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FRICTION ELEMENTS AND METHOD OF MAKING SAME

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This present invention relates to friction elements and process of making same, said friction materials comprising clutch facings, friction blocks, and the like formed from a base of asbestos pulp or woven asbestos tape saturated with an organic drying oil binder, without the aid of any solvent or carrier for the binder.

The method generally employed at the present time in the manufacture of clutch facings and other friction elements when using an asbestos pulp base saturated with an organic drying oil binder is essentially as follows:

Asbestos sheeting in the desired thickness and form is impregnated at room temperature with a solution of the liquid binder, for instance, linseed oil, in a suitable solvent, such as gasoline or the like. After impregnation, the solvent is removed by heating the impregnated asbestos in an oven, which heating is continued, to dry and harden the oil. It has been found by those skilled in the art, that in employing a solvent, the proportion of binder oil to solvent may not safely be raised above 3 to 1 without encountering a glazing of the surface due to exudation of binder oil from the interior portions of the impregnated pulp to the outside with resultant hardening there, which thereupon effectually seals the interior from the access of air needed for satisfactory drying of the binder oil, and so prolongs to a disproportionate time the heating period essential for the complete hardening of all the binder.

Thus, for example, it was found that a clutch facing which normally cured in thirty hours, when impregnated with a slightly heavy oil solution, formed a skin of dried oil on its surface, and did not cure completely in sixty hours. It is, however, quite possible to manipulate the cure of a clutch facing such as described above so as to prevent the formation of a glaze by means of a long drying at a low temperature previous to exposure to the normal hardening temperature. This would be extremely objectionable in practice due to the care necessary in regulation of temperatures, and the prolonged time of cure. It will be seen, therefore, that not only is the loss of a considerable amount of solvent necessary, but that slight changes in solution strength have serious effects on the cure. Another disadvantage is that due to the use of a solvent, the pores, though completely filled with the impregnating fluid at first are afterwards partially emptied due to the volatilization of the solvent on heating. This results in less compactness, solidity and strength than where the pores are more completely filled, as in the process to be described below.

Another disadvantage attachable to this method of saturation and cure lies in the fact that it is practically impossible to cure a drying oil in an asbestos pulp base uniformly hard from center to outside even when there is no decided glazing in a reasonable length of time such as 24 to 60 hours, in any thickness greater than ¼ inch, due to the gradual sealing of the surface pores in a cure which must commence from the outside and proceed inwards. By the methods described below the whole thickness is evenly cured to begin with, and there is no sealing of the interior portions. I have cured asbestos pulp or wood fibre pulp in thicknesses as high as one inch, and believe the method capable of use in curing still greater thicknesses.

My invention comprises essentially the impregnation of the asbestos base such as asbestos pulp, or woven yarn with an organic drying oil, the partial hardening of the oil by heat treatment under pressure with partial or complete exclusion of air, or in a non-oxidizing atmosphere, with or without pressure and the final hardening of the oil by heat treatment in an oxidizing atmosphere, with or without pressure. The last operation may, of course, be omitted if partial hardening of the oil is sufficient for the purpose desired.

The following description exemplifies one illustration of this procedure, which I have practiced in the fabrication of friction elements for use in automobile clutches: Annular ring blanks of approximately the desired dimensions are stamped out from asbestos mill board by the use of a die and die

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press. These rings are then dried free of moisture and immersed for ten minutes in a bath of China wood oil, heated to 300° F. This is equivalent to a complete saturation at this temperature. The rings are then removed from the bath and allowed to stand at room temperature until the surface feels fairly dry to the touch. This may take from 12 to 24 hours. The purpose of this operation is merely to lessen the tendency to adhere during the immediately subsequent cure, and is not essential to the process. A coating of fine graphite may then be applied to the rings and they are stacked in any desired number, the pack being held together between two iron plates connected by a bolt. The entire pack may then be subjected to a temperature of 400° F. for say, 4 hours. On removal from the oven, the pack is allowed to cool and the rings are then separated. At this point the oil has been partially hardened, and the rings are firm, and fairly strong, but not yet sufficiently hard for satisfactory use in a clutch. They may be then hung on spindles and baked in the open in an oven heated to 325° F. for a period sufficient to bring the hardness up to 14 Brinnell. This may take from six to twenty hours, depending on the thickness of the rings. After the final cure is complete, the rings may be sanded down to size and the graphite removed from the surface in the same operation. The edges may be brushed, or if necessary, turned down to size in a lathe. The finished ring is a product superior to any made with the aid of a solvent as carrier for the drying oil, in density, toughness, flexibility, resistance to shock, and general machine ability.

The foregoing illustration is only one of a large number of applications of this process to the art of friction element manufacture. I have used it for friction blocks up to one inch in thickness. The method for producing brake linings with an asbestos pulp base and drying oil binder is a simple operation, the resultant product being very durable. Cone clutch facings have substantially the same characteristics as the brake lining. Insulation sheeting made with a drying oil and any vegetable, mineral or animal fibre can be made up to a thickness of one inch without lamination. Also as has been shown above, this method provides a means for the hardening of a drying oil in fibrous base of much greater thickness than has been practical heretofore, by the use of a solvent as vehicle for carrying the oil.

The invention may be applied to thick woven fabrics with equally good results, and brake lining, clutch facings and other products with woven fibrous base show the same advantageous characteristics that are evidenced in pulp base materials.

The drying oil used in my invention may include any oil which will harden under the conditions described above. The true drying oils such as linseed, China wood, perilla, etc., are the best for the ends desired, but I have found that many so called non-drying or semi-drying oils such as palm, corn, rapeseed, etc., also give very satisfactory results by the use of the method specified.

Oils or combinations of oils which do not have a marked tendency to glaze, especially China wood oil and mixtures of it with other oils when used as a saturant as heretofore described, may be partially hardened, if desired, in a substantially non-oxidizing atmosphere such as carbon dioxide, nitrogen, flue gas, ammonia, etc., at an elevated temperature, say from 300° to 500° F. with or without pressure, depending on the character of the oil. Oils with marked tendency to glaze, such as linseed when used as a saturant, as heretofore described may be preferably hardened in an inert gas under pneumatic pressure, while China wood oil which has only slight glazing tendency, may be hardened with the gas at atmospheric pressure.

I claim as my invention:

1. Steps in a process of producing friction elements consisting in impregnating a non-combustible fibrous base with saturant, partially hardening the saturant by subjecting the impregnated fibrous base to heat under pressure with partial or complete exclusion of air, and finally hardening the saturant in the impregnated base by subjecting the base to heat in an oxidizing atmosphere.

2. Steps in a process of producing friction elements consisting in impregnating a non-combustible fibrous base with a saturant, partially hardening the saturant by subjecting the impregnated base to heat in a non-oxidizing atmosphere, and finally hardening the saturant in the impregnated base by subjecting said base to heat in an oxidizing atmosphere.

3. Steps in a process of producing friction elements consisting in impregnating a non-combustible fibrous base with a saturant, partially hardening the saturant by subjecting the impregnated base to heat in a non-oxidizing atmosphere, and finally hardening the saturant in the impregnated base by subjecting said base to heat and an oxidizing atmosphere under pressure.

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