May 18, 1926. 1,585,611

J. A. HEANY

PROCESS OF MANUFACTURING YARN

Filed Jan. 19, 1926 2 Sheets-Sheet 1

Fig. 1.

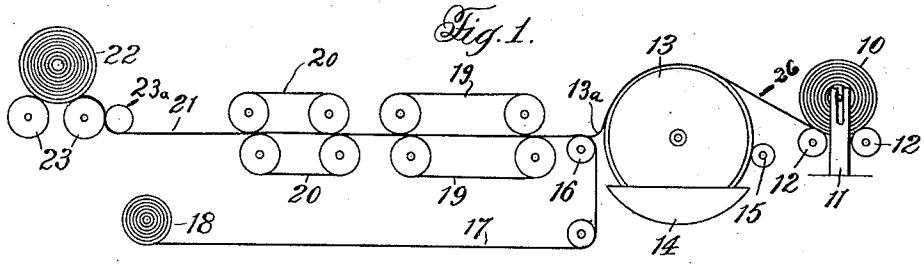


Fig. 2.

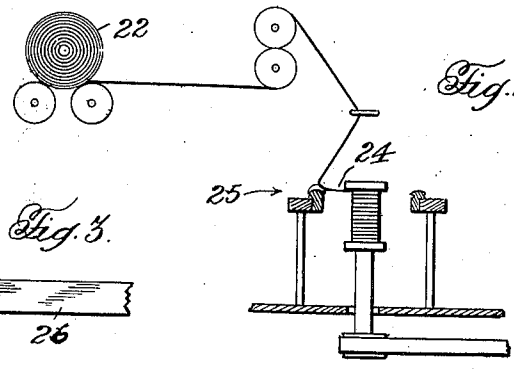


Fig. 3.

Fig. 4.

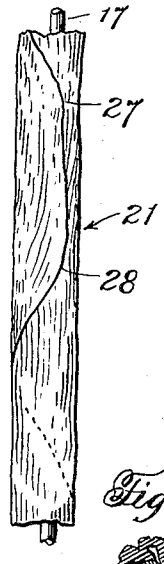


Fig. 5.

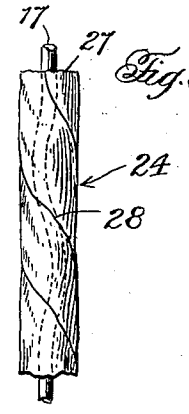


Fig. 6.

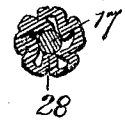


Fig. 8.

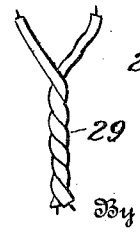


Fig. 7.



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PROCESS OF MANUFACTURING YARN

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Fig. 9.

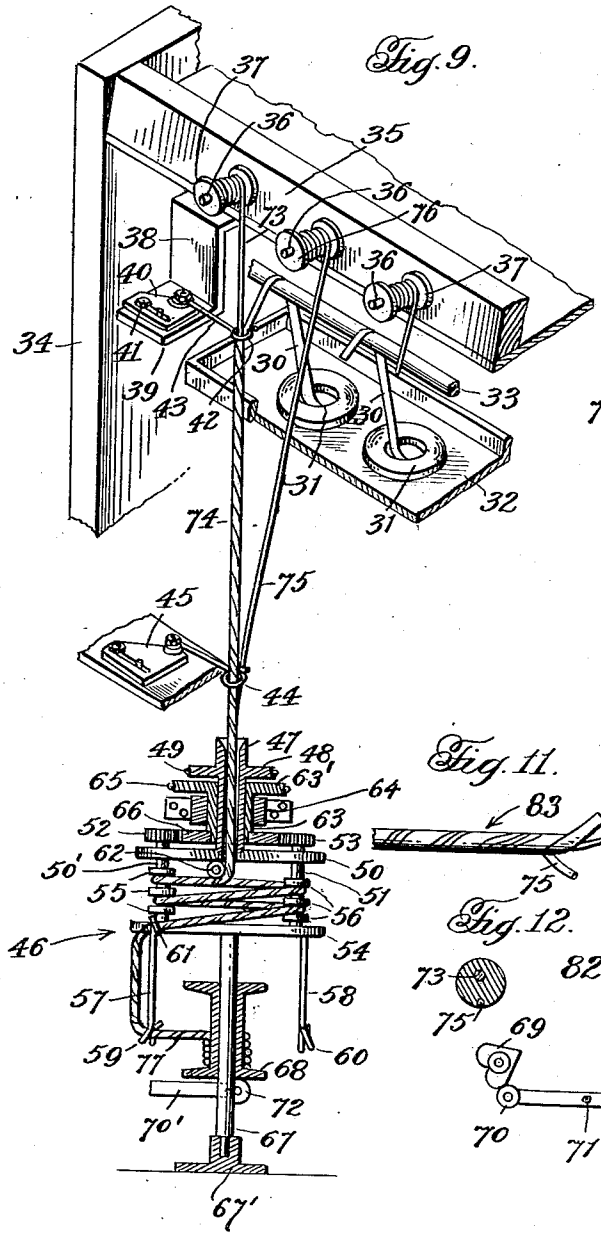


Fig. 10.

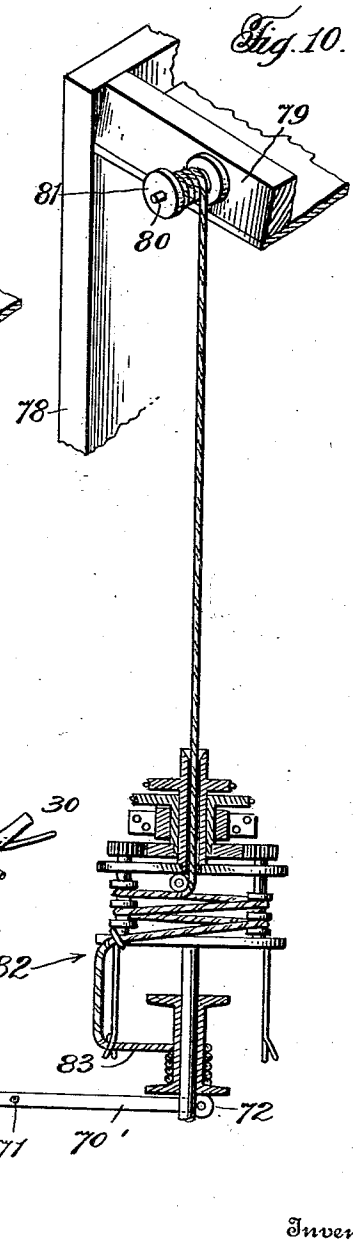


Fig. 11.

Fig. 12.

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Patented May 18, 1926. 1,585,611

UNITED STATES PATENT OFFICE.

JOHN ALLEN HEANY, OF NEW HAVEN, CONNECTICUT, ASSIGNOR TO WORLD BESTOS CORPORATION, OF PATERSON, NEW JERSEY, A CORPORATION OF DELAWARE.

PROCESS OF MANUFACTURING YARN.

Application filed January 19, 1926. Serial No. 82,249.

The present invention relates to the manufacture of yarn from asbestos or material consisting largely of asbestos, and has to do with the elimination of numerous difficulties occurring in the manufacture of such yarn by old processes.

This application is a continuation of my co-pending application, Serial No. 516,129, filed November 18, 1921, as to subject matter originally disclosed in said co-pending application, but as to other subject matter described and claimed herein, the same is disclosed in one or more of the following co-pending applications:

Serial No. 529,143, filed January 14, 1922.
Serial No. 654,118, filed July 27, 1923.
Serial No. 684,324, filed January 4, 1924.
Serial No. 684,325, filed January 4, 1924.
Serial No. 685,091, filed January 9, 1924.
Serial No. 685,092, filed January 9, 1924.
Serial No. 685,300, filed January 10, 1924.
Serial No. 687,218, filed January 19, 1924, and
Serial No. 709,723, filed April 29, 1924.

An important object of the invention is to provide an improved process for making yarn from asbestos fibre or fibrous material containing a considerable proportion of asbestos.

Another important object of the invention is to provide a process of which the product is an improved yarn, uniform, durable, adapted for weaving, and costing less than such yarns heretofore produced. One important use of such yarns is in the making of friction fabrics for brake and transmission linings.

Another important object of the invention is to provide a process of manufacturing yarn including a step of manufacturing paper or paper-like material from asbestos material. The paper or paper-like material during the paper making operation is preferably subjected in finishing to such drying and compression as to give it the proper thickness and to compact and strengthen the surfaces thereof sufficiently to withstand the formation of the paper or paper-like material into rolls, the separation of the paper of such rolls into narrow strips or bands, as by slitting, and such handling as may be necessary.

A further object of the invention is to provide a process in which asbestos fibrous material is formed in connection with a binder, or a binder and other suitable material, into thin paper or paper-like material, and strips or bands of such paper or paper-like material, are formed into yarn as by combining them or mechanically combining them in twisted or other relation with suitable cores or reinforcing elements to form yarn.

Other objects of the invention are to provide for economy in use of the material, for methods or processes of manufacture which tend to improve the welfare of the workmen as to working conditions, and for economy in operation and expenditure of labor.

Generally speaking, the process of the present invention consists in the formation of a yarn from asbestos material having its fibres held together by suitable binding material, or from asbestos paper-like material bound with sufficient cohesiveness and tenacity and adapted for yarn manufacture and more specifically the process consists in the combination of at least one element of such material with at least one reinforcing element or filament to form a yarn.

In the drawings:

Fig. 1 is a diagrammatic side elevation illustrating one form of apparatus for forming yarn material into strands;

Fig. 2 is a view in elevation of apparatus which may be used for twisting the strands to form yarn;

Fig. 3 is a view illustrating a paper-like strip or band utilized in making the yarn;

Fig. 4 is a view illustrating a strand formed by rubbing a moistened strip or band of asbestos material about a filament;

Fig. 5 is a view illustrating a yarn or preliminary yarn formed by twisting the strand illustrated in Fig. 4;

Fig. 6 is a view in cross section of the strand shown in Fig. 4;

Fig. 7 is a view in cross section of the yarn illustrated in Fig. 5;

Fig. 8 is a view illustrating a yarn formed by twisting together two elements, each of which consists of a filament combined with a paper-like strip or band of asbestos material;

Fig. 9 is a fragmentary view, partly in section, of another form of apparatus used in carrying out the invention;

Fig. 10 is a view illustrating the final

Process of making yarn from asbestos paper (US Patent 1,585,611, 1926) Published by AsbestosClaims.Law
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twisting of the strand or preliminary yarn formed by the apparatus of Fig. 9;

Fig. 11 is a view of a short length of such completed yarn; and

Fig. 12 is a cross section of the yarn shown in Fig. 11.

In carrying out my invention, according to the first illustrative form here disclosed, I form the material, which may be principally of asbestos, into thin uniform paper-like strips or bands of sufficient cohesiveness and tenacity to undergo subsequent strand and yarn forming operations, which may consist of combining at least one strip or band with at least one reinforcing filament or element to form a strand and then twisting the strand to form a yarn. In forming the paper-like strips or bands the fibrous material may be treated with water and suitable binding material, which preferably includes a workable binder, and formed into a pulp in a beater, from which the pulp is transferred to an ordinary paper making machine where it is formed into paper-like material which may be rolled up in the usual way. The paper-like material is then cut into strips or bands of the desired width in a cutting machine or slitter, and the strips or bands thus formed are wound into rolls.

In combining an asbestos paper-like strip or band with a filament or reinforcing element to form a yarn, the strip or band is preferably first treated to soften the same, as by a plasticizing agent such as water, applied to a reinforcing element or filament for support thereby in subsequent steps of yarn making, and afterwards twisted with said element or filament. While such treatment or softening by a plasticizing agent, such as water, has been found to be desirable under some conditions, it should be understood that such softening is not essential under all conditions. The strip or band is preferably united with the corresponding reinforcing filament by passing them together through rub motion belts, which shape or encase the material of the strip or band around the filament and produce a reinforced strand or preliminary yarn, which may be twisted into final yarn by means of a twisting machine. By uniting the paper-like strip or band and filament by means of the rub motion belts and then twisting the resulting strand, a yarn of considerable strength and uniform thickness is obtained. Due to the formation of the asbestos material into a paper-like strip or band, the fibres are held together throughout substantially their whole length, thus facilitating the handling of the material and enabling the production by mechanical means of a better yarn. Although the strip or band of asbestos material, after it has been softened is rubbed around the filament or element and to a certain extent molded therearound, the strip or band tends to retain its paper-like formation but is put into a closely creased or crinkled form. It should be understood that the strip or band and the binding material therein are preferably such as to somewhat harden again in the finished yarn and tend to hold the fibres in position relative to each other.

Referring to Fig. 1, the numeral 10 designates a roll of paper-like strip or band formed as above described; 11 designates a support in which one end of a core carrying one or more such rolls 10 may be guided for vertical movement, and 12 designates positively driven rolls on which the roll or rolls 10 rest and by which unwinding at a uniform rate is obtained. The moistening or softening of each strip or band to make it more workable is effected by passing it over a positively driven roll 13, which is preferably covered with felt. This felt covered roll dips into water or other softening or moistening material contained in a receptacle 14, the amount of water carried up by the felt covering being regulated by a roll 15 which presses against the felt. The softened strip or band passes from positively driven roll 13 under diminished tension to a roll 16 over which it passes in superposed relation with a reinforcing filament or element 17 of wire or thread drawn from a reel 18. The filament and strip or band then pass between two pairs of rub motion belts 19 and 20, which are driven longitudinally at the same rate and are laterally reciprocated with respect to each other, as well understood in the art. The softened strip or band is thereby rubbed around the reinforcing filament and formed into a reinforced strand or preliminary yarn 21 of uniform thickness and capable of general use. The strand 21 may then be wound into a cheese or cop 22, as indicated in the drawing, the cheese 22 being actuated by positively driven rolls 23 and the strand 21 being guided to the cheese in any suitable manner. I prefer however to employ a guide roller 23^a having a shallow peripheral groove therein (not shown) to receive the strand 21. This roller preferably contacts with one of the driven rollers 23 and is axially movable by transverse mechanism (not shown) so as to effect a uniform winding of the finished strand or preliminary yarn 21 along the longitudinal length of the cop or package 22, as will be understood. It is obvious that the positively driven rolls 12, 13 and 23 and rub motion belts 19 and 20 are driven substantially in synchronism to effect a uniform feed. However provisions are made for imparting a longitudinal movement of the strip to the rub belts slightly greater than that imparted thereto after the same reaches the belts. This is clearly illustrated

at 13ª. From the foregoing it will be apparent that the asbestos material is conveyed from the roll 10 or other source to the rub motion belts 19 substantially free from any tension which would tend to break or even rupture the strip between the two points mentioned.

The final step of the process consists in twisting the strand 21, produced as above described, to form the finished yarn 24. For this purpose the cheese 22 is placed on an ordinary ring twister, indicated generally by the numeral 25, Fig. 2. Instead of twisting a single strand to form a single yarn, two or more strands may be twisted together forming a multiple yarn of greater strength and durability; or, of course, two or more twisted strands may be twisted together with a similar result. While I prefer to form the strands by rubbing the moistened or softened paper-like material around the reinforcing filament the strands may be formed unreinforced and such coreless strand may subsequently be twisted or otherwise operated upon, either alone or with a filament to form yarn.

No claims to the apparatus just described are made herein, as such subject matter is reserved for another application.

The strand 21 and the yarn 24, the subject matter of both of which is claimed in my co-pending application, Serial No. 529,-143, filed January 14, 1922, are more fully disclosed in Figs. 4, 5, 6 and 7. After the formation of the asbestos paper-like strip or band 26 illustrated in Fig. 3, said strip or band is rendered more workable, as by moistening, and is shaped, formed or molded around a core or reinforcing element or filament 17 to provide an envelope 27 therefor.

In applying the strip or band 26 to the core 17 by passing the same through the rub motion belts 19 and 20 which roll the core and strip or band first in one direction and then in the other, the edges of the strip or band may be brought together along a line 28 which due to the rubbing action will, starting from a position where it is generally parallel to the core, curve around the core in one direction to an extent dependent upon the transverse movement of the rubbing belts and then curve around the core in the opposite direction, such reversals in the direction of curvature of the line occurring at intervals along the strand 21 thus formed. Although, as shown in Fig. 4, the line 28 is irregular, such irregularity is taken out to a great extent in the subsequent twisting and, as shown in Fig. 5, the line 28 takes a generally helical form. In the twisting operation, the core 17 itself will be twisted and will especially if formed of wire, tend to retain the twisted form.

I have illustrated diagrammatically in Fig. 1 a form of machine capable of carrying out the process described and claimed herein. Only one strand 21 is illustrated as being formed but it will be obvious to those skilled in the art that any number of strands, within reasonable limits, may be simultaneously formed.

Through the loosening or softening of the strip or band 26 and the rubbing or pressing thereof while in a soft or semi-plastic condition, longitudinal portions of the strip or band, that is along adjacent edges or surfaces of successive convolutions, are caused to fit or mesh with each other to form a smooth unitary structure which serves, together with the stiffening of the strip or band on subsequent drying, to give the fibrous material a set and to interlock the edges of the strip or band when the strand is subsequently twisted. One of the principal effects of the rubbing is to produce a smooth uniform strand or yarn. As illustrated in Fig. 8, two or more strands or yarns, such as strand 21 and yarn 24, may be twisted together to form a yarn 29 in which there is greater resistance to stripping than in the single element yarns.

In the asbestos paper strips or bands used in manufacturing the strands and yarns hereinbefore described, the fibres of the asbestos material are held together throughout substantially their whole lengths, as by suitable binding material which may include a soluble or substantially soluble binder such as starch. Such yarns are adapted for use in forming fabrics, as by weaving or other textile methods, and the starch binder, which like other carbohydrates and also like proteids has well known oil repellent characteristics, is of particular value in fabrics used for brake linings or clutch linings where the surface of the fabric may be subjected to the action of oil, mineral oil for example. Under such conditions the starch, although it may absorb some oil, remains relatively hard and serves to maintain the shape and strength of the asbestos fabric which otherwise might be reduced to more or less pulpy form. Obviously yarn may be of utility entirely independent of such fabrics.

In its broad form the present invention may also be carried out by the apparatus disclosed in Figs. 9 and 10. In using the apparatus now under consideration, asbestos paper-like strips or bands 30 in the form of rolls 31 are preferably moistened either in a tray 32, forming part of the yarn forming apparatus, or in a tank not shown before being placed in the tray 32. While such moistening or softening of the strips or bands is found to be desirable under some conditions, it should be understood that such moistening or softening is not essential under all conditions. From the center of each

roll 31 in the tray 32 the corresponding strip or band 30 is led over a guide rod 33 attached to standards 34 by which the tray 32 may also be supported. Positioned above the guide rod 33 is a support 35 also attached to the standards 34, and projecting perpendicularly from the rearwardly and upwardly inclined front face of this support are a plurality of spool pins 36 upon which spools 37 carrying filamentary material, such as wire or thread, may be positioned. Suitable frictional resistance to the turning of the spools 37 is obtained by such inclination of the pins and the front face of the support 35, thus producing suitable tension on the filamentary material as it is drawn from the spools.

Depending from the support 35 is a bracket 38 having an outwardly extending arm 39 for adjustably holding a plate 40 by means of a slot and bolt connection 41, a pig tail loop 42 being attached to the plate 40 by means of a connecting rod 43. A second guide loop 44, similar to the loop 42, is mounted on a pivotally adjustable base 45 connected with a fixed part of the frame by a bolt and slot connection. The guide loop 44 is substantially vertically beneath the loop 42 and at an appreciable distance therefrom which may be, in accordance with the general dimensions of the apparatus, from one to two feet. Such distances may, however, be varied, the requirements of the final yarn determining to some extent the exact distances desired between the loops 42 and 44.

A twister 46 is positioned substantially vertically beneath the guide loop 44 and includes feed drive mechanism and twisting mechanism. The twisting mechanism is indicated as including a sleeve 47 adjacent the top of which is a drive pulley 48 engaged at its periphery by a drive cord or belt 49. To the lower end of the sleeve 47 is fixed a cross-bar 50 which carries at its ends stub shafts 50′ and 51, which at their upper ends carry pinions 52 and 53 and at their lower ends have rotatable connection with a second cross-bar 54. The shafts 50′ and 51 intermediate the cross-bars 50 and 54 carry guide rollers formed by discs 55 and 56. Depending from the ends of the cross-bar 54 are rods 57 and 58 of which the ends are formed into pig tail guide loops 59 and 60. There is also a guide loop 61 adjacent one end of the cross-bar 54 and a guide roller 62 attached to and depending from the cross-bar 50 adjacent the lower end of the sleeve 47.

The feed mechanism of the twister includes a sleeve 63 supported by a bracket 64 and surrounding the sleeve 47. The upper end of the sleeve 63 terminates in a drive pulley 63′ grooved at the periphery to receive a drive cord or belt 65 (which may be the same as belt 49 when use is made of suitable means such as an idler) and the lower end of the sleeve 63 carries a gear 66 which meshes with the pinions 52 and 53 on the stub shafts 50′ and 51, respectively.

The twister is supported on a rod 67 which at its upper end engages cross-bar 54 and at its lower end rests upon a base or bearing 67′. Mounted on the rod 67 is a spool 68 upon which the strand or yarn is wound as it comes from the twister, reciprocating movement being given to the spool 68 in order to distribute the strand or yarn on the spool, such reciprocation being obtained by use of a cam 69 (see Fig. 10) engaging a contact roller 70 at one end of a lever 70′ pivoted at 71 and carrying at its other end a contact roller 72 engaging the lower end of spool 68.

Describing the operation of this mechanism and confining the description to the making of a single yarn, a strip or band 30 of asbestos material is led over the rod 33 and through the guide loop 42 and a second guide loop 44 to the twister 46. A filament 73, from a spool 37 directly above the guide loop 42, is also led through said guide loop 42 where it is united with or encased by the strip or band 30 and formed into a strand 74 which also passes through the guide loop 44 into the twister 46. Another filament 75, drawn from a spool 76, is united with the strand 74 adjacent the guide loop 44, preferably just below said loop, and then drawn with the strand 74 into the twister. With the filaments 73 and 75 passed into the twister and attached to the spool 68, the drive mechanism is actuated and a twist imparted to the united elements, including the strip or band 30 and the filaments 73 and 75. In such operation of the twister the twisting of the filament 73 and the strip or band 30 between the loop 42 and the loop 44 forms the strand 74 in which the strip 33 has about three twists to the inch. Between the loops 42 and 44 the strand 74 is free from any external holding means, but beneath the loop 44 the filament 75 is added to the strand 74 and the three combined elements are passed into the twister 46 and receive therein a further and increased twisting effect, which causes a loose winding or wrapping of the filament or element 75 around the strand 74 to rest on the surface of the paper strip or band 30 and to hold the latter in position on the element or filament 73, thus forming a preliminary yarn 77 in satisfactory form for winding on the spool 68. It will be seen that the loop 44 acts to hold the strand 74 in a substantially straight line and that the filament or element 75, as applied to the strand below the loop 44, lies entirely on the surface of the yarn and therefore must be supplied at a relatively lower tension than the element or filament 73. In practice, tensioning is obtained by inclining the spool pins, as hereinbefore described, and where further

increase of tension is required, by placing a device such as a washer on the outer end of the proper spool pin. The preliminary yarn 77, as it emerges from the twister 46, is wound on the spool 68 as hereinbefore described, and when the spool is full it is removed and the yarn thereon while still moist is supplied to a second twisting operation which will now be described.

In Fig. 10 of the drawing there is shown a standard 78 to which is attached a support 79 arranged in the same manner as the support 35 in Fig. 9 and carrying one or more pins 80 to receive one or more spools of yarn from the twister 46. Although the spools 68 are transferred directly from the first twister to the pins 80, the spool shown in Fig. 10 is for convenience designated as spool 81. A twister 82 similar to the twister 46 is positioned beneath each pin 80 to receive the preliminary yarn unwound from the spool 81. Inasmuch as the twister 82 is similar to the twister 46, it is unnecessary to go into a detailed description of the twister 82.

The preliminary yarn 77 from the twister 46 is operated upon preferably while still moist by the twister 82, the yarn being twisted intermediate the spool 81 and the second twister 82, the final twist being given within the twister itself. The function of the second twister is in general to bring the preliminary yarn down to smaller size and to compact the fibrous material and bind it into closer relationship with the central core and the external reinforcing filament. The operation of the twister 83 is such as to increase the number of twists per inch to two or three times that which the strand receives in the first twisting operation. In addition, the action of the second twister, operating as it does upon the moist body material of the yarn, forces the external filament into the surface of the yarn to give the yarn a relatively smooth exterior, and, since the number of twists per inch is considerably increased over that existing in the preliminary yarn, secures a much greater uniformity of product.

The final yarn 83 thus produced is illustrated in Figs. 11 and 12, Fig. 11 showing the filament 75 embedded in the surface of the yarn and Fig. 12 showing a cross section of the yarn with the filament 73 near the center and the filament 75 at the surface thereof. One of the great difficulties in manufacturing such yarn from asbestos material and the like is in producing the yarn without lumps or bunching of material. Such defects are obviated largely by employing the asbestos material in the form of a paper strip or band, but the use of paper strip or band does not wholly remove the tendency of the material to bunch when the strip or band is twisted with a filament. I have found, however, that by passing a filament and a strip or band together through a single loop at a considerable distance from the twister, there is obtained an initial twist which is exceedingly smooth. Such distance between the loop and the twister enables relatively free adjustment of the strip or band and filament relative to each other to be made. Thus the strip or band is given a preliminary twisting with the core filament and this preliminary yarn is then subjected to a final close twist to bring the yarn to the proper size and compact and bind the same in position. For certain uses the yarn is in usable form as it comes from the first twister.

It may be stated that the apparatus illustrated in Figs. 9 and 10 and herein described, the specific process of manufacture of the yarn disclosed in Figs. 11 and 12, and the yarn manufactured by such specific process constitute the subject matter of my copending application, Serial No. 687,218, filed January 19, 1924.

While I have described more particularly above the method preferably practiced in the manufacture of reinforced yarn made from asbestos paper-like material, I wish it to be understood, however, that unreinforced strands or yarns or unreinforced strands combined later with reinforcing filaments may be made by the above mechanism which shows a way of practicing my process for the manufacture of yarn such as covered by the broader claims hereinafter recited and which is not limited to the manufacture of reinforced yarn. For example, the reinforcing filament 17 of Fig. 1 may be eliminated and unreinforced or coreless strands may be made from the asbestos paper-like material or paper-like strips or bands in the rolls 10. Of these unreinforced or coreless strands, two or more may be twisted or otherwise combined together to form a yarn or the strands may be finished into yarn as by twisting the said strands singly. Also one or more of the unreinforced or coreless strands, after such strands are formed, may be twisted or otherwise combined with a reinforcing filament to form finished yarn. The unreinforced or coreless strands just described may be associated singly or in multiple with a reinforcing filament in helical arrangement to further improve the finished yarn made from such strands.

Unreinforced or coreless strands may also be made by the apparatus shown in Fig. 9 with the reinforcing filament omitted and these strands may be either subjected to an additional twisting operation as shown in Fig 10 to further improve the yarn, or combined subsequently with one or more reinforcing filaments to form finished yarn as described in the preceding paragraph.

It is therefore to be understood that the process defined by the broader claims of this application may be practiced by the mecha-

nism shown herein to produce either reinforced or unreinforced yarn, but the more specific claims herein are directed to reinforced yarns, the specific process for the manufacture of unreinforced or coreless yarn being reserved for my co-pending applications, Serial No. 684,324, filed January 4, 1924, Serial No. 685,091, filed January 9, 1924, and Serial No. 709,723, filed April 29, 1924. Generic claims, that is claims covering the subject matter common to this application and my co-pending applications just referred to, are therefore included in the present application. The process employed in manufacturing an asbestos yarn by forming an unreinforced strand subsequently combined with a filament, being for a different species of the invention, is not specifically claimed herein but is claimed in my co-pending application, Serial No. 685,300, filed January 10, 1924, and in my said co-pending application, Serial No. 685,091. Nor do I claim specifically herein the process of making a reinforced or unreinforced asbestos yarn from a plurality of strips or bands as such subject matter is reserved for other co-pending applications including those above referred to.

It should be understood that the term "filament" is intended to include metallic filaments as well as non-metallic filaments. Preferably such filaments consist of wire, brass wire for example, or thread manufactured from any suitable fibre, cotton or other vegetable fibre for example. It should also be understood that it is within the scope and spirit of the present invention to use, instead of single filaments, groups of filaments and that instead of using single strips or bands, a plurality of strips or bands may be used.

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.

From the foregoing description taken in connection with the accompanying drawings it will be seen that I have devised a new method for the manufacture of yarn. The yarn itself constitutes the subject matter of a separate application filed on even date herewith. It will be readily apparent, however, to those skilled in the art that the method may be carried out in practice by other mechanism, and accordingly it is to be understood that the two forms of such mechanism herein illustrated and briefly described are for illustrative purposes only and that I do not limit myself thereto in the practice of the method. It is also to be expressly understood that various modifications of the process may be resorted to without departing from the true spirit and scope of my invention.

Having thus described my invention, I claim:

1. A method of making asbestos yarn including forming a thin strip of fibrous asbestos material the fibres of which are held together by binding material which permits the strip to be worked, applying the strip to a filament for support thereby in subsequent steps of the operation, and twisting the filament and the strip supported thereby.

2. In a process of making asbestos yarn the followings steps: treating asbestos fibres with water and a binder to form a pulp, forming the pulp into a dry paper strip, wetting the said strip and feeding it together with a reinforcing filament between longitudinally progressing and laterally reciprocating surfaces, and twisting the reinforced strands thus produced.

3. A method of making asbestos yarn for the manufacture of fabrics including forming a strip of asbestos material, the fibres of which are held together by binding material which permits the strip to be worked, and combining the strip with a filament to form a yarn.

4. A method of the type described which includes forming a paper strip of asbestos material, the fibres of which are held together by binding material, treating the binding material with a plasticizing agent to render the strip more workable and rubbing the strip about a filament.

5. A method of the type described which includes forming a paper strip of asbestos material, the fibres of which are held together by binding material in workable condition, and forming the strip about a core without frictional drag resulting therefrom.

6. A method of making yarn for the manufacture of fabrics, including forming a strip of asbestos material, the fibres of which are held together by binding material which permits the strip to be worked, treating the binding material to render it more workable, combining the strip with a filament to form a strand, and twisting a plurality of such strands together to form a yarn.

7. A method of making yarn from fibrous asbestos material, which consists in forming a strip of the material with binding material, softening the binding material within the strip, combining the strip with a reinforcing strand in such manner as to support the strip on the strand, intimately uniting the strand and strip in such manner as to cause a partial distortion of the fibrous structure of the strip, and permitting the strip binding material to harden or reset to maintain the strip fibres in their reorganized form.

8. A process of making asbestos yarn which

Process of making yarn from asbestos paper (US Patent 1,585,611, 1926) Published by AsbestosClaims.Law
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comprises the following steps: forming a pulp containing asbestos material and workable binding material, passing the pulp through a paper making machine and forming dry finished asbestos paper, and treating and forming said paper into a yarn.

9. A process of making asbestos yarn which comprises the following steps: forming a pulp containing asbestos material and workable binding material, forming the pulp into a dry finished asbestos paper, slitting the paper into strips of suitable width, and treating and shaping said strips to form them into yarn.

10. A process of making asbestos yarn which comprises the following steps: forming thin paper from asbestos material and suitable binding material to permit slitting, slitting the paper into strips, treating a strip to loosen the binding material, combining said treated strip with a reinforcing element to form a strand, and then drying the strand to cause the loosened binding material to reset to form yarn.

11. A process of making asbestos yarn which comprises the following steps: forming paper of asbestos material and of sufficient binding material as to permit slitting the paper, slitting the paper into strips, shaping a strip around a reinforcing core to form a strand, and twisting the strand thus formed.

12. A process of making asbestos yarn which consists in forming a strip of asbestos material of which the fibres are held together by workable binding material, and combining the strip with a core to form an element in which the strip is arranged in twisted form about the core.

13. A process of making asbestos yarn which consists in forming a strip of asbestos material of which the fibres are held together by binding material, treating the strip to render it more workable, and combining the treated strip with a core to form an element in which the strip is arranged in twisted form about the core.

14. A process of making asbestos yarn which consists in forming pulp containing asbestos material and workable binding material, forming a web from said pulp, treating and drying the web to compact and strengthen the surface thereof, separating the web into strips of suitable width, and combining each strip with a reinforcing element in twined relationship.

15. A process of making asbestos yarn which consists in forming pulp containing asbestos material and binding material, forming a web from said pulp, treating and drying the web to compact and strengthen the surfaces thereof, separating the web into strips of suitable width, treating the binding material with a plasticizing agent to render the strips more workable, and combining each strip with a reinforcing element in intertwined relationship.

16. A method of making asbestos yarn for the manufacture of fabrics and other purposes, which comprises binding and forming asbestos material into a thin uniform paper-like strip or band of sufficient cohesiveness and tenacity to undergo subsequent strand and yarn forming operations, combining said strip or band with a filament to form a strand, and thereafter twisting the strand to form a yarn.

17. A method of making asbestos yarn for the manufacture of fabrics and other purposes, which comprises binding and forming asbestos material into a dry thin uniform paper-like strip or band of sufficient cohesiveness and tenacity to undergo subsequent strand and yarn forming operations, softening said strip or band, combining said softened strip or band with a filament to form a strand, and thereafter twisting the strand to form a yarn.

18. A method of making asbestos yarn for the manufacture of fabrics and other purposes, which comprises binding and forming asbestos material united with workable binding material into a thin uniform paper-like strip or band of sufficient cohesiveness and tenacity to undergo subsequent strand and yarn forming operations, softening said strip or band, and uniting the softened strip or band with a filament in twisted arrangement to form a yarn.

19. A method of making asbestos yarn for the manufacture of fabrics and other purposes, which comprises binding and forming asbestos material by workable binding material into a dry thin uniform paper-like strip or band of sufficient cohesiveness and tenacity to undergo subsequent strand forming operations, softening said strip or band, combining said softened strip or band with a filament to form a strand, and thereafter twisting the strand while in softened condition to form a yarn.

20. A method of making asbestos yarn for the manufacture of fabrics and other purposes, which comprises binding and forming asbestos material into a dry thin uniform paper-like strip or band of sufficient cohesiveness and tenacity to undergo subsequent strand forming operations, softening said strip or band, and uniting the softened strip or band with a filament in twisted arrangement to form a yarn.

21. A method of making asbestos yarn for the manufacture of fabrics and other purposes, which comprises the steps of binding and forming asbestos material into a thin uniform paper-like strip or band of sufficient cohesiveness and tenacity to undergo subsequent strand forming operations, of

softening said strip or band, and of combining said softened strip or band with a filament to form a strand.

22. A method of making asbestos yarn for the manufacture of fabrics and other purposes, which comprises the steps of binding and forming asbestos material by workable binding material into a thin uniform paper-like strip or band of sufficient cohesiveness and tenacity to undergo subsequent strand forming operations, of softening said strip or band, and of combining said strip or band with a filament to form a strand.

23. A method of making asbestos yarn for the manufacture of fabrics and other purposes, which comprises binding and forming asbestos material into thin uniform paper-like strips or bands of sufficient cohesiveness and tenacity to undergo subsequent strand and yarn forming operations, moistening said strips or bands, combining each of said moistened strips or bands with a filament to form moistened strands, and thereafter twisting a plurality of moistened strands together to form a yarn.

24. A method of making asbestos yarn for the manufacture of fabrics and other purposes, which comprises the steps of binding and forming asbestos material by workable binding material into a thin uniform paper-like strip or band of sufficient cohesiveness and tenacity to undergo subsequent strand forming operations, and of combining said strip or band with a filament to form a strand.

25. In a method of making asbestos yarn for the manufacture of fabrics and other purposes, the step which consists in binding and forming asbestos material into a thin uniform paper-like strip or band of sufficient cohesiveness and tenacity to undergo subsequent strand forming operations.

26. In a method of making asbestos yarn for the manufacture of fabrics and other purposes, the step which consists in binding and forming asbestos material by workable binding material into a thin uniform strip or band of sufficient cohesiveness and tenacity to undergo subsequent strand forming operations.

27. In a method of making asbestos yarn for the manufacture of fabrics and other purposes, the step which consists in binding and forming asbestos material into a thin uniform paper-like strip or band of sufficient cohesiveness and tenacity to undergo subsequent strand forming operations whilst retaining its strip or band formation.

28. A process of making asbestos yarn, which comprises binding and forming asbestos material into a thin uniform paper-like strip or band of sufficient cohesiveness and tenacity to undergo subsequent strand and yarn forming operations, advancing said strip or band, moistening the strip or band as it advances, and combining the moist advancing strip or band with a filament to form a strand or a yarn.

29. A process of making asbestos yarn, which comprises binding and forming asbestos material into a thin uniform paper-like strip or band of sufficient cohesiveness and tenacity to undergo subsequent strand and yarn forming operations, advancing said strip or band, moistening the strip or band as it advances, combining the moist advancing strip or band with a filament into a strand, and thereafter twisting said strand into a yarn.

30. A method of making asbestos yarn from asbestos paper-like material bound with sufficient cohesiveness and tenacity and adapted for strand and yarn manufacture, which comprises advancing said paper-like material, and associating the advancing strip or band with a filament to form a strand or yarn.

31. A method of making asbestos yarn from a paper-like strip or band of asbestos material bound with sufficient cohesiveness and tenacity and adapted for strand and yarn manufacture, comprising mechanically associating said strip or band with a filament to form a yarn.

32. A process of making asbestos yarn, which comprises binding and forming asbestos material into a uniform paper-like strip or band of sufficient cohesiveness and tenacity to undergo subsequent strand forming operations, advancing a filament, moistening said strip or band and conveying it substantially free from tension to said advancing filament, and thereafter combining said strip or band with said filament to form a strand or yarn.

33. A method of making asbestos yarn from paper-like strips or bands of asbestos material bound with sufficient cohesiveness and tenacity and adapted for strand and yarn manufacture, which includes advancing a strip or band, associating the advancing strip or band with a filament, and further associating the strip or band and the filament to form a yarn.

34. A method of making asbestos yarn from a paper-like strip or band of asbestos material bound together with sufficient cohesiveness and tenacity and adapted for strand and yarn manufacture, which includes softening the strip or band, and associating the softened strip or band with a filament to form a yarn.

35. A process of making asbestos yarn, which comprises the steps of binding and forming asbestos material into a uniform paper-like strip or band of sufficient cohesiveness and tenacity to undergo strand forming operations, conveying said strip or band substantially free from tension to a strand forming device, moistening said strip

Process of making yarn from asbestos paper (US Patent 1,585,611, 1926)
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or band while being conveyed, and thereafter combining said strip or band with a filament to form a strand or a yarn.

36. A method of making asbestos yarn which comprises forming a paper-like strip or band of asbestos material united with workable binding material, mechanically associating said strip or band with a filament to form a strand, and further uniting by mechanical means said strip or band and said filament.

37. A method of making asbestos yarn for the manufacture of fabric and other purposes, which comprises the steps of binding and forming asbestos material into a paper-like strip or band of sufficient cohesiveness and tenacity to undergo subsequent mechanical strand and yarn forming operations, mechanically placing said strip or band around a core, and further uniting by mechanical means said strip or band and said core to form a strand or yarn.

38. A process of making asbestos yarn which comprises forming a pulp containing asbestos material and workable binding material, forming the pulp into finished asbestos paper-like material, and mechanically forming said paper-like material into a yarn.

39. A process of making asbestos yarn which comprises forming a pulp containing asbestos material and workable binding material, forming the pulp into finished asbestos paper-like material, and mechanically combining said paper-like material with a filament to form a strand or a yarn.

40. In a process of making asbestos yarn the following steps: treating asbestos fibres with water and soluble binding material to form a pulp, forming asbestos paper from said pulp, cutting the asbestos paper thus produced into strips of the desired width, softening a strip and associating it by mechanical means with a reinforcing filament to bring them into a helical arrangement.

41. A method of making asbestos yarn for the manufacture of fabrics and other purposes, which comprises binding and forming asbestos paper-like material of sufficient cohesiveness and tenacity to undergo subsequent mechanical strand and yarn forming operations, and mechanically uniting said paper-like material with a filament in helical arrangement to form a yarn.

42. A method of making asbestos yarn for the manufacture of fabrics including forming asbestos paper-like material, the fibres of which are held together by binding material which permits the paper-like material to be worked, and combining by mechanical means said paper-like material with a metallic core to form a yarn.

43. The process of making asbestos yarn from asbestos paper-like material, the fibres of which are held together by binding material, moistening the binding material in said paper-like material, mechanically associating said paper-like material with a core which takes a set when deformed, and mechanically twisting the core and said paper-like material into a strand in which the core is deformed along its longitudinal length.

44. A process of making asbestos yarn which comprises the following steps: forming asbestos paper-like material with workable binding material securing together the fibres of said asbestos paper-like material, and mechanically incorporating into a yarn said paper-like material in twisted formation.

45. A process of making asbestos yarn which comprises the following steps: forming asbestos paper-like material held together by workable binding material, mechanically shaping the paper-like material around a reinforcing core to form a strand, and mechanically twisting the strand thus formed.

46. A method of making asbestos yarn for the manufacture of fabrics and other purposes, which comprises the steps of binding and forming asbestos paper-like material of sufficient cohesiveness and tenacity to undergo subsequent mechanical strand forming operations, of softening said paper-like material, and of mechanically combining said paper-like material with a metallic reinforcing core to form a strand.

47. A method of making asbestos yarn for the manufacture of fabrics and other purposes, which comprises the steps of binding and forming asbestos paper-like material of sufficient cohesiveness and tenacity to undergo subsequent mechanical strand forming operations, and of mechanically combining said paper-like material with a filament to form a strand.

48. A process of making asbestos yarn, which comprises in binding and forming asbestos paper-like material united with binding material and of sufficient cohesiveness and tenacity to undergo subsequent mechanical strand and yarn forming operations, mechanically advancing said paper-like material, moistening the paper-like material as it advances, and mechanically combining the moist paper-like material with a metallic reinforcing core to form a yarn.

49. A process of making asbestos yarn, which comprises binding and forming asbestos paper-like material united with binding material and of sufficient cohesiveness and tenacity to undergo subsequent mechanical strand and yarn forming operations, advancing a metallic reinforcing core, mechanically conveying said paper-like material substantially free from tension to said metallic core, mechanically combining said

paper-like material with said metallic core to form a strand, and thereafter mechanically twisting said strand to form a yarn.

50. A process of making asbestos yarn, which comprises the steps of binding and forming asbestos paper-like material of sufficient cohesiveness and tenacity to undergo subsequent mechanical strand and yarn forming operations, mechanically conveying said paper-like material substantially free from tension to a strand forming device, and thereafter mechanically forming such paper-like material into a strand or a yarn.

51. A process of making asbestos yarn, which comprises the steps of binding and forming asbestos paper-like material of sufficient cohesiveness and tenacity to undergo subsequent mechanical strand forming operations, mechanically conveying said paper-like material substantially free from tension to a strand forming device, moistening said paper-like material while being conveyed, and thereafter mechanically forming such conveyed paper-like material into a strand or a yarn.

52. A process of making asbestos yarn, which comprises the steps of binding and forming asbestos paper-like material of sufficient cohesiveness and tenacity to undergo subsequent mechanical strand and yarn forming operations, mechanically advancing said paper-like material, moistening the said paper-like material as it advances, and thereafter mechanically forming such advanced paper-like material into a strand or a yarn.

53. A method of making asbestos yarn for the manufacture of fabrics and other purposes, which comprises binding and forming asbestos paper-like material of sufficient cohesiveness and tenacity to undergo subsequent mechanical strand and yarn forming operations, mechanically combining said paper-like material with a filament to form a strand, and thereafter mechanically combining a plurality of such strands to form a yarn.

54. A method of making asbestos yarn for the manufacture of fabrics and other purposes, which comprises binding and forming asbestos paper-like material of sufficient cohesiveness and tenacity to undergo subsequent mechanical strand and yarn forming operations, mechanically combining said paper-like material with a metallic reinforcing filament to form a strand, and thereafter mechanically combining a plurality of such strands in helical arrangement to form a yarn.

55. A method of making yarn for the manufacture of fabrics and other purposes, which comprises the steps of binding and forming asbestos material into a thin uniform paper-like strip or band of sufficient cohesiveness and tenacity to undergo subsequent strand and yarn forming operations, of encasing a core with said paper strip or band, and of further uniting said strip or band and said core to form a strand or yarn.

56. A method of making asbestos yarn for the manufacture of fabrics and other purposes, which consists in encasing a core with paper formed of asbestos material held together by workable binding material, and of further uniting said paper with said core to form a strand or a yarn.

57. A method of making asbestos yarn from asbestos paper-like material bound with sufficient cohesiveness and tenacity and adapted for strand and yarn manufacture, including mechanically forming said paper-like material into a strand or yarn.

In testimony whereof, I affix my signature.

JOHN ALLEN HEANY.

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