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ADOLPH ROSNER, OF SOUTH BEND, INDIANA, ASSIGNOR TO BENDIX BRAKE COMPANY, OF SOUTH BEND, INDIANA, A CORPORATION OF ILLINOIS

BRAKE LINING

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This invention relates to friction material as employed in the facing of brake shoes or clutch elements.

The commercial lining as now fabricated is usually of either the woven or the molded type and this invention is particularly concerned with the former. A conventional woven lining is prepared by weaving a tape or webbing from a wire reinforced asbestos and cotton yarn and then impregnating the tape with a water-proofing and friction compound which is subsequently cured. Such a lining is objectionable, due in part, to the cotton content which is highly water absorptive and is easily carbonized or charred; it is further objectionable, owing to the high cost of the long staple asbestos necessary to make such a yarn, and particularly is such a lining objectionable because of the usual complicated formula of the water-proofing compound and the involved technique necessary to effect the impregnation.

It is therefore the prime desideratum of my invention to greatly reduce the cost of a woven lining by both simplifying the process of making and by employing cheaper materials, all without sacrificing the desirable features of this type of lining.

In a preferred embodiment, a paper felt yarn, preferably of the short staple asbestos variety is impregnated during the weaving of the yarn into tape form with a substantially inert inorganic salt of relatively high melting point, such for example, as a cyanide salt. It is also desirable that this salt have such a selective spectral wave absorption characteristic as to impart to the friction facing a red or substantially red color. The tape may then be impregnated with a substantially non-hygroscopic and non-oxidizable oil to fix the crystallized salt in situ, also a synthetic resin to give strength and hardness to the product after curing.

Other objects of the invention, including the provision of a high grade woven lining, irrespective of the manner of effecting the same and other details of the construction and technique will become apparent from the following detailed description.

According to a preferred manner of practicing my invention, a felted paper yarn, preferably a short staple asbestos paper yarn of the type disclosed in the United States patent to Edward Slade, No. 1,798,359, is woven in the conventional manner into tape form. The afore-mentioned yarn is made by binding a twisted short staple asbestos paper with oppositely twisted strands of brass wire in such fashion as to produce a relatively strong product. The paper surrounds a reinforcing core of straight wire of the same material.

An important feature of my invention resides in the impregnation of the afore-mentioned yarn, during the weaving operation, with an inorganic salt such as copper ferrocyanide. To this end the warp or longitudinal threads may be, before weaving, saturated with a solution of potassium ferrocyanide and the weft or transverse filler threads may likewise be saturated with a solution of copper sulphate. The concentration of the two salt solutions is preferably such as to completely chemically react to precipitate the desired amount of copper ferrocyanide $Cn_2Fe(Cn)_6$. The quantity of the cyanide salt is predetermined to give the desired physical characteristics to the finished product. If desirable the cops or rolls of the weft thread may be kept saturated with the copper sulphate solution prior to their use in the loom. A limited amount of boracic acid may be added to the cyanide solution in impregnating the warp thread and if desired, the binder threads in the warp, which may amount to one in every eight of said threads, may be strengthened with a core of lead wire, all for a purpose to be described in detail hereinafter. Due to the weaving operation and close proximity of the various threads, the copper ferrocyanide is disseminated or commingled quite uniformly throughout the entire weave. The copper ferrocyanide renders the lining tape reddish brown in color which gives to the same a distinguishing characteristic in the trade. The tape is then thoroughly heated to drive off the water vehicle leaving the copper ferrocyanide in a crystalline form within the weave.

As an alternative the woven tape may be

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saturated with an aqueous solution of non-poisonous sodium sulphurous cyanide, the tape being then dried to volatilize the water leaving the cyanide salt crystals uniformly commingled throughout the tape.

The tape may then be run through a bath of a non-hygroscopic and non-oxidizing oil such as caster oil dissolved in a thinner such as commercial solvent naphtha or alcohol. After saturating with the castor oil solution, the lining is again heated to drive off the vehicle and may then be passed through a solution of a phenolic condensation product, preferably though not necessarily an aqueous solution of this product. In lieu of the phenolic constituent there may be employed an aqueous solution of any other synthetic resin which is capable of being rendered substantially insoluble and infusible when adequately heated. The tape is then heated to drive off the vehicle of the last treatment and is then further heated or cured to render the resin substantially insoluble and infusible resulting in a desirable friction material of the necessary tensile strength, hardness, etc.

The castor oil is substantially inert and does not oxidize. The oil is furthermore substantially non-hygroscopic and tends to render the lining to a degree flexible. The copper ferrocyanide crystals commingled throughout the lining are fixed in the same by the caster oil, obviating the absorption of moisture by the cyanide crystals and the possibility of their washing out of the lining. The deleterious effect of moisture absorbed in the lining over night is therefore avoided by the use of the caster oil impregnant in my novel lining. The lead in its solid condition serves to vary the coefficient of friction depending upon the amount used and also serves to lubricate the lining when fused. The boracic acid or other low melting point salt may be used in lieu of the lead with substantially the same effect.

The cyanide, which is substantially inert at ordinary temperatures, fuses at the very high brake surface temperatures around 1500° F. and serves to lubricate the lining, thereby lowering the coefficient of friction during the heavy brake operations. This is quite desirable as it obviates grabbing, drum scoring and squealing of the lining. The cyanide also serves to case harden the drum, thereby obviating scoring and preventing the formation of rust. The use of the phenolic condensation product makes possible a very quick and effective "doping" of the lining, obviating the usual complicated dipping, aging, curing, recuring and other processing necessary with the use of any one of the conventional asphalts, pitches, bitumens or drying oils such as china-wood oil.

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 need not necessarily be of a felted 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:

1. A process of preparing friction facings comprising impregnating a yarn with a cyanide salt while being woven into tape form and then impregnating the tape with a suitable binder to fix the salt in situ.

2. A process of preparing friction facings comprising impregnating an asbestos paper felt yarn with copper ferrocyanide while the yarn is being woven into tape form and then impregnating the tape with a suitable binder to fix the salt in situ.

3. A process of preparing friction facings comprising depositing copper ferrocyanide in crystalline form throughout the weave of a tape stock, saturating said tape with castor oil and then further saturating the tape with an aqueous solution of a synthetic condensation product.

4. A process of preparing friction material comprising weaving together warp threads saturated with a cyanide salt and weft threads saturated with copper sulphate to form a tape, and then impregnating said tape with a non-hygroscopic material and a condensation product.

5. A process of preparing friction facings, comprising depositing copper ferrocyanide in crystalline form throughout the weave of a tape material, certain of the threads of said tape being reinforced with a metal core, impregnating said tape with castor oil and then further impregnating the tape with a water soluble material capable of forming an insoluble resin when heated.

6. A method of forming a woven brake lining comprising weaving together warp and weft threads, precipitating a cyanide salt on the threads during said weaving, impregnating the resulting tape with castor oil, then impregnating the tape with a water soluble synthetic condensation product, and lastly heating the tape to cure the condensation product.

7. A brake facing comprising a woven fabric impregnated with copper ferrocyanide, castor oil and a resin.

8. A friction facing comprising a woven fabric matrix impregnated with cyanide salt, castor oil, synthetic resin and lead.

9. A friction material comprising a fibrous matrix impregnated with copper ferrocya-

nide and a waterproofing hardener of such constitution as to be inert with regard to the cyanide salt and have no effect upon the natural reddish color thereof which distinguishes said friction material.

In testimony whereof, I have hereunto signed my name.

ADOLPH ROSNER.