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FRICTION MATERIAL

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This invention relates to improvements in friction materials such, for example, as may be employed as brake linings or clutch facings.

The woven, semi-molded and molded types of lining which constitute the material now used by the trade are, in the main, produced by lengthy and involved processes. Taking a well-known process for producing woven lining for example, the so-called white tape or webbing is woven from a long staple asbestos and cotton yarn containing brass wire as a reinforcement, saturated with a water proofing and frictioning compound such as a phenolic condensation product and China-wood oil and finally aged and cured. The afore-mentioned process consumes considerable time, in both the saturating and aging of the intermediate product prior to the curing operation; furthermore, the long staple asbestos is expensive and the cotton is objectionable due to its charring under the heat developed by friction resulting in a porous lining and a change in the coefficient of friction.

It is, therefore, the principal object of my invention to appreciably reduce the cost of friction material by using less expensive materials and employing a much simpler technique in producing the product without sacrificing the desirable features thereof.

To this end, a suitable stock material such as short staple asbestos millboard or woven tape is saturated with an aqueous solution of an organic binder such as a phenolic condensation product together with an inorganic salt such as sodium cyanide, the stock is then dried and cured to fix the salt in situ and render the organic material substantially insoluble and infusible.

A further object of my invention resides in providing a lining uniformly colored throughout its mass to give the product a distinguishing characteristic in the trade.

Other objects of the invention including the provision of a high grade non-scoring, noiseless friction facing having substantially constant physical characteristics, irrespective of the manner of effecting the product and other details of construction of the product and steps in the technique will become apparent from the following detailed description.

According to a preferred manner of practicing my invention, a short staple asbestos millboard stock of a type well known to the trade is machine-cut into strips of a width determining the width of the finished product. These strips are then magazine-fed from the machine into a bath of an aqueous solution of an inorganic salt such

as sodium cyanide or sodium sulphurous cyanide, together with a phenolic condensation product or other synthetic resin capable of being rendered substantially insoluble and infusible with the application of heat. The parts by volume of a water soluble phenolic condensation product and a sodium or sodium sulphurous cyanide solution are chosen so as to effect the desired physical characteristics to the product. One formula which gives an excellent product consists of fifty parts by volume of commercial water soluble phenolic condensation product, fifty parts by volume of a ten percent solution of cyanide and sufficient alcohol to render the solution clear.

Whether the resulting composition is a true solution or a colloidal suspension is open to question; but since this type of phenolic condensation product is known to the trade as "water soluble", and since the composition is a clear liquid without tendency to segregate, the terms "water soluble", "solvent", and "solution" are used herein to designate the particular type of phenolic condensation product, the water and alcohol (or other agent) with which the phenolic condensation product is compounded, and the resulting composition.

If desired, the impregnation may be accelerated by the use of a suitable introfier or by carrying out the impregnation under reduced pressure. This would tend to reduce alcohol losses if this vehicle is employed. Also, if desired, the fibrous material may first be lightly heated and submitted to a vacuum in order to more or less completely evacuate the material of moisture, thereby accelerating subsequent penetration of the saturant.

The saturated millboard stock is then preferably vacuum dried to evacuate the water vehicle and then calender rolled to give the final chamfered edge, surface and thickness. The strips which are plastic by virtue of the uncured organic binder may then be cut to length, clamped to the rim of a brake shoe and then cured in a suitable oven which renders the condensation product substantially insoluble and infusible and further secures the lining to the rim by virtue of the adhesive action of the binder. After curing, the lining may, if desired, be further secured to its shoe by rivets in the usual fashion. The uncured stock may also be cured to shape under pressure in suitable molds in the conventional manner.

A white tape preferably woven from short staple asbestos paper felt yarn may be used in lieu of the millboard. This tape is saturated with the aforementioned solution, dried, calendered and

cured. It is significant to note, however, that it is not necessary to finally cure the tape during the aforementioned process. The calendered uncured tape which is plastic may be stored and then subsequently cured as desired, it may also be cut to brake shoe length, clamped to the rim and heated to cure the lining directly on the shoe as described above. The tape may, furthermore, be cured in the rolled form.

10 An important feature of my invention lies in the color given the finished product, thereby distinguishing it from other friction materials in the trade. To this end, the inorganic salt is so chosen as to give the desired color to the finished product by virtue of its reaction with the organic condensation product. I prefer that the color purple be imparted and find that this color is produced by employing the cyanide and phenolic condensation product referred to above.

20 The process set forth above gives a good quality friction facing adaptable for either brake or clutch facings. The condensation product imparts the necessary water proofing, hardening, strengthening and other desirable physical characteristics and the substantially inert cyanide salt with its high melting point fuses at the relatively high lining surface temperatures of excessive braking to act as a lubricant and thus obviate drum scoring by lowering the coefficient of friction and minimizing the tendency to grab. The cyanide salt also serves to case-harden the drum, thereby obviating drum scoring and the formation of rust.

35 The process set forth is a substantially continuous one, there being no interruptions to age or recure such as is necessary with the use of the conventional mixture of phenolic condensation product and China-wood oil or other drying oils. It is also important to note that the inorganic salt is uniformly distributed throughout and effectively fixed in the lining by the organic binder, this by virtue of the intimate aqueous mixture of the two forming the saturant. It is also important to note that, by curing the lining on the shoe, I obviate scrappage due to shipment and handling of the relatively brittle cured material.

50 The specific embodiments of the invention are given merely by way of example, for obviously, within the range of equivalents, the various steps in the process and the various materials employed may be varied within the scope of the principles involved. For example, the yarn employed in weaving the white tape need not necessarily be of a felted short staple asbestos paper, but may, if desired, be of any suitable type which is sufficiently strong to be woven and sufficiently absorbent to take the various fillers. Hence, it is not intended that the invention shall be limited to the descriptive matter set forth in the specification, except as such limitations are clearly imposed by the appended claims.

I claim:

70 1. A process of preparing friction facings, comprising saturating a fibrous material with an aqueous solution of a phenolic condensation product and sodium cyanide and subsequently heating said material to evacuate the aqueous solution and then cure the fibrous material to render the same substantially insoluble and infusible.

2. A process of preparing friction material comprising saturating a fibrous material with an aqueous solution of a synthetic resin and an inorganic salt selected from the group consisting of sodium cyanide and sodium sulphurous cyanide and subsequently heating said material to evacuate the aqueous solution and cure the fibrous material.

3. A process of preparing friction facings comprising saturating a fibrous material with an aqueous solution of a synthetic condensation product and sodium cyanide and subsequently heating said material to first evacuate the solvent and then cure the condensation product to render the same substantially insoluble and infusible.

4. A process of forming friction facing comprising saturating a fibrous matrix with a solution comprising approximately 50 parts by volume of a commercial water soluble synthetic resin and approximately 50 parts by volume of a ten percent solution of sodium cyanide and then heating the said fibrous matrix to evacuate the water vehicle.

5. A brake lining comprising a short staple asbestos matrix impregnated with an insoluble resin and an inorganic salt selected from the group consisting of sodium cyanide and sodium sulphurous cyanide.

6. A woven friction material bonded with a synthetic resin and an inorganic salt selected from the group consisting of sodium cyanide and sodium sulphurous cyanide.

7. A brake lining comprising a fibrous matrix impregnated with a substantially insoluble and infusible resin and an inorganic salt selected from the group consisting of sodium cyanide and sodium sulphurous cyanide.

8. A friction material comprising a tape adapted to be rolled without adhesion of the convolutions thereof, said material comprising a fibrous matrix impregnated with an uncured water soluble phenolic resin, together with an inorganic salt selected from the group consisting of sodium cyanide and sodium sulphurous cyanide.

9. A substantially continuous process of preparing friction material comprising cutting mill-board stock into strips, and magazine feeding said strips into a saturant comprising an aqueous solution of a synthetic resin and an inorganic salt selected from the group consisting of sodium cyanide and sodium sulphurous cyanide.

10. A process of preparing friction facings, comprising saturating a fibrous material with an aqueous solution of a phenolic condensation product and sodium sulphurous cyanide and subsequently heating said material to evacuate the aqueous solution and then cure the fibrous material to render the same substantially insoluble and infusible.

11. The process of forming friction facing which comprises saturating a fibrous matrix with a solution comprising approximately fifty parts by volume of a commercial uncured water soluble phenolic resin, and approximately fifty parts by volume of a ten-percent solution of an inorganic salt selected from the group consisting of sodium cyanide and sodium sulphurous cyanide, then heating the said fibrous matrix to remove the liquid.

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