May 13, 1930. W. NANFELDT 1,758,055

FRICTION AND HEAT RESISTING ARTICLE AND METHOD FOR MANUFACTURING THE SAME

Filed Nov. 6, 1925

Fig. 1. Fig. 2. Fig. 3.

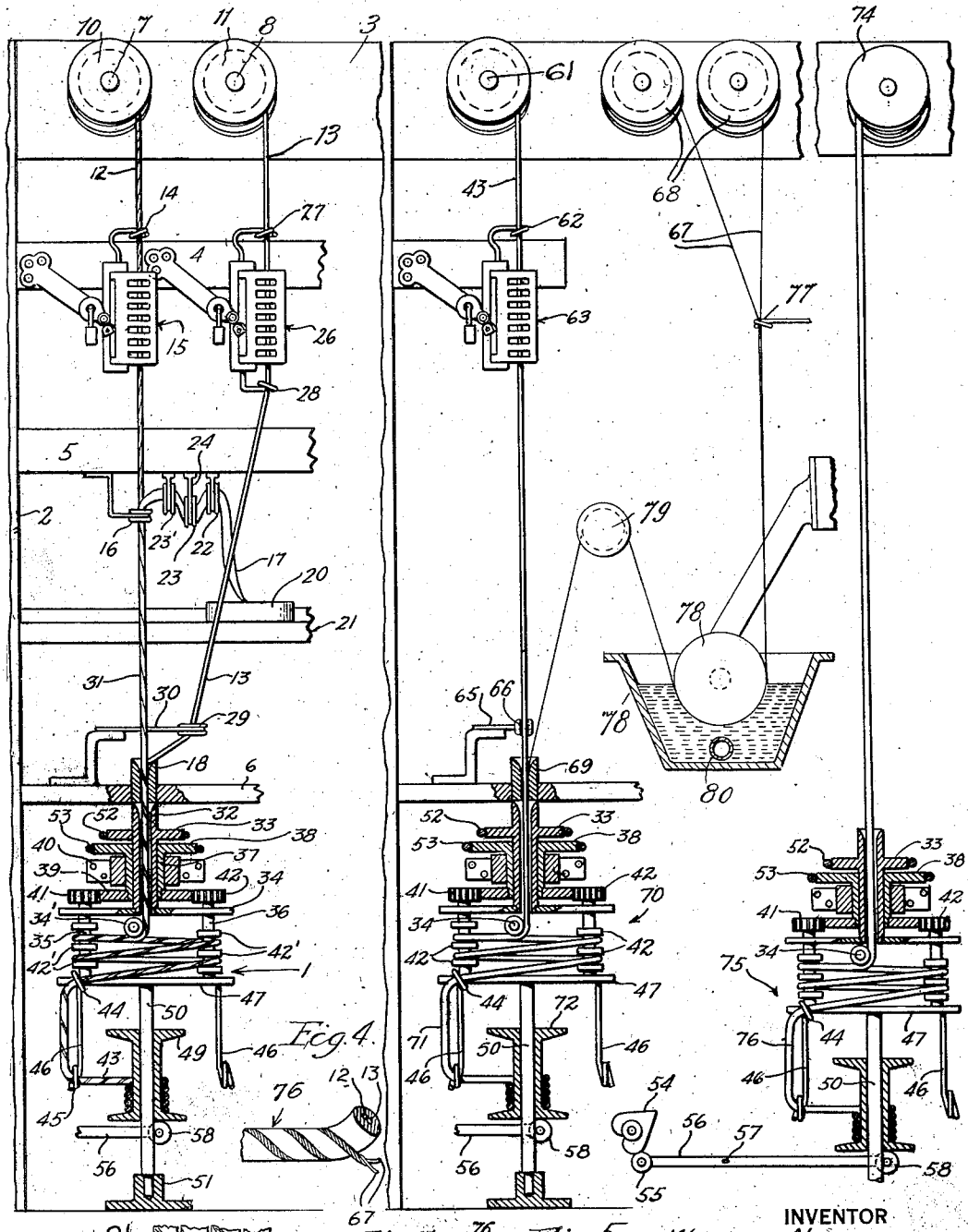


Fig. 4.

Fig. 6.

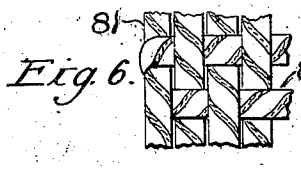


Fig. 7.

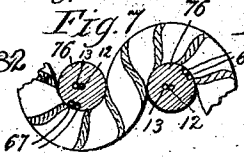
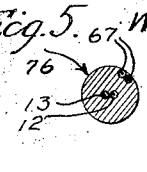


Fig. 5.



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UNITED STATES PATENT OFFICE

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FRICTION AND HEAT RESISTING ARTICLE AND METHOD FOR MANUFACTURING THE SAME

Application filed November 6, 1925. Serial No. 67,399.

This invention relates to the manufacture of friction and heat resisting articles, and more particularly, to the manufacture of yarn from material such as asbestos, to paper of such material, to the manufacture of said paper from such material, to yarn made from such material, to a method of making the yarn, to apparatus for making such yarn, and to fabrics made from such yarn.

More specifically, the invention relates to the manufacture of yarn adapted for different uses but having characteristic advantages for use in friction fabrics suitable for brake and transmission linings.

Heretofore, it has been proposed to make paper from asbestos material and after forming the same into rolls, to form the material of such rolls into flat rolls of strip material. Then each strip, usually in moistened condition, is drawn preferably from the center of the flat roll under low tension and twisted with one or more supporting or reinforcing filaments, combined with the strip one at a time or more than one at a time. There may also be a plurality of successive twisting operations.

The strip material, so far as the herein described method of and apparatus for making yarn is concerned, may be formed as described in the co-pending application of J. A. Heany, Serial No. 516,129, filed November 18, 1921. The asbestos material is formed into a pulp and passed through an ordinary paper making machine to form a web, which is rolled up in the usual manner. This web, which in the paper making operation has been rendered sufficiently strong to permit slitting, is slitted by a slitting machine into narrow strips to be utilized in yarn manufacture. It should be understood that in the finishing of the web, the material of the surfaces thereof has been strengthened, and that the strength of the finished web is to a large extent dependent upon the strength of the surface portions thereof. Satisfactory results in the manufacture of the web are obtained by combining with the asbestos material in the pulp, suitable binding material, which serves to increase the strength or coherence of the finished yarn or paper, thus rendering it suitable for manipulation in the yarn making operations, and of sufficient strength and coherence to withstand the stresses arising in the operation of yarn making mechanism.

A main object of the invention is to produce yarn having advantageous characteristics for the purposes specified. Another object of the invention is to produce paper peculiarly adapted for use in making such yarn. A further object of the invention is to produce fabrics having advantageous heat and wear-resisting characteristics.

Other objects of the invention are to provide paper strip material containing a binder which will retain its strength when wet; paper strip material which has friction material disseminated therethrough; paper strip material containing a binder including friction material; paper strip material containing a binder through which is disseminated material adapted to prevent undue hardening of the binder; paper strip material containing a binder through which is disseminated material adapted to provide for a relatively smooth friction effect; an advantageous method of making such paper; an advantageous method of making such improved yarn; and improved yarn-making mechanism.

Various other objects of the invention relate to the manufacture of the asbestos paper, to yarn structure having particular utility for friction fabrics and adapted to withstand wear in the presence of heat and oil, and to considerations relating to details of the process, apparatus and product, such as will appear upon reference to the detailed description below and to the accompanying drawings, in which

Figure 1 is a view of the mechanism for supporting and feeding the yarn composing elements to the twisting mechanism;

Figure 2 is a view of the apparatus employed in the second step of the process of making the yarn;

Figure 3 is a view of the apparatus employed in the third step of the process of making yarn;

Figure 4 is a view of a short length of the completed yarn;

Figure 5 is a section of the yarn shown in Figure 4;

Figure 6 is a plan of fabric made from such yarn; and

Figure 7 is a section of the fabric of Figure 6.

In the process of the present invention, there is manufactured asbestos paper formed of asbestos material containing asbestos fibres of any available or suitable length, held together by binding material of such a nature as to retain its strength under all working conditions as, for example, when the paper is wet. Heretofore, asbestos paper for this purpose has been held together, to a great extent, by binding material which is generally water soluble, or material which may be softened by water and which by use of a sufficient amount of water may be brought into colloidal suspension. As a result of the low tensile strength of such asbestos paper when wet, considerable difficulty has been met in so handling it as to withstand the strain of the mechanical working necessary in yarn manufacture. Such difficulties have been overcome to a great extent by the use of another kind of binding material.

One binder which gives the proper result contains rosin which is introduced in a suitable manner. Ordinary rosin dissolved in solvents, such as gasoline, alcohol and other hydrocarbons, would not answer, for the reason that when such a binder is placed in a beater with asbestos, water and other binders, which are soluble or capable of being brought into colloidal suspension, (starch for example) the rosin would give up its solvent and would be precipitated in the bottom of the beater. A binder which is free from these defects has been obtained by a method which will now be described.

Preferably the method is put into practice in the following manner. Caustic soda is added to starch in a suitable container and treated with steam (boiled). Then alum is added, and after mixing, the mixture is poured into a beater which has previously been charged with asbestos material and water. The beater roll is then lowered and the beater started. Then a new mixture of starch and caustic soda is made, and sodium resinate (rosin soap) treated with hot water is added and the ingredients thoroughly mixed. Then a few minutes before starting the formation of paper, the last mixture is added to the beater. It should be understood that the alum acts to render the rosin insoluble.

The rosin binder, prepared in this manner and introduced with the asbestos and other binders into a beater, is thoroughly disseminated through the whole mass of material and is homogeneously distributed throughout such a mass or charge. When the paper thus formed is dry, most of the alkali is dissipated, leaving the rosin thoroughly distributed throughout the paper, and giving sufficient strength to the paper, while wet, to permit the subjection of the wet paper to a considerable tension and the strain of mechanical working during the process of manufacturing yarn.

One of the more important features of my invention is to add material which tends to prevent the binder from becoming too hard and stiff, and also to render the frictional effect thereof comparatively smooth and uniform. Preferably, use is made for this purpose of graphite substantially free from impurities, such as silica and mica. Graphite of the quality used in manufacturing leads for lead pencils, may be utilized. Preferably, the graphite is placed in the beater at any time before the addition of the sodium resinate, and by the action of the beater, is disseminated thoroughly through the pulp. The resulting paper will then have the resin and graphite distribute therethrough to a sufficient degree of uniformity. It should be understood that the graphite may be of value in connection with binders other than rosin binders.

The manufacture of the paper may be performed by the use of an apparatus such as shown in the application of J. A. Heany, Serial No. 692,947, filed: February 15, 1924, now Patent No. 1,642,495, granted September 13, 1927. After the paper has been made and wound into rolls, the material of these rolls may be cut into strips which are normally formed into flat rolls of such asbestos strip material.

Before making these strips or bands into yarn, the material of the strips is preferably softened and rendered more flexible, as by moistening. Preferably this is done by dipping the rolls into a tank containing water, for a short interval of time which has been determined to be the proper one.

Another important feature of the invention consists in treating the strips or bands, prior to their manufacture into strands or yarns, with material which not only softens the strips or bands at the time of treatment, but retains them in this condition during the manufacture of both the yarn and the fabric. Preferably, glycerine of a cheap grade is used for this purpose and is applied to the strips in the water of the aforesaid tank, the proportion of glycerine in the solution being about 10% by volume.

Glycerine has the properties of dissolving without limit in water and of absorbing as much as 50% of water from the air, and on account of its never drying quality is useful to keep the paper strips moist and supple. The paper contains considerable starch and this is kept soft by the glycerine.

Referring to Figure 1 of the drawing, I

have shown apparatus similar to that disclosed in my copending application, Serial No. 23,777, filed: April 17, 1925, now Patent No. 1,585,628, granted May 18, 1926, which is here used for supporting spools of material such as cotton thread and moistened rolls of asbestos strip material, uniting the threads and strip material at a predetermined point, and guiding the united elements into a twisting device 1. Fixed to a plurality of standards, one of which is shown at 2, are a plurality of cross beams or bars 3, 4, 5 and 6, from which the various spools and guides are supported. Projecting perpendicularly from the inclined front face of the beam 3 are pins 7 and 8 on which are placed spools 10 and 11 which carry, respectively, cotton cords or threads 12 and 13, which may be of either right or left twist according to requirements. The cotton thread 12 passes through a guide 14 to the upper end of a clamping or tension device 15 which serves to retard the movement of the thread and exert a sufficient degree of tension thereon to maintain the same free of knots or undesirable twists. This clamping or tension device may be substantially the same as described in my said application, Serial No. 23,777, Patent No. 1,585,626.

Below the tension device 15 the strand 12 is led through a circular guide 16 of suitable material, such as porcelain, supported from the beam 5, and is combined at this point with an asbestos strip 17 and then passed through a friction cylinder 18 supported by the beam 6 where it is combined with the cotton strand 13 and is fed into the twister 1. The asbestos strip 17 is provided preferably in the form of a flat roll 20, which has been dipped into a tank containing an aqueous solution of glycerine, and is carried by a tray 21 extending horizontally from the standard of the supporting frame intermediate the beams 5 and 6 in such position, as to permit feeding of the strip from the center of the roll to and through three guides 22, 23 and 23′, in the order mentioned.

The intermediate guide 23 is mounted on the lower end of an arm 24 pivoted, as shown in my said copending application, to the beam 5, thus permitting the guide 23 to be shifted to and from the line through the other guides to vary the tension of the strip. The strip 17 is needled through these guides or, if the strip is mechanically weak, through two or only one of these guides and thence into the main axial guide or cylinder 16 into union with the filament or core. Tray 21 may be preferably provided with an upstanding rim 25 to prevent the flow therefrom of the water used to moisten the paper of the asbestos rolls to modify the binder in the paper and permit easier working of the strip during the twisting operations.

The second cotton cord 13 is led from the spool 11 adjacent to spool 10 through a tension device 26, the strand being guided at the top of the tension device by a guide 27 and at the bottom of the tension device by a guide 28, which is necessary to maintain the cord 13 in its proper direction through the tension device 26 and to prevent the cord from being drawn to one side by the inclined stretch thereof extending toward the twister 1. From the guide 28, the cord 13 passes in an inclined direction to and through an eye 29 on the end of an arm 30 fixed to the beam 6, and from the eye 29 the filament passes into the friction cylinder 18 where it is combined with the strand 31 formed of the cord 2 and the asbestos paper strip 17.

From the friction cylinder 18, the strand 31 and the cord 13 are passed downwardly through a central sleeve 32 of the twister, having thereon a pulley 33 near its upper end, and at its lower end a member 34 perpendicular thereto. From the sleeve 32 the yarn is passed around a pulley 34′ on the member 34, and then wound back and forth around shafts 35 and 36 journaled in the cross member 34. Surrounding the twisting sleeve 32 is a winding sleeve 37 carrying at its upper end a pulley 38 and at its lower end a gear 39, sleeve 37 being supported in a bracket 40.

The gear 39 at the lower end of the sleeve 37, engages gears 41 and 42 at the upper ends, respectively, of said shafts 35 and 36, each of which is provided with three discs 42′ to guide the strand or yarn 43 so that it will be fed around the shafts 35 and 36 and through an eye 44 downwardly to an eye 45 in a flyer arm 46, another flyer arm 47 being shown at the opposite end of the cross member 47 at the ends of said shafts 35 and 36. From the loop or eye 45 the preliminary yarn or strand 43 passes to a spool 49, loosely mounted on a vertical shaft 50 which, at its upper end, supports the member 47, and at its lower end, is supported by a bearing 51.

It will be seen that upon driving the pulleys 33 and 38 by belts 52 and 53, respectively, the member 34 will be turned and the strand 31 twisted. This movement of the member 34, in connection with the driving of the sleeve 37 from the pulley 38, will cause the gears 41 and 42 to be driven by the gear 39 to turn the shafts 33 and 34 and draw the strand 43 around the pulley 34′ and around shafts 35 and 36, and will also cause the strand to pass through the guides 44 and 45 and be wound on the spool 49, which is moved up and down during such winding by means of a heart-shaped cam 54 acting on roll 55 on one end of a lever 56 pivoted at 57, and having at its other end a roll 58 on which the spool rests.

Preferably the cotton threads or cords 12 and 13 are of two or more plies. The thread 12 and the strip 17 are twisted together to the right three twists to the inch, and at the upper

end of the cylinder 18 are twisted with the cotton thread 13 which is wrapped around the strand 31, the resulting strand 43 being wound on spool 49.

It has been found that if cotton thread in its ordinary condition is combined with moist asbestos paper, the thread absorbs moisture from the paper and causes irregularities in the strands or yarns. According to the present invention, the cotton threads are treated with suitable material, preferably light paraffin or cylinder oil, to water-proof the threads and thereby avoid disadvantageous effects such as shrinkage.

In the second operation, the spool 49 containing the strand 43, resulting from the first operation, is removed from the spindle 50 after lifting the latter out of its bearing 51 and placed on an inclined pin 61 projecting from a beam, corresponding to the upper beam 3 of the frame shown in Figure 1, and the strand 43 is passed downwardly from the spool through a guide 62 just above a tension device 63, corresponding to tension devices 15 and 26, shown in Figure 1. From the tension device, the strand 43 passes downwardly to a point where it is deflected, to some extent, by means including a tension rod 65 mounted on a beam corresponding to the beam 6. At its free end the tension rod 65 is provided with an open eye 66 through which the strand 43 passes and beneath which it is united with one or more filaments, such as wires 67, drawn from spools 68 mounted on inclined pins, so as to produce tension on the wires 67 when drawn from spools 68. The two wires 67, which are slightly twisted together before reaching a friction cylinder 69, pass into the friction cylinder mounted on the beam 6, and after passing through the friction cylinder the strand 43 with the wires 67 wound therearound passes through a twister 70 corresponding to the twister 1, the strand 71 thus formed as a result of the second step, being wound on a spool 72.

It should be remembered that the twisting in this operation is in a direction opposite to that of the twisting in the first operation. In the first operation the resulting strand was given approximately three twists to the inch to the right, and in the present or second operation, the resulting strand is given approximately three twists to the inch to the left. From the point where the strand 43 leaves the spool 59 down to the point where it frictionally engages eye 66, there is no twisting of this yarn, that is, it retains the same number of twists as was given the strand 43 resulting from the first operation. From the point of engagement with the eye 66, however, down to the point where it enters the twisting mechanism 70, this yarn receives approximately three twists to the left per inch. Inasmuch as in the first operation the paper was twisted three times to the right, and in the second operation the paper receives three twists to the left, the paper in the strand 71 resulting from the second operation will have no twist. However, the wires or filaments pass from spools 68 to the point where the strand enters the twister and the filaments or wires 67 are then twisted three times to the left around the modified strand 43. There is obtained then at this stage, a strand or preliminary yarn 71 in which the paper has no twist and the wires have three twists to the left per inch.

In the third operation, the preliminary yarn 71 resulting from the second operation, is placed on spool 74 mounted in inclined position on the upper beam of a frame, such as shown in Figure 1, and is led downwardly therefrom to a twister 75 by which the yarn 71 is given three additional twists to the left, thus producing a yarn 76 having six twists of the wires or filaments to the left and three twists of the paper to the left.

Although a certain number of twists is specified, the third operation may consist in giving the yarn 72 any number of final twists, depending upon the requisites of the trade and the kind of yarn desired. It should be understood that the original twists may be either to the right or to the left, and the reversal in such twists may be obtained in the later operations. The number of twists given to the yarn determines the strength, homogeneity and tightness of the finished product, according to commercial requirements, and is an important factor in determining the quality of fabric made from the yarn.

The wires 67 are preferably of brass and it has been found that, when combined directly with moist asbestos paper strips in forming yarn, there is considerable corrosion and deterioration of the wires which may result in breakage thereof. Such deterioration may be due to some galvanic or electrolytic action and may be avoided by coating the wires with suitable material. A coating of paraffin wax has been found to give very satisfactory results and as disclosed in this application, the wires are passed through a pig tail guide 77, under a roller 78, submerged to its axis in melted paraffin in a vessel or pot 78 and over a roller 79 which determines the direction of entrance of the wires 67 into the friction cylinder 69. The paraffin is kept in melted condition by means of a steam pipe 80 in the pot 78.

In recapitulation, the invention may be stated to comprise, in general, the steps of making paper, having incorporated therein, binding material which is not substantially weakened by moistening the asbestos strip, and which may contain lubricating material, of moistening the asbestos strip with water, or, if desired, a solution containing material which will keep the strip soft, flexible and

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moist; of forming a strand of asbestos paper and cotton threads twisted in one direction; of adding one or more filamentary bodies or wires to support the strand and wrapping them about the strand already formed by a twist in a direction opposite to that of the first, and sufficient to leave the strip substantially without twist; of giving the yarn a final tighter twist, tending to embed the wires in the paper material at the surface of the yarn, the twists in different steps being in different directions as hereinbefore specified; and of making fabrics from said yarn. By making the twist in the second operation the reverse of that in the first operation and sufficient in extent to leave the paper strip substantially without twist, the tension on the paper strip is relieved, thus reducing the danger of rupturing the asbestos paper strip during the third step in which a tighter twist is given to the yarn or in the later operations, such as weaving. It should be understood that the extent of the twists in the different directions may be varied and that the material and number of core filaments and binding filaments may be changed without departing from the spirit of the invention.

The invention also comprehends fabrics made from the yarn in any suitable manner, as by weaving, braiding and knitting, and of such texture, strength, thickness and other qualities, as to meet the requirements of the service for which they are designed. As illustrated in Figures 6 and 7, the fabric comprises warp threads or yarns 81 and weft threads or yarns 82. Preferably, said warp and weft yarns are so interwoven that the wearing surface is made up principally of warp yarns. Fabrics made from such yarn have been found to give particularly desirable results when used for brake linings, clutch linings and the like. The rosin in the paper serves to give suitable strength and friction qualities, and the graphite in the paper has been found to play a great part in giving to the fabric of the present invention, its features of superiority. The graphite in the paper serves to lubricate the guides through which the material is drawn in the course of yarn manufacture thereby rendering the frictional drag on the yarn uniform and imparting to the yarn a uniform strength and structure.

The graphite acts as a lubricant to render the braking action of the brake lining more smooth and to prevent sudden gripping, and due to its lubricating qualities, tends to keep the surface of the brake band smooth and to prevent undue hardening of the band at the braking surface. It has also been found that the brake bands containing graphite, substantially retain their effectiveness when wet and, therefore, are reliable in wet weather. Another quality of graphite which renders it of particular value in brake linings, is that of great resistance to heat. The brake lining containing graphite is therefore not affected, by ordinary changes in temperature as to friction or other qualities. Inasmuch as graphite is a very good conductor of heat and therefore dissipates heat rapidly, it is very much more difficult to heat up a lining containing graphite and, when heated, the lining cools very rapidly. Although such brake linings are preferably of fabric made from asbestos yarn, the invention is of such breadth as to include friction fabrics containing asbestos material and graphite, but formed without first manufacturing asbestos yarn.

It should be understood that the apparatus herein disclosed is merely illustrative of the invention, and that various changes may be made in the construction and arrangement of the parts without departing from the spirit of the invention.

It should be understood that the term "asbestos material", wherever it appears in the specification and claims, is intended to refer to material having a substantial percentage of asbestos fibres, such as to give more or less the characteristics of asbestos as far as working and handling are concerned, and the term "asbestos material", where used in the specification and claims, shall be considered as thus defined.

I desire to claim as my invention:—

1. A method of making asbestos material adapted for use in yarn manufacture and other uses which comprises incorporating in asbestos containing pulp a binding agent, and a material adapted to soften said asbestos containing pulp, and thereafter forming the desired product therefrom.

2. A method of making asbestos paper for use in the manufacture of yarn, which consists in forming pulp of asbestos material, disseminating a rosin material and graphite therethrough, and binding such material with the rosin and graphite distributed therethrough into paper.

3. An asbestos product having a binder and a material to prevent undue hardening of the binder.

4. An asbestos product including a binder containing resin, and material to prevent undue hardening of the binder.

5. An asbestos product including a binder and glycerine to prevent undue hardening of the binder.

6. An asbestos product including a binder containing resin, and glycerine to prevent undue hardening of the binder.

7. An asbestos product for friction purposes having disseminated therethrough friction producing binding material and having also a lubricating material therein to insure smooth frictional action; and a material for

preventing undue hardening of the binding material.

8. An asbestos product for friction purposes having disseminated therethrough friction binding material including resin, and having therein lubricating material to insure smooth frictional action and material for preventing undue hardening of the binding material.

9. An asbestos product for friction purposes having disseminated therethrough friction binding material, lubricating material including graphite to insure smooth frictional action, and material for preventing undue hardening of the binding material.

10. An asbestos product for friction purposes having disseminated therethrough friction binding material, lubricating material to insure smooth frictional action, and glycerine for preventing undue hardening of the binding material.

11. A method of making an asbestos product adapted for various uses such as for sheets, fabrics, paper, yarn, for friction elements as in brake linings, and various other uses which comprises incorporating in an asbestos containing pulp a binding material adapted to increase the adhesion of the finished product and to impart sufficient strength thereto to render it suitable for manipulation to withstand the stresses arising in the various operations of manufacture, adding a material for preventing undue hardening of the binding material, and forming the desired product from the resulting pulp material.

12. A method of making an asbestos product adapted for various uses, which comprises incorporating in an asbestos containing pulp material a binder adapted to increase the coherence of the said asbestos material, and incorporating therewith a lubricating material, the said materials being incorporated in proportions such that the resulting product will have sufficient adhesion or coherence in the wetted condition to permit being mechanically worked, and thereafter forming the desired product therefrom.

13. A method of making an asbestos product for use in manufacturing asbestos yarn and other uses which comprises forming a pulp of asbestos material, treating a resinous material in such a manner chemically so as to render it soluble in water, disseminating the treated resinous material throughout the pulp, adding a material to form a substantially insoluble compound therefrom, and forming the desired product with the said compound distributed therethrough.

14. A method of making an asbestos product for use in manufacturing asbestos yarn and other uses which comprises forming a pulp of asbestos material, treating a resinous material in such a manner chemically as to render it soluble in water, forming a water solution thereof and disseminating the treated resinous material throughout the pulp and thereafter adding a material thereto to form an insoluble resinate in the pulp to impart the desired strength to the product in the wetted condition so as to permit being mechanically worked, and thereafter forming the desired product therefrom.

In testimony whereof, I affix my signature.

WILLIAM NANFELDT.

CERTIFICATE OF CORRECTION.

Patent No. 1,758,055. Granted May 13, 1930, to

WILLIAM NANFELDT.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 3, line 4, for "1,585,628" read 1,585,626; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 5th day of August, A. D. 1930.

(Seal)

Wm. A. Kinnan,
Acting Commissioner of Patents.

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