May 18, 1926. 1,585,625

W. NANFELDT

FRICTION YARN AND PROCESS AND APPARATUS FOR MAKING SAME

Filed April 6, 1925 2 Sheets-Sheet 1

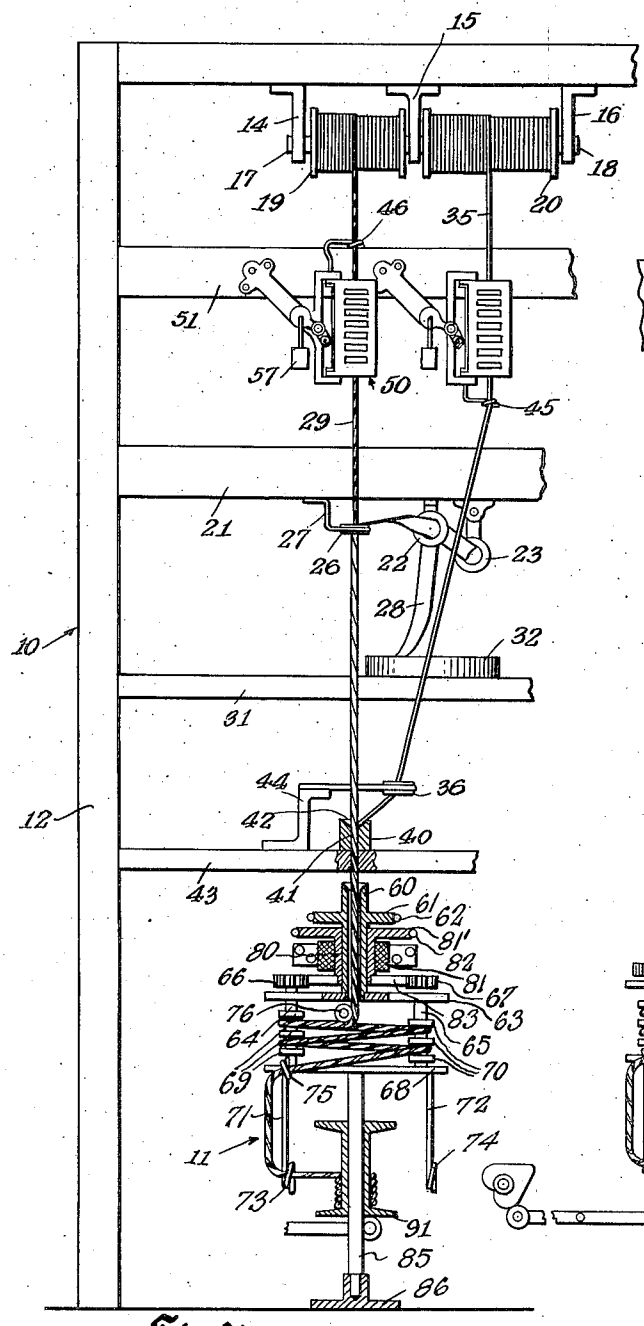


Fig. 1.

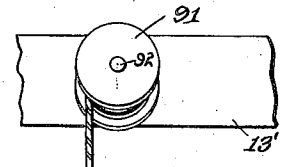


Fig. 2.

Fig. 3.

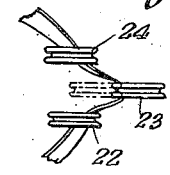
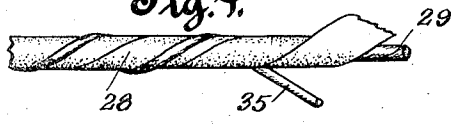


Fig. 4.



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Fig. 5.

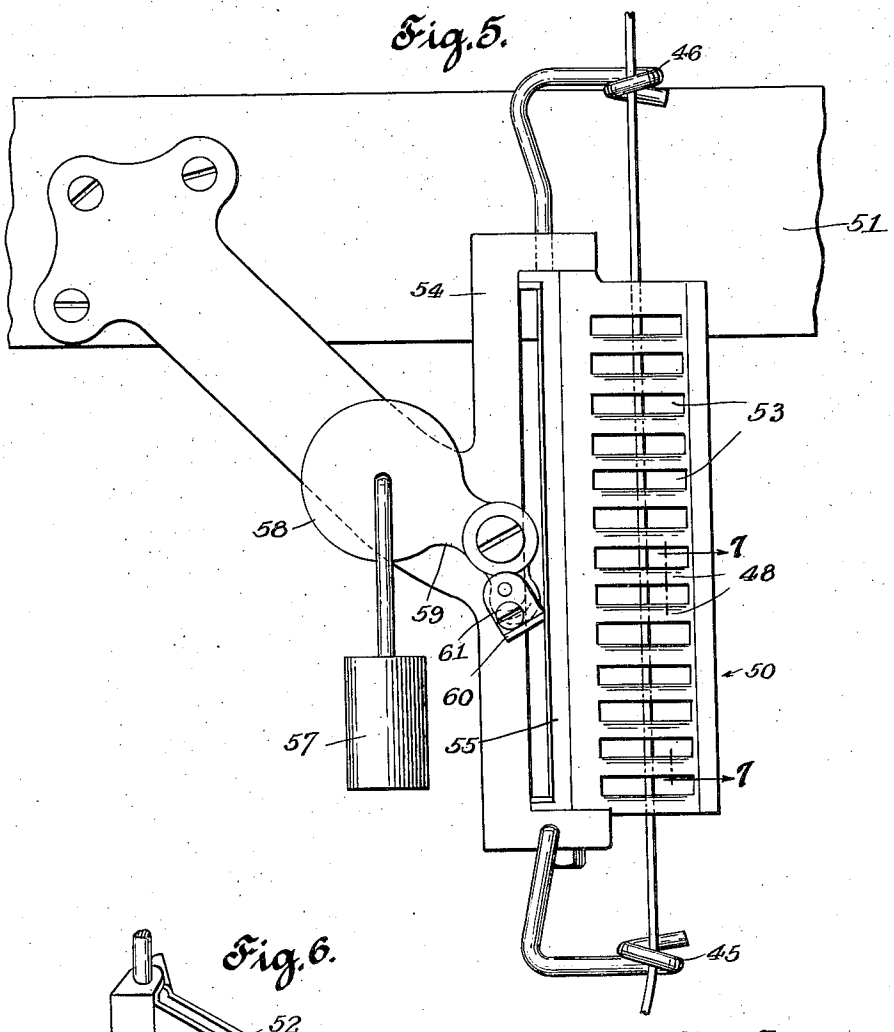


Fig. 6.

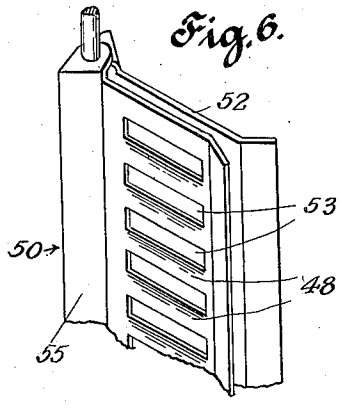
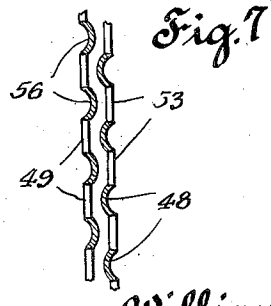


Fig. 7.



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UNITED STATES PATENT OFFICE.

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FRICTION YARN AND PROCESS AND APPARATUS FOR MAKING SAME.

Application filed April 6, 1925. Serial No. 21,087.

This invention relates to yarn and a process for making the same. More particularly, the invention relates to the manufacture of a yarn having specific utility in friction fabrics, clutches, brake bands and the like, although advantageously usable for other purposes.

Generally stated, the invention, in its important aspects, consists in a new yarn in which a paper strip, preferably of asbestos material, is placed arouid a relatively loose strand of vegetable fibre, such as jute, and secured thereto by a filament and in a new method of manufacture by which the various component yarn strands are maintained unitary in the final yarn structure and with certain advantageous twists therein; use being made of improved apparatus for supporting and twisting the yarn strands so that bunching of the material of each strand at various points is prevented.

As disclosed in the present invention, I have found that the use of a vegetable fibred strand, such as jute, combined with a paper strip or asbestos in the form of a paper-like strip or band and optionally with a second strand of cotton, wire or the like, produces a yarn which has greatly improved wearing qualities with decidedly less tendency to glaze or vitrify on its surface when used in friction fabrics, and possessing greatly improved elasticity, frictional resistance and other advantageous characteristics.

Among the important objects of the present invention therefore, may be considered that of providing means for improving the wearing qualities of a yarn usable in a friction fabric. Another object is that of diminishing the tendency to glaze in the wearing surface of yarns used for friction fabrics. An object also is to provide a yarn suitable for maintaining a semi-lubricating action when woven with asbestos fibres for use as a friction fabric.

An important object of the invention is to provide means for adding elasticity to a yarn containing strands of mineral fibre, such as asbestos. An object also is to form a composite yarn containing asbestos in which the frictional gripping area, when applied to a cooperating friction surface, is greater than that wherein asbestos alone is used.

With the above objects in mind, I have obtained a product and devised a method and apparatus for producing the same, the details of which will now be described. In the accompanying drawing, I have shown an embodiment, which may be preferred, of the apparatus for manufacturing the yarn, in which

Figure 1 is a view of the supporting frame and twisting mechanism;

Figure 2 is a view of the support and twister for the final operation;

Figure 3 is a detail of the paper strip;

Figure 4 is a detail of the finished yarn;

Figure 5 is a section through the finished yarn;

Figure 6 is a detail of the tension apparatus of Figure 1; and

Figure 7 is a section on the line 7—7 of Figure 5.

Referring particularly to Figures 1 and 2 of the drawing, the apparatus for carrying into effect my invention is disclosed. Essentially, this apparatus consists of a supporting means 10, upon which is mounted means for supporting and guiding the various strand units entering into the completed yarn and supporting also the twister unit 11, beneath the supporting means for the yarn units.

The supporting means 10 includes a standard 12, to which is attached a horizontal bar or beam 13. The beam 13 carries depending brackets 14, 15 and 16, which support the shafts 17 and 18. On these shafts are rotatably mounted reels or spools of the yarn forming strands of the present invention, the shaft 17 supporting a spool 19 of jute fibre, the shaft 18 a spool 20 of cotton fibre. The shafts 17 and 18 with spools 19 and 20 revolvably mounted thereupon, are positioned approximately directly above the twisting mechanism 11 and the jute and cotton strands therefrom are adapted to feed the twisting mechanism in combination with a strip of asbestos paper, as will be now described.

Beneath the beam 13 and supported by the standard 12 is a second beam 21, from which the paper strip 9 for the yarn is supported. This supporting means consists of a plurality of depending circular guides 22, 23 and 24, formed preferably of porcelain or a similar substance, through which the asbestos strip 28 is needled. The guides 22 and 24 are immovable relative to the support 21, but the guide 23 is pivoted between the

guides 22 and 24 and may be swung into or out of alignment, with the other guide to vary the frictional resistance on the strip. I provide also a pig-tail guide 26 supported by the bracket 27 beneath the beam 21 and in approximate alignment with the spool 19 and twister 11 through which the strip 28 and jute strand 29 are led to the twister.

The paper or paper-like strip or band is provided preferably in the form of narrow rolls, which are placed in a tray 30, supported from the frame 10 and having upstanding edge walls 31 adapted to retain water or other moisture whereby the rolls of tape or paper strip are thoroughly moistened. The tray 30 is directly beneath the beam 13, there being a roll of tape 32 placed adjacent the guide rings 22, 23 and 24 through which the strip is fed, although where a minimum friction is desired or where the paper strip is mechanically weak, a single friction guide, as 22, may be utilized. Both the strip 28 and the jute core strand 29 are fed into the pig-tail guide 26 and subsequently twisted.

The cotton strand 35 is added to the jute and asbestos strip at a point beneath the guide 26 near the twister 11 and after a preliminary twist has been given to the jute and asbestos as is shown clearly in Figure 1 of the drawing. As means for guiding the cotton strand 35 into its proper position in relation to the other yarn elements, there is provided a ring guide 36 and a combined guide and friction device 40 directly above the twister 11 and consisting of a cylindrical block having a central aperture 41 and a flared upper end 42 leading into said aperture, the edges of the flare being rounded so as to facilitate entrance and feeding in of the yarn elements without breakage. The guide block 40 is supported on a rod or beam 43 fixed to the standard 12 and the guide 36 is supported to one side of the axis of the twister 11 by the bracket 44. The block 40 is of sufficient length to develop a certain amount of frictional contact as the yarn strands pass therethrough, thereby smoothing out any lumps or knots which tend to form.

Additional friction elements are provided to prevent too rapid movement of the core and external strands in the present invention, there being the strands of jute 29 and the strand of cotton 35. For this purpose, I utilize a unit 50 supported from the beam 51 and having a fixed plate 52 provided with a plurality of alternate horizontal narrow slots 53 and ridges 48. A U-shaped bracket 54 forms a pivot support for a cooperating plate 55 on which a plurality of slots 49 and ridges 56 are horizontally positioned and adapted to engage the various corresponding slots 53 and ridges 48 on the fixed plate 52 when the plate 55 is moved into cooperating engagement therewith. These plates are normally yieldably held together by means of the weight 57 supported from the end 58 of the lever 59. This lever is pivoted on the bracket 54 and carries a contact shoe 60 which is pivoted on the lever end and is slotted to receive the adjusting screw 47. These plates, as above described, are adapted to frictionally retain the strand or core of jute cotton or wire, as the case may be, which extends parallel to the pivotal axis of the device and adjacent the various slots and ridges the corrugations of each plate tending to force the strand into slots and thus frictionally tend to prevent movement thereof.

Auxiliary pig-tail guides 46 and 45 are also utilized to center the strands in the friction units 50. One of these units 50 is provided for each of the core and winding strands and is effective to prevent too rapid feeding thereof and to straighten out tangles and knots and in general to permit uniformity of feeding of the component strands.

Proceeding with the description of the mechanism employed in the formation of the yarn, the various jute and cotton strands and the asbestos paper strip are, after combination, fed simultaneously as a single unit into the twisting mechanism. This twisting mechanism 11 is in general of well known construction and consists essentially in combined twisting and feeding mechanism. The twisting mechanism per se includes a sleeve 60 adjacent the top of which is a drive pulley 61 on the periphery of which a drive cord 62 is positioned. At the base of the sleeve 60 a cross bar 63 is fixed, the same carrying at its respective ends the stub shafts 64 and 65. The stub shafts have affixed thereto at their upper ends the pinions 66 and 67 and their lower ends are adapted to have rotatable connection with a second cross bar 68. The shafts 64 and 65 carry also intermediate the cross bars 63 and 68 the guide rollers 69 and 70. Depending from either end of the cross bar 68 are rods 71 and 72, the ends of which are formed into pig-tail guide loops 73 and 74. In addition to the guide mentioned, there is indicated also the guide loop 75 adjacent one end of the cross bar 68 and a guide roller 76 attached to and suspended from the cross bar 63 beneath the sleeve 60.

The feed mechanism of the twister is embodied in a sleeve 80 supported by a bracket 81 and surrounding the sleeve 60. The upper end of the sleeve 80 terminates in a drive pulley 81′ grooved at its periphery to receive the drive cord 82 and at its base terminates in a gear 83 which meshes with the pinions 66 and 67, hereinabove indicated.

The twister is supported on a rod 85 which contacts with the cross bar 68 at its middle point and rests upon a base plate 86.

The rod 85 is adapted to receive the spool 91 upon which the strand of yarn is adapted to be wound as it comes from the twister. Reciprocated movement is given to the spool 91 in order to facilitate the winding of the yarn in layers thereupon, the mechanism for this action consisting in an appropriate cam operated device having an arm 88 with a contact roller 89 at the end thereof. The cam mechanism of Figure 2 is employed to reciprocate the spool 91.

The mechanism as above described is adapted for use in the first step of the process. For the second step of the process, use is made of a twister 90 similar in all respects to the twister unit 11 employed in the first step of the process, this second twister 90 being positioned beneath a cross beam 13' appropriately supported. Instead of the horizontal shaft support for the spool 91 of the preliminary yarn, use is made of a pin 92 having a slight upward incline so that the lower upper edge of the spool contacts with the beam and is frictionally hindered from rotation.

Operation.

The mechanism, as above described, is utilized in my process in the following manner. The jute, in accordance with the present disclosure or other fibrous vegetable stock having similar characteristics, is positioned on a spool as 19 in the form of a core or strand which is led downwardly through the guides 46, 26 and 40 and through the unit 50 into the twisting mechanism 11. The jute as utilized in this process has normally about three turns to the right per inch, although the degree of twist may be somewhat varied in accordance with the requirements of the finished yarn. A strip 28 of asbestos paper is then led through the guides 22, 23 and 24, the relative position of guide 23 depending upon the strength of the paper or upon the resistance necessary to keep it in proper relationship and into the guide 26 with the jute core 29. Also, the cotton strand 35 supported on a spool 20 and having normally about six turns per inch to the left is led through the resistance unit 50 and guides 36 and 40 into juxtaposition with the strip and jute and then into the twister mechanism. The twister 11 is then operated in a direction to give a left hand twist to the strands and a preliminary twist is thereby imparted to the yarn elements which is relatively loose, approximating about three twists to the inch, this preliminary yarn being wound upon the spool 91. This operation completes the first step of the process and results in a preliminary yarn in which the jute core has three turns to the left and the asbestos strip about six turns to the left.

The preliminary yarn made as above described, is then placed on the pin 92 while still moist and fed into the second twister 90, in this twisting operation the number of twists being increased two or three times over that received in the first twisting operation. Not only is the number of twists increased in the second step of the process, but the various component strand elements of the yarn are tightened and the cross section of the yarn diminished and the whole structure compacted and made more stable and useful than that obtained by the preliminary operation. The second operation also tends to force the cotton thread or strand 35 into the body of the yarn so that it forms a continuous and uniform part thereof and the completed yarn accordingly has a smooth surface, the jute, asbestos and cotton all appearing on the surface of the same, as shown clearly in Fig. 4 of the drawing, and providing the wearing surface thereof.

The second step of the process as above described is found desirable for the reason that during the first twisting operation the component strands of the yarn cannot easily be bound together with a sufficiently low pitch of twist. It is desirable that the number of twists per inch be small so that the jute and cotton shall lie almost straight, the parallel yarn in consequence having the component parts bound together in a uniform manner without a pronounced helical formation of either the jute or the cotton. With the yarn completed in its parallel form and the cotton positioned properly relative to the other parts, the yarn is in condition to receive an increased number of twists per inch, without disturbing the relative position of the various strands.

In the twisting operation of the first step of the process, attention is directed to the fact that the jute and strip receive a preliminary twist above the twister and prior to the union therewith of the cotton strand and the cotton strand or thread is accordingly wound about rather than incorporated in the line of twist as is the case with the jute and the asbestos which are fed simultaneously into the guide 26 and are uniformly twisted with each other. By this action, the cotton thread is forced to serve as a holding means for the asbestos strip, which being normally non-coherent and easily torn or abraded, preferably requires an external holding or binding agent to maintain it in position in the yarn structure.

The first operation also by reversing the normal twist of the jute causes the same to loosen and combine more thoroughly with the asbestos and cotton than would be the case if the jute strand were not untwisted. Moreover, since the jute in its final state has approximately the same number of twists as it had initially, although to the left instead of to the right, there is no in-

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creased tendency for the jute to wind or knot itself and thus hinder weaving operations. It should be observed that a similar effect is obtainable by stopping the twisting action before the jute is retwisted to its normal number of turns in the opposite direction, although yarn having an untwisted jute strand is not so desirable for weaving operations as the yarn in which there is an appreciable twist in the jute strand. The cotton reinforcing strand being considerably weaker than the jute is twisted in a direction to twist the same as the strength of the partially completed yarn combined with the weakness of the cotton, does not operate to disturb the advantageous structure of the final yarn by being twisted in the same direction as the normal twist of the cotton strand.

The various resistance and friction elements employed, according to the first step of the process, advantageously combine to eliminate bunching of the component parts of the yarn and to disentangle knots and, in general, facilitate a uniform feeding of the various strands so that a very desirable finished product of uniform contour and dimensions is obtained by the process. The upward inclination of the pin 92 tends to cause frictional resistance to rotation of the spools mounted thereupon as the upper inner edge of the spool contacts against the supporting beams and this arrangement also combines with the frictional means hereinabove mentioned.

For the purposes of a clear description of the invention, I have described, in connection with the apparatus and process of making the yarn, a core filament or strand of jute, a reinforcing or wrapping filament or core of cotton and a body strip of asbestos paper. These elements possess certain distinctive characteristics which makes them exceedingly valuable in producing a yarn which is not only flexible for weaving operations, but is also very valuable for use in so-called friction fabrics including brake linings, transmission fabrics and similar materials requiring pronounced resistance to temperature and frictional wear very frequently in the presence of oils. The advantage of asbestos for brake lining and similar uses is well known, asbestos being a mineral. The chief difficulty in connection with asbestos is its fibrous formation and the difficulty with which the fibres are agglomerated to form a compact mass sufficiently stable for use under high mechanical stresses in the presence of moisture.

In accordance with my invention, I employ asbestos which may be either short or long fibred, in the form of paper strip normally held together by a binder, such as starch, so that when formed into the yarn it enters the yarn structure as a homogeneous body and not as a loose fibre as has been customary in other processes of utilizing asbestos fibre. The binder, during the yarn making process, is loosened by moisture, as hereinabove described, so that the strip while maintaining in general its unity, is nevertheless easily molded into the desired form.

The use of jute I have found to be highly desirable in a yarn intended for friction purposes. Jute is relatively cheap as a raw material for manufacturing purposes. Aside from the matter of cost, jute is much more absorbent than asbestos and does not have so great a tendency to vitrify or glaze as asbestos when employed in friction fabrics in the presence of heat and oils. This tendency to glaze is more pronounced in cotton than in jute and consequently jute forms an exceedingly desirable component element in the final yarn structure.

Also when subjected to heat and friction, a yarn having alternating areas of jute and asbestos on its surface has properties which tend to increase the life of the fabric and its efficiency of operation. The jute, due to the heat, wears more rapidly than the asbestos providing a shallow channel for foreign material and also a channel for the free oils which may be on the bearing surface of the fabric. The jute also, due to its absorbent action, brings oils to the bearing surface of the friction fabric. Moreover, the jute strands break up the surface of the asbestos so that a continuous glazed surface is impossible in a friction fabric formed of the yarn I have described, and the undesirable results of a friction lining, the surface of which is completely glazed is therefore largely avoided.

While jute is mentioned as a suitable material to form the core strand of the yarn, a vegetable fibre having equivalent characteristics of flexibility, elasticity absorptiveness may be substituted.

For instance, I may employ as a core filament a strand of cotton fibre or hemp and the like. The advantage of jute, as hereinabove mentioned, resides primarily in its ability to resist the glazing action of heat and friction in which it is superior to cotton and other vegetable fibres, but in general, vegetable fibres possess this characteristic to a greater extent than any mineral fibres, such as asbestos.

One of the outstanding features of the process as above described, consists in the utilization of a core strand or thread having a certain number of twists in a given direction, and twisting the same with an untwisted strip of asbestos in a direction to reverse or unwind the twist in the core strand and subsequently combining these two elements, the core and the strip, with a third strand to form the preliminary yarn structure. The

advantage of the reversal of twist of the core is in part the prevention of kinking or knotting of the yarn in its final form as a twisting of a core strand in the direction of the normal twist will cause a spiral elastic twist to be set into the yarn structure which will result in knotting in final form. Moreover, untwisting of the core strand permits a closer contiguity of the core and asbestos paper strip which makes the resultant yarn more uniform in cross section.

I have described the use of cotton as a combining agent for the asbestos and jute, and for this purpose it is useful. I may, however, if greater tensile strength is desired in the finished yarn, employ a wire of brass, copper or other metal which serves a purpose similar to that of cotton. However, it should be observed that cotton, in connection with jute, has the important advantage of permitting the yarn to yield as a whole. Where the component elements are too rigid, the yarn structure may yield in parts at different points along its length or the asbestos may break due to the weaving operation or due to sharp twists being made in the yarn. This rupture of the asbestos stock is, in general, prevented by the use of yieldable jute with the cotton as a combining agent, the whole forming a yarn which is readily woven without rupture of the asbestos fibre, and which in general forms a highly useful and durable yarn.

Attention is directed to the fact that the final yarn is formed of vegetable fibre and mineral fibre, and in the proposed modification where metal wire is used as a strand, the final yarn is formed of vegetable fibre, non-metallic fibre and a metal. It should be observed further that the specific number of twists mentioned for the component parts of the yarn and for the yarn as a whole may be varied in accordance with the requirements of the product.

An important feature relating both to the yarn and the process for making same resides in the use of asbestos paper-like material or strips or bands of asbestos material bound together with sufficient cohesiveness and tenacity and adapted for yarn manufacture. 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.

While I have described a form of yarn and detailed an apparatus and process for manufacturing the yarn, I do not wish to be limited to the exact details employed and the description, the invention being defined only as specified in the claims hereto appended.

I desire to claim as my invention:

1. A process for making yarn which includes the step of loosely twisting in a given direction a paper strip with a strand of vegetable fibre having a normal twist in the opposite direction, to wrap the paper strip around said strand of vegetable fibre.

2. A process for making yarn, which includes the steps of loosely twisting in a given direction a paper strip with a strand of vegetable fibre having a normal twist in the opposite direction, and combining in helical arrangement said strip and strand and a reinforcing filament.

3. A process for making yarn, which includes the step of loosely twisting in a given direction a paper-like strip of asbestos material bound with sufficient cohesiveness and tenacity and adapted for yarn manufacture with a strand of jute fibre having a normal twist in the opposite direction, to cover said strand of jute fibre with said paper-like strip or band.

4. A process of making yarn, which includes the step of loosely wrapping a paper-like strip or band of asbestos material bound with sufficient cohesiveness and tenacity and adapted for yarn manufacture around a twisted strand of jute fibre and simultaneously twisting said strand in a direction to untwist the same.

5. A process of making yarn, which includes the steps of loosely twisting a paper-like strip or band of asbestos material bound with sufficient cohesiveness and tenacity and adapted for yarn manufacture with a wisted strand of jute fibre in a direction to untwist the strand, applying a filament to said strip or band and said strand at an intermediate stage of said twisting to bind the strip or band and strand together and tightly twisting said strip or band, said strand and said filament to form a finished yarn.

6. A process for making yarn, which includes forming a preliminary yarn by loosely twisting in a given direction a paper-like strip or band of asbestos material bound with sufficient cohesiveness and tenacity and adapted for yarn manufacture with a strand of vegetable fibre having a normal twist in the opposite direction, the twist of the strand of vegetable fibre in the article produced by such step being approximately three to the inch and the corresponding twist of the combined strand of vegetable fibre and the strip or band being approximately six to the inch.

7. A process for making yarn, which includes forming a preliminary yarn by loosely twisting in a given direction a paper-like strip or band of asbestos material bound with sufficient cohesiveness and tenacity and

adapted for yarn manufacture with a strand of vegetable fibre having a normal twist in the opposite direction, the twist of the strand of vegetable fibre in the article produced by such step being approximately three to the inch and the corresponding twist of the combined strand of vegetable fibre and the strip or band being approximately six to the inch, and subsequently twisting said strip or band and said strand more closely to form a finished yarn.

8. A process for making yarn, which includes loosely twisting a twisted strand of vegetable fibre and a moistened strip or band of asbestos paper-like material bound with sufficient cohesiveness and tenacity and adapted for yarn manufacture in a direction to untwist the strand, combining and twisting said strand and strip or band with a reinforcing filament, and finally closely twisting the strand of vegetable fibre, the strip or band and said filament in the same direction to form a final yarn.

9. A process of making yarn, which includes the steps of supplying an asbestos paper-like strip or band under adjustable tension, loosely twisting said strip or band with a twisted core of vegetable fibre in a direction to untwist the core, applying a filament helically around said strip or band and core, and twisting said strip or band, said core and said filament in a direction to tighten said filament.

10. A yarn having a core strand of jute fibre, a cover for said jute strand formed from asbestos paper-like material bound with sufficient cohesiveness and tenacity and adapted for yarn manufacture.

11. A yarn including a core strand of jute, a cover for said core strand formed from asbestos paper-like material bound with sufficient cohesiveness and tenacity and adapted for yarn manufacture, and a binding filament arranged around said asbestos paper-like material.

12. A yarn including a jute core strand, a paper-like strip or band of asbestos material arranged helically around said core strand, and a binding filament arranged helically around said strip or band and securing it to the strand.

13. A yarn including a relatively elastic core strand of jute fibre, a cover for said core strand formed from a paper-like strip or band of asbestos material bound with sufficient cohesiveness and tenacity and adapted for yarn manufacture, and a binding filament securing said strip or band to said core strand.

In testimony whereof, I affix my signature.

WILLIAM NANFELDT.