cellulose fibers and flocks, etc.; particulate fillers such as mica, diatomaceous earth, etc.; or any other filler which will not have an abrasive, corrosive or otherwise adverse effect upon the packing or the surfaces which contact the packing.

The compositions also normally contatin substantial proportions of solid lubricating fillers such as graphite, carbon, metallic soaps, such as zinc stearate, etc. In addition to the particulate fillers and lubricants, it is often desirable to incorporate in the molded packing substantial proportions of metallic particles or filaments such as wires, chips or ribbons of soft metals such as lead, zinc, copper, etc. These fillers serve the function of forming retention in the packing to prevent extrusion or movement thereof from its operating position. The filler content of the packings of this invention preferably comprises approximately about 30 to about 90% by weight of the molded body.

As heretofore indicated, the desirable characteristics of the molded packing of this invention and particularly the excellent weight loss factor are due to the use of a novel binder matrix of poly(ethylene oxide). The poly(ethylene oxide) forms a very high viscosity solution in water which when added to the novel asbestos-graphite core composition permits extrusion without the separation of water which happens when a latex or water dispersion of rubber is used. These poly(ethylene oxide) materials are water-soluble resins of high molecular weight polymers of ethylene oxide ranging in molecular weight from several hundred thousand to five million. The preferred resin is that sold under the trademark Polyox WSR–301 and is characterized by viscosity of 2000 to 4000 centipoises in a 1% by weight concentration in water at 25° C. (using a Brookfield RVF viscometer at 2 r.p.m.). The amount of material used is dependent somewhat on the amount of weight loss permissible in the final composition. Since it is the desire to keep this loss to a minimum, the preferred embodiment herein uses only that amount necessary to effect an extrudable product which will maintain flexibility and plasticity. It has been found that about 0.1 to about 2.0% by weight of the dry product gives excellent results with about 0.5 to about 1.0% being preferred. Of course, higher amounts can be used, if desired, to obtain the benefits of the extrudability of the material if weight loss is not necessarily a determining factor. This may be the case of a low temperature use of the packing.

The metal mesh fabric may be knitted from thin, flat, narrow, metallic strands of, preferably, a corrosion-resistant, metal or metal alloy, such as copper, aluminum or nickel steel. In certain instances a softer metal or metal alloy may be employed, such as lead, babbitt or the like, but where a relatively high degree of resilience is desired as is generally the case, the harder metals are particularly applicable. A preferred material for the uses referred to above is copper, although alloys such as "Inconel" or "Monel" metal may be used. The individual, flat, metal strands are fabricated into mesh on knitting equipment of any suitable type such as, for example, a circular knitting machine, to provide a continuous, tubular fabric.

The outer mesh should carry sufficient fibrous sealing material to form a barrier to the passage of gases or other fluids through the compacted cord without, however, destroying the resiliency or other characteristics of the cord.

Fibrous sealing material is suitably initially adhered to a metal mesh by a tacky adhesive as, for example, a rubber cement or the like.

Any suitable mixing and molding procedure may be employed to form the packings of this invention. Preferably, the inert fillers or fibers, such as asbestos, are blended with the inert filler and lubricant before the water is added. After mixing of all ingredients, the composition is extruded or otherwise molded to the desired configuration and the products obtained are dried to the desired stage.

The following are examples of molded composition packings formed in accordance with this invention and the novel method of preparation. It is understood, of course, that the composition of and method for producing these composition packings are exemplary and are not to be considered to limit the invention to the particular composition and operation conditions illustrated. In the examples, all percentages are by weight unless otherwise indicated.

Example I

A flexible molded composition packing was formed from the composition of:

	Percent
Asbestos fibers	75
Powdered graphite	22
Sodium nitrite powder	2
Polyox 301 [1] resin, a poly(ethylene oxide)	1

[1] Manufactured and sold by Union Carbide & Carbon Co. under that trade name.

by initially mixing these ingredents in a sigma blade mixer. Thereafter 70 parts of water were added and the mixer operated for approximately 30 minutes. The resulting matrix was removed from the mixer, placed in a hydraulic extruder and extruded through a copper tube into the braid being formed on a braider using wire reinforced, asbestos yarn, to form a jacket about the mastic core. After allowing time for the water to dry out of the packing, a coating of graphite was applied to the jacket containing the core composition. The final product was calendered to size to compress the packing into a square cross section. The packing obtained exhibited good flexibility and plasticity, and did not harden to any substantial degree during standard aging test procedures when placed in service position. The packing had good physical properties. Test on this packing at 850° F. dry heat applied for twenty hours showed approximately 5½% weight loss. Packings made in accordance with prior procedures and compositions showed a 10½% weight loss under the same conditions.

Example II

A flexible molded composition packing was fabricated in a similar manner as the packing of the preceding example from a composition of:

	Percent
Asbestos fibers	75
Graphite	19
Poly(ethylene oxide)	1
Sodium nitrite powder	5

The poly(ethylene oxide) with 40 parts by weight water was added along with the graphite and inhibitor. The mixer was started and the asbestos fiber added slowly. The mixing was continued for one hour. The packing was formed in a similar manner and exhibited similar characteristics in the processing in addition to excellent properties in service position.

Example III

An additional composition packing was made from a composition of:

	Percent
Asbestos	75
Mica	24.5
Poly(ethylene oxide)	0.5

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by mixing the ingredients with water in a mixer. The extruded packing exhibited physical properties comparable with those of the previous examples.

A packing of the type described above operates successfully under high temperature conditions. The loose asbestos fibers distributed throughout the compacted cords adequately sealed the packing against the passage of fluid. Inasmuch as, during the twisting or other compacting step, the fiber is intimately bound into the mesh, it will not blow out or otherwise become displaced.

It is readily apparent from the foregoing that decisive advantages may be gained by employing the new and useful composition of the instant invention. In addition to the highly desirable decrease in loss of weight under high temperature conditions, the composition requires a much lower amount of organic binder, thereby providing significant cost advantages. Moreover, the use of water instead of organic solvents reduces the fire and health hazards during packing manufacture.

It is believed the above provides a complete description of the invention in such manner as to distinguish it from other inventions and from what is old, and provides a description of the best mode contemplated of carrying out the invention and thereby complies with the patent statutes.

It is understood that variations and modifications of the invention, as illustrated by specific examples herein, may be made without departing from the spirit of the invention, it is also to be understood that the scope of the invention is not to be interpreted as limited to the specific embodiments disclosed herein but only in accordance with the appended claims, when read in the light of the foregoing description.

What I claim is:

1. A flexible molded composition packing consisting essentially of, within the approximate ranges, the following ingredients on a dry weight basis: 19 to 24.5% solid lubricating filler selected from the group consisting of graphite, mica, and mixtures thereof, up to 5% sodium nitrite inhibitor, 0.1 to 2% high molecular weight water soluble poly(ethylene oxide) resin, and the remainder asbestos fiber.

2. A flexible molded composition packing as defined in claim 1 wherein the poly(ethylene oxide) resin is further characterized by the viscosity of 2000 to 4000 centipoises at 25° C. in a 1% by weight concentration in water.

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