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VALVE DISK COMPOSITION

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This invention relates to valve disks and similar articles, designed more particularly for controlling steam under pressure, and to moldable compositions suitable for their manufacture and comprising a filler bonded with a suitable binder.

Moldable compositions are evidently the most suitable materials for valve disks and similar articles that are reproduced in quantities, and compositions bonded with rubber or prepared from vulcanized fiber are commonly used for this purpose. For controlling media at moderate and higher temperatures, such as steam under pressure, these compositions are not suitable; and so far as I am aware, metal alloys which are objectionable in that they require machining or grinding for each individual disk cut or cast therefrom and in the sense herein contemplated are therefore not moldable, have heretofore been regarded as the only suitable materials for use under such conditions.

According to the present invention moldable compositions are provided which are capable of being pressed into valve disks, etc., ready for use without any further machining operation to withstand steam at pressures of 300 pounds or thereabouts and without disintegration or loss in shape because of the flow or the wiredrawing action of hot steam in contact therewith. Furthermore valve disks molded from the compositions of this invention exhibit very low shrinkage, low water absorption and low coefficient of expansion while possessing relatively great mechanical strength and sufficient elasticity to permit proper seating when closing pressures are applied thereto.

The binder preferably used in the compositions of this invention is a condensation product of phenol and formaldehyde reacted in proportions to yield a resinoid, that is, a resinous material which in its initial or potentially reactive condition is soluble and fusible but changes or transforms upon the application of heat into a hard infusible form; other resinoids, such as cresol-formaldehyde, etc., can, however, be substituted. As a filling material for use in conjunction with the resinoid binder I have found that, fabric woven from asbestos is highly satisfactory and yields compositions with the steam resistant and other properties heretofore mentioned.

The resinoid binder can be applied to the woven asbestos fabric in various ways, but I prefer to impregnate the fabric sheet by dipping or passing it through a solution of the resinoid in alcohol, the binder being in the potentially reactive condition at this stage. To insure the removal of the solvent after impregnation, the impregnated sheet is heated for from ½ to 3 hours at about 85° C., the temperature being low enough to avoid hardening or advancement of the resinoid to an extent that unduly interferes with the molding property of the composition; compositions not preheated and dried in this manner yield articles that do not compare in surface appearance and other properties with those that have been so treated. After impregnation and preliminary baking, blanks are stamped from the sheet; the blanks may be cut out before the drying and even before impregnation, but when cut after impregnation and drying, better edges are then obtained and there is less danger of distortion than when cutting the unimpregnated fabric. The size of the blanks is preferably the same as the disks or other articles to be molded therefrom; but the size need not be accurate, for it is found in practice that the impregnated fabric has sufficient flow in the mold to fill out to dimensions materially greater than the cut size.

In molding a valve disk, for example, a closed mold is charged with a pack of given weight formed from superposed blanks, and pressure is thereupon applied through a plunger. Pressures that are common in molding resinoid compositions, that is, 1000

to 2000 pounds to the square inch, are not generally sufficient, and articles decidedly superior in resistance to delamination, etc., are obtained when the pressures are increased to 5000 and even as high as 9000 pounds to the square inch, depending somewhat on the number of blanks or layers in the pack and the thickness of the molded article. Of course with pressures of such magnitude the resinoid must be in a sufficiently sluggish or viscous condition that it will not be forced out of the filler and exude from the mold. This condition depends upon the nature and advancement of the resinoid, the amount of plasticizing or volatile agent remaining in the composition, etc. A preliminary baking or heating of the composition as above indicated affords a means of securing the requisite viscous condition. While in the mold, the charge is heated to about 125 to 160° C. for a time depending on the resinoid and the size of the disk; for example, a disk an inch and a half in diameter and about one fourth inch thick should be heated for about 10 minutes when a composition containing about 35 per cent of a phenol-formaldehyde resinoid binder is used. It is preferable to charge the mold while it is relatively cold, then heat it up to the desired temperature gradually and continue the heating until the resinoid binder is hardened or advanced with substantial completeness; this method raises the interior temperature of the charge into substantial uniformity with the exterior before the resinoid in the outer portion has set and no longer flows. Uniformity of temperature can also be promoted by preheating a charge to 85° C. or thereabouts, depending on the resinoid, before filling the mold. When the heating period is finished, the molded article can be discharged while hot from the mold, particularly if a small amount, say about 1 per cent based on the weight of resinoid, of a lubricant, such as butyl stearate, has been incorporated in the resinoid binder.

The discharged valve disks have good smooth surfaces and sharp well-defined edges even though the fabric used is relatively coarse and heavy and the disks are discharged hot.

In place of the impregnated woven asbestos fabric there can be substituted, particularly for the interior portion of an article, a mass of loose thread ends obtained by shearing the woven fabric after impregnation. The use of fabric pieces for the exterior surfaces and a filler therebetween of the thread end material is particularly desirable in that it is thereby possible to accurately charge a mold with a given weight and thus regulate the size and still retain the advantages inherent in the cloth for the wearing surfaces. Since asbestos is loosely woven material, shearing of the fabric into small pieces is accompanied largely by a separation of the cut pieces into loose impregnated thread ends, which pieces, retaining their woven character, can be removed by a sieve, if desired. There is no substantial destruction of the threads or separation into individual fibers by this method and no consequent material loss of impregnating binder; that is, the spun condition of the threads is retained together with the binder which is locked therein. A further advantage of the thread structure over the separate fibers is the retention of the strength inherent in the threads, giving molded articles commensurate in shock resistance, etc., to those made from the woven fabric composition. Likewise a molding compound prepared from a resinoid and commercial asbestos, or other fiber filler can for some purposes be used in place of the intermediate fabric layers, so long as the surface layers for contact with a valve seat are of the woven asbestos fabric.

The proportionate amount of binder incorporated in the composition depends upon the varnish used, the time of contact of the varnish with the fabric and the method of application; but it is found desirable that these conditions be so controlled as to yield a composition containing about 25 to 45 per cent by weight of resinoid. While impregnation of the sheet with varnish, from which the solvent is subsequently removed, is preferred, it is not essential that this practice be followed, and all or part of the resinoid can be applied in a pulverized form to unimpregnated or partially impregnated fabric; in this case the powdered resinoid need not be the same as that with which fabric is impregnated.

Valve disks made in accordance with this invention are not restricted in use to the field of high pressure steam as above indicated, but are suitable for pump valves, check valves, throttle valves, etc., and for controlling other media. The chemical inertness of the bonding resinoid, including its resistance to ordinary solvents, points to the fitness of the composition for valve disks controlling the flow of media having a corroding or deteriorating action on rubber and metal. Furthermore, the composition is obviously suited to the manufacture of gaskets and similar articles involving the properties here set forth; and its use is not limited to simple shapes, such as disks, for I have found that the composition, particularly in its loose thread end form, has surprising flow in a mold and can be generally substituted for other moldable resinoid compositions.

I claim:

1. A method of making a valve disk which comprises charging a mold with woven asbestos fabric pieces impregnated with a potentially reactive phenol-formaldehyde resinoid and cut to the size of the mold and having a filler therebetween of asbestos fiber like-

wise impregnated with a potentially reactive phenol-formaldehyde resinoid, the whole constituting a weighted charge and submitting the charge to a pressure of from 5000 to 9000 pounds per square inch while heating to about 135 to 160° C.

2. A method of making a moldable composition which comprises impregnating woven asbestos fabric with a potentially reactive resinoid in solution, removing the solvent, and shearing said fabric to form loose thread ends.

3. A method of making a composition suitable for molding valve disks and the like which comprises impregnating woven asbestos fabric with a potentially reactive resinoid in solution and in amount to form about 35 per cent by weight of the composition, and removing the solvent by heating to about 85° C. for a period of ½ to 3 hours.

4. A valve disk molded from resinoid-impregnated woven asbestos fabric in sheet form cut to size for the exterior surfaces and a filler therebetween of asbestos fibers likewise impregnated with resinoid.

5. A valve disk molded from woven asbestos fabric and bonded with a phenolic resinoid.

6. A valve disk molded from a composition including woven asbestos fabric and a resinoid binder for the valve seat contacting portion.

7. A molded valve disk resistant to the disintegrating action of steam at high pressures and comprising asbestos bonded with a resinoid.

8. A moldable composition comprising asbestos and a phenolic resinoid binder and including butyl stearate as a lubricant.

9. A method of making a valve disk which comprises charging a mold with a composition including asbestos and a potentially reactive resinoid brought to a condition of viscosity suitable for molding under pressures ranging from about 5000 to 9000 pounds to the square inch at molding temperatures, and subjecting the charge to a pressure ranging from about 5000 pounds to the square inch and over while simultaneously transforming the resinoid by the application of heat.

10. A valve disk molded from a composition including asbestos and a reactive resinoid binder with the use of pressures ranging from about 5000 pounds to the square inch and over and with the simultaneous application of heat to transform the resinoid.

11. Process of making a moldable composition suitable for the molding of valve disks resistant to the disintegrating action of steam at high pressures which comprises mixing asbestos with a reactive resinoid and heating the composition to increase the viscosity of the resinoid and adapt the composition for the application of pressures ranging from about 5000 to 9000 pounds to the square inch when heated to molding temperatures.

12. Composition suitable for the molding of valve disks resistant to the disintegrating action of steam at high pressures comprising a filler of asbestos and a reactive phenolic resinoid binder in a condition of viscosity adapted to receive the application in a mold of pressures ranging from about 5000 to 9000 pounds to the square inch when heated to molding temperatures.

In testimony whereof I affix my signature.

CLARENCE A. NASH.