May 18, 1926. 1,585,612

J. A. HEANY

YARN

Filed Jan. 19, 1926 2 Sheets-Sheet 1

Fig. 1.

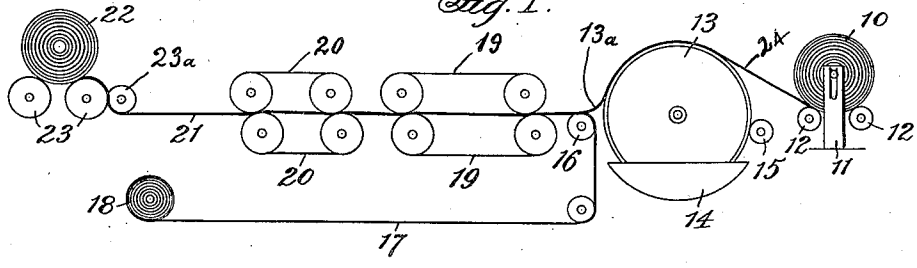


Fig. 2.

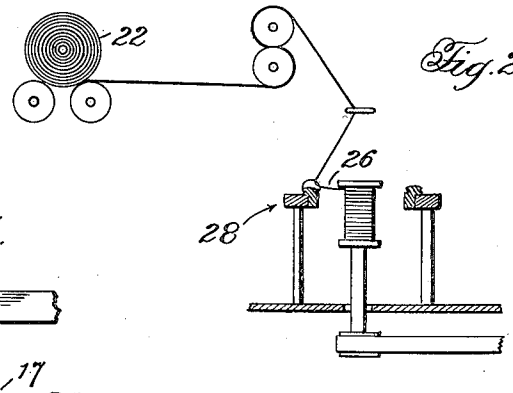


Fig. 3.

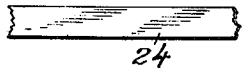


Fig. 4.

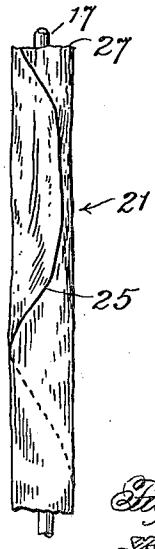


Fig. 5.

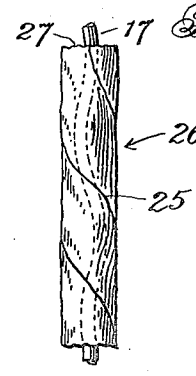


Fig. 6.

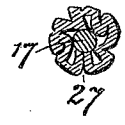


Fig. 8.



Fig. 7.



Inventor:
John Allen Heany.
By Chester A. Braselton
Attorney.

Published by AsbestosClaims.Law
asbestosclaims.law/library/23483/1

May 18, 1926. 1,585,612

J. A. HEANY

YARN

Filed Jan. 19, 1926 2 Sheets-Sheet 2

Fig. 9.

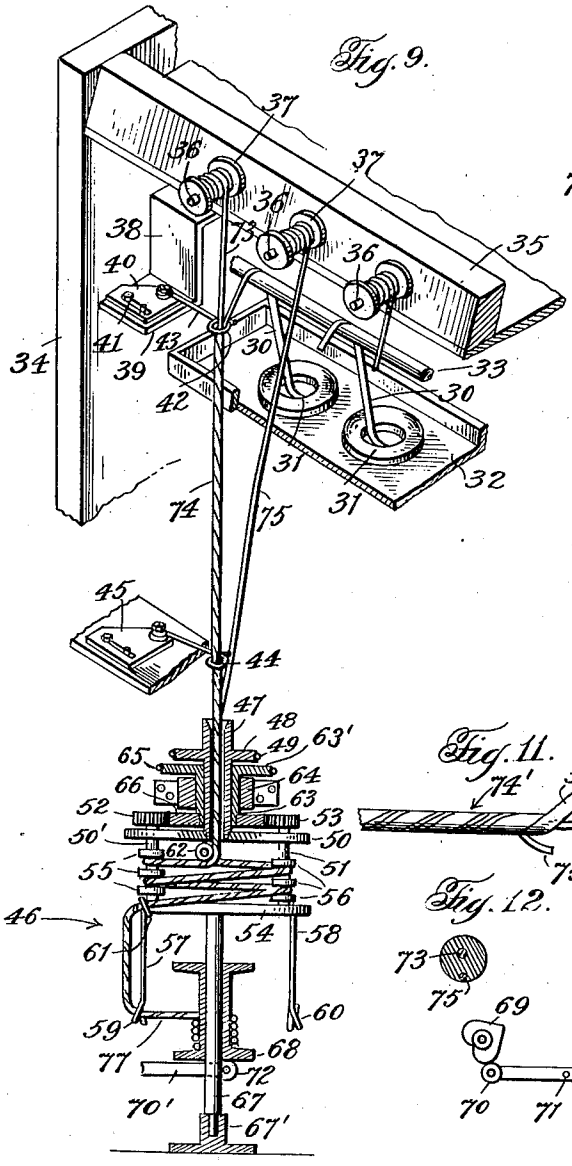


Fig. 10.

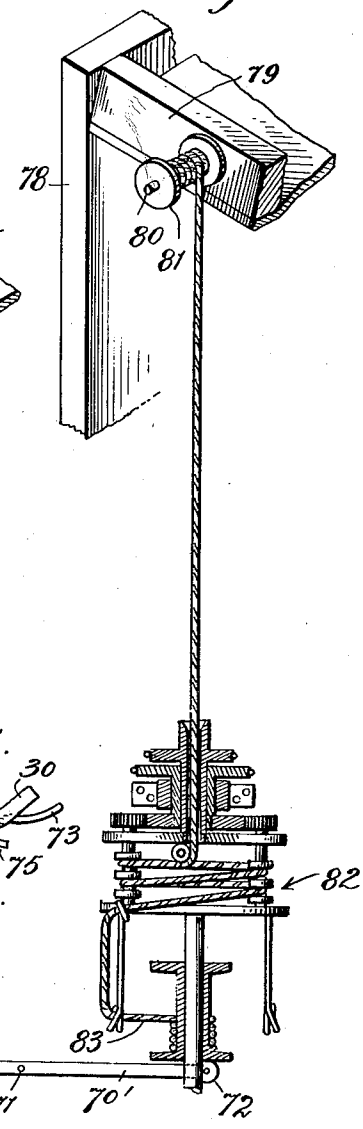


Fig. 11.

Fig. 12.

Inventor:

John Allen Heany,

By Chester W. Brasellton

Attorney:

Published by AsbestosClaims.Law
asbestosclaims.law/library/23483/2

Patented May 18, 1926. 1,585,612

UNITED STATES PATENT OFFICE.

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

YARN.

Application filed January 19, 1926. Serial No. 82,250.

The present invention relates to the manufacture of yarn from asbestos or material consisting largely of asbestos.

This application is a continuation of my co-pending application, Serial No. 529,143, filed January 14, 1922, 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. 516,129, filed November 18, 1921; 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.

The yarn which is the subject of the present invention may, for example, be produced by the process described and claimed in my co-pending application, Serial No. 516,129, filed November 18, 1921.

An important object of the invention is to provide an improved yarn. Other objects are to obtain a yarn which is strong, uniform, smooth, durable, adapted for weaving, and of low cost as compared with yarns heretofore produced. One important use of such yarns is in the making of friction fabrics for brake and transmission linings.

In its broad aspect my invention has to do with an asbestos yarn for the manufacture of fabric and other purposes, said yarn comprising asbestos material bound and formed into a substantially uniform strip or band of sufficient cohesiveness and tenacity to undergo subsequent strand and yarn forming operations. However, the preferred form of yarn of the present invention is produced by combining one or more of such asbestos strips or bands with one or more cores or filaments to form a yarn.

In producing the yarn, the material, principally of asbestos, may be bound and formed into thin uniform paper-like strips or bands of sufficient cohesiveness and tenacity to undergo subsequent strand and yarn forming operations. In forming such paper-like strips or bands, 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 dry and compact to have the necessary strength, particularly in the surface portions thereof, is separated preferably by a slitting machine into narrow strips or bands to be utilized in yarn manufacture. Satisfactory results in forming said strips or bands are obtained by combining with the asbestos material in the pulp suitable binding material, which serves to increase the strength of the finished web, thus rendering it suitable for manipulation in yarn making operations. The strips or bands, as they are fed from the slitting machine, are wound into rolls for convenience in using the same in the subsequent steps of yarn manufacture.

Preferably in combining such a paper-like strip or band with a filament or reinforcing element to form a yarn, the strip or band is first treated to loosen or soften the same, as by moistening with water, and then brought together with the reinforcing filament, with which it is afterward twisted. While such treatment of 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. According to one illustrative form of the process, each strip or band is united with a corresponding reinforcing filament by passing them together through rub motion belts, which rub the material of the strip or band around the filament and produce a reinforced strand or preliminary yarn, which may be twisted into a final yarn by means of a twisting machine. In the rubbing operation, the strip or band is to a certain extent molded around the reinforcing element but retains its paper-like formation, the shaping or molding being effected by tightly creasing or crinkling the material of the strip or band. Although the strip or band retains its paper-like formation, it is transversely deformed and successive layers thereof adhere closely together. By uniting the strip or band and the filament by means of the rub motion belts and then twisting the resulting strand, a strand or yarn of considerable strength and uniform thickness is obtained. As described in said co-pending application Serial No. 516,129, multiple strand yarns may be produced, for example,

Published by AsbestosClaims.Law
asbestosclaims.law/library/23483/3

two or more of such twisted strands may be twisted together to form a yarn. Due to the formation of the asbestos strip or band, the fibres of the asbestos material are held together substantially throughout their lengths, thus facilitating the handling of the material and the production of a better yarn. It should be understood that the binder or binding material is preferably such as to somewhat harden again in the finished yarn and tend to hold the fibres in positions relative to each other.

Preferably the strips or bands consist of asbestos materials united with suitable binding material which may include a soluble or substantially soluble binder, such as starch. The yarn formed from such strips or bands is adapted for use in forming fabrics 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 subject to the action of oil. Under such conditions the starch, although it may absorb some of the 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. Although the yarn of the present invention may be used to particular advantage in such fabrics as brake or clutch linings, it should be understood that fabrics made from such yarns may be used to advantage for other purposes, and that the yarn may be of utility entirely independent of any fabric.

Yarns of asbestos material produced by prior methods, including carding and other operations to which textile fabrics are usually subjected in making yarn, are usually irregular both as to size and smoothness of surface, and are lacking in strength due to the fact that the fibres are of such a nature as to slip past each other without much if any resistance. In the manufacture of applicant's yarn the fibres are held firmly together at all times and there is no projecting fluff, whereas in yarns produced by prior processes there is considerable projecting fluff which causes watse and renders the weaving operation more difficult and the resulting fabric less desirable.

The asbestos strip or band used in the manufacture of the yarn of the present invention is substantially uniform in thickness and width, and the fibres are bound together throughout their lengths by suitable binding material so as to impart considerable tensile strength and to preserve a substantially smooth surface.

Other objects, features and advantages of my invention will more fully hereinafter appear.

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 strands to form yarn;

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

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

Referring to Figs. 1 and 2, which show one form of apparatus for producing yarn according to the present invention, the numeral 10 designates a roll or paper-like strip or band of asbestos material formed as hereinbefore 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 paper-like strip to make it more workable is effected by passing it over a positively-driven roller 13 which is preferably covered with felt. This felt-covered roll dips into water 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 roll 13, under diminished tension due to the positive drive of the roll 13, to the 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 therewith 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 rollers 23 and the strand 21 being guided to the cheese in any suitable manner. I prefer however to employ a guide roller 23ª 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 traverse 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.

In applying an asbestos paper-like strip or band 24 to a filament 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 edge of the strip may be brought together along a line 25 (see Fig. 4) 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 25 occurring at intervals along the strand 21 thus formed. Although as shown in Fig. 4 the line 25 is irregular, such irregularity is taken out to a great extent in the subsequent twisting and, as shown in Fig. 5, the line 25 takes a generally helical form. In the subsequent twisting operation, the core 17 itself will be twisted and will, especially if formed of wire, tend to retain the twisted form.

The strand 21 is then subjected to an operation which consists in twisting the strand to form a yarn 26, which comprises a core filament 17 and a fibrous envelope 27. For this purpose the cop or package 22 is placed on an ordinary ring twister, indicated generally by the numeral 28, Fig. 2. Instead of twisting a single strand to form a single core yarn, two or more strands may be twisted together, forming a multi-core 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 around the reinforcing filament, the strands may be formed unreinforced and subsequently twisted with the filament.

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

The process of yarn manufacture just described is disclosed and claimed in my copending application filed on even date herewith. Various features of the present invention as produced by such process are illustrated in Figs. 4 to 8, Fig. 8 showing a two-strand yarn 29 which may be formed by twisting together two such strands or yarns as shown in either Fig. 4 or Fig. 5.

Yarn embodying the broad features of the invention may also be produced by the apparatus disclosed in Figs. 9 and 10. In using the apparatus now under consideration, asbestos paper 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 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 distance 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 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 its periphery to receive a drive cord or belt 65 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 the 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 the lever 90′ pivoted at 71 and carrying at its other end a contact roller 72 engaging the lower end of spool 68.

In describing the operation of this mechanism and confining the description to the making of a single yarn, a strip or band of asbestos material 30 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 the strip or band 30 and formed into a strand 74 which also passes through the guide loop 44 into 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 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 another spool 37, 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 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 82 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 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 centrally located 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-like strip or band, but the use of such 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 should be understood that the term "filament" is intended to include metallic filaments as well as non-metallic filaments. Preferably such filaments are 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 filament, a group of filaments and that, instead of using a single strip or band in each strand or yarn, a plurality of strips or bands may be used.

It will be manifest that I have devised a new form of asbestos yarn in which, among other things, at least one filament is combined with asbestos paper-like material or with at least one paper-like strip or band of asbestos material. I have found in use that the undulatory, wavy or distorted formation of the core, particularly when made of wire, is of special advantage in that it prevents the relative slipping of the core and asbestos material, as, for example, in weaving such asbestos yarn into a fabric.

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 more particularly above the mechanism preferably employed 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 for the manufacture of yarn such as covered by the broader claims hereinafter recited and which is not limited to 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 either reinforced or unreinforced yarn defined by the broader claims of this application may be made by the mechanism shown herein, but the more specific claims herein are directed to reinforced yarns, the specific claims on 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 asbestos yarn formed of a strand comprising asbestos paper-like material and a filament helically arranged around said strand, being for a different species of my 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 herein specifically a reinforced or unreinforced asbestos yarn made from a plurality of strips or bands as such subject matter is reserved for other co-pending applications including those above referred to.

From the foregoing description taken in connection with the accompanying drawings it will be seen that I have produced a new yarn. The broad process for producing the new yarn constitutes the subject matter of a separate application filed on even date herewith. The apparatus illustrated in Figs. 9 and 10 and the specific process of manufacture thereby of the yarn disclosed in Figs. 11 and 12 constitute the subject matter of my copending application Serial No. 687,218, filed January 19, 1924. It will be readily apparent, however, to those skilled in the art that details of the yarn structure may be varied within proper limits and that other processes as well as other mechanism may be employed to produce such a yarn without departing from the true scope and spirit of my invention.

Having thus described my invention, I claim:

1. An asbestos yarn including a paper-like strip or band of fibrous asbestos material of which the fibres are matted together and are held by binding material, arranged in intertwisted relation with a reinforcing core and in a substantially solid mass while retaining the strip or band formation.

2. An asbestos yarn including a twisted filamentary core and a paper-like strip or band formed of fibrous asbestos material and settable binding material holding the fibres together throughout their lengths, said strip or band being arranged in helical form about the core.

3. An asbestos yarn including a plurality of strands twisted together, at least one of the said strands including a paper-like strip or band of asbestos fibres held together by binding material, said strip or band being arranged in twisted formation and transversely deformed with face portions thereof adhering to other face portions thereof.

4. An asbestos yarn including an element consisting of a paper-like strip or band of asbestos material, of which the fibres are held together by binding material, and a reinforcing element, said elements being combined in compact relation with at least one of them twisted about the other, and with the asbestos material in substantially solid molded form, but retaining the strip or band formation.

5. A yarn including a filamentary core and a paper-like strip or band arranged in twisted relation about said core, said strip or band being formed of asbestos material and binding material, substantially all of the fibres of said asbestos material being arranged between the surfaces of the strip or band material and held together throughout their lengths, thereby preventing the separation of the fibres by wear.

6. An asbestos yarn including a longitudinally creased strip or band of asbestos paper in which the fibres are held together by binding material, said strip or band forming a substantial part of the surface of the yarn.

7. An asbestos yarn including a longitudinally creased strip or band of asbestos paper arranged in twisted form, the fibres of the strip or band being held together by binding material.

8. An asbestos yarn including a reinforcing core and a paper-like strip or band of asbestos material arranged in twisted form around said core to form an envelope substantially uniform throughout its length, the fibres of the strip or band being securely held along substantially their entire lengths by oil repellant binding material used in forming the strip or band.

9. An asbestos yarn including a filamentary core and, arranged in intertwisted relation therewith, an asbestos paper-like strip or band in which the fibres are held together throughout substantially their entire lengths by binding material including an oil repellant carbohydrate.

10. An asbestos yarn comprising a strip or band of finished asbestos paper transversely deformed into yarn shape but retaining the paper strip or band formation, the

fibres of said strip or band being held together by means of oil repellant binding material.

11. An asbestos yarn comprising a paper-like asbestos strip or band the fibres of which are held together by binding material capable of giving strength to the finished yarn and capable of retaining said strength when exposed to oil.

12. A yarn including a metallic filament, and combined therewith a paper-like strip or band of asbestos material, the fibres of which are held together by binding material which permits the strip or band to be worked.

13. An asbestos yarn for the manufacture of fabrics and other purposes formed by binding and forming asbestos material into a uniform paper-like strip or band of sufficient cohesiveness and tenacity to undergo strand and yarn forming operations and having a reinforcing filament combined therewith.

14. An asbestos yarn for the manufacture of fabrics and other purposes formed of uniform paper-like strip or band of asbestos material, united with binding material, of sufficient cohesiveness and tenacity to undergo strand and yarn forming operations, and having a reinforcing filament combined therewith.

15. An asbestos yarn for the manufacture of fabrics and other purposes formed by binding and forming asbestos material into a thin uniform paper-like strip or band of asbestos material of sufficient cohesiveness and tenacity to undergo strand and yarn forming operations and having a reinforcing element associated therewith, said strip or band retaining its strip or band formation.

16. An asbestos yarn, consisting of a plurality of yarn elements, each of said elements in helical arrangement being formed by binding and forming asbestos material into a paper-like strip or band having a reinforcing filament associated therewith.

17. An asbestos yarn consisting of a plurality of intertwisted yarn elements, each of said elements being previously formed by binding and forming asbestos material into a paper-like strip or band twisted with a reinforcing filament.

18. An asbestos yarn comprising a paper-like strip or band of asbestos material bound with sufficient cohesiveness and tenacity to undergo strand and yarn forming operations, and a reinforcing filament twisted therewith.

19. An asbestos yarn formed of a core and paper-like strip or band of asbestos material bound with sufficient cohesiveness and tenacity to undergo strand and yarn forming operations.

20. An asbestos yarn formed of a core and a strip or band of asbestos material bound with sufficient cohesiveness and tenacity to undergo strand and yarn forming operations wrapped about the core and combined therewith.

21. An asbestos yarn for the manufacture of fabrics and other purposes formed of paper-like strip or band of asbestos material united with binding material and of sufficient cohesiveness and tenacity to undergo strand and yarn forming operations, and having a metallic reinforcing filament associated therewith.

22. An asbestos yarn for the manufacture of fabrics and other purposes formed by binding and forming asbestos material into a paper-like strip or band of sufficient cohesiveness and tenacity to undergo strand and yarn forming operations and having a metallic reinforcing filament twisted therewith.

23. An asbestos yarn for the manufacture of fabrics and other purposes formed by binding and forming asbestos material into a paper-like strip or band of sufficient cohesiveness and tenacity to undergo strand and yarn forming operations and having a metallic reinforcing element associated therewith, said strip or band retaining the strip or band formation.

24. An asbestos yarn consisting of a plurality of yarn elements intertwisted with each other, at least one of said elements being previously formed by binding and forming asbestos material into a paper-like strip or band combined with a metallic reinforcing filament.

25. An asbestos yarn formed of a twisted metallic core and paper-like strip or band of asbestos material bound with sufficient cohesiveness and tenacity to undergo strand and yarn forming operations.

26. An asbestos yarn formed of a metallic core and a strip or band of asbestos material bound with sufficient cohesiveness and tenacity to undergo strand and yarn forming operations arranged about the core and combined therewith.

27. An asbestos yarn comprising a metallic core and asbestos paper-like material bound with sufficient cohesiveness and tenacity to undergo strand and yarn forming operations.

28. An asbestos yarn comprising asbestos paper-like material bound with sufficient cohesiveness and tenacity to undergo strand and yarn forming operations.

29. An asbestos yarn comprising a metallic core having undulations or distortions along the longitudinal length thereof and paper-like asbestos material bound with sufficient cohesiveness and tenacity to undergo strand and yarn forming operations intimately combined with said undulations or distortions to prevent the stripping from the core of the asbestos material.

30. An asbestos yarn comprising a twisted metallic core having undulations or distortions along its longitudinal length and twisted paper-like asbestos material bound with sufficient cohesiveness and tenacity to undergo strand and yarn forming operations intimately combined with and united to said undulations or distortions to prevent the stripping from the twisted core of the asbestos material.

31. An asbestos yarn comprising asbestos material present in the yarn in paper-like formation and bound with sufficient cohesiveness and tenacity to retain such paper-like formation.

32. An asbestos yarn comprising asbestos material present in the yarn in paper-like formation and the fibres of which are held together by binding material.

33. An asbestos yarn comprising asbestos paper-like material the fibres of which are bound together with sufficient cohesiveness and tenacity to undergo strand and yarn forming operations by binding material, and a reinforcing undulating metallic filament united with said paper-like material.

34. An asbestos yarn for the manufacture of fabric and other purposes, comprising a wire and combined therewith in helical arrangement asbestos paper-like material bound together with sufficient cohesiveness and tenacity to undergo strand and yarn forming operations.

35. An asbestos yarn consisting of a plurality of intertwisted yarn elements; at least one of said elements comprising a metallic core and asbestos material bound with sufficient cohesiveness and tenacity to undergo strand and yarn forming operations and associated with said core.

36. An asbestos yarn consisting of a plurality of intertwisted yarn elements; at least one of said elements comprising a metallic core having undulations or distortions along its longitudinal length, and asbestos material present in the element in paper-like formation and intimately combined with and united to said undulations or distortions to prevent the stripping from the metallic core of the asbestos material.

37. An asbestos yarn consisting of a plurality of strands in helical arrangement, each of said strands comprising a reinforcing filament and associated therewith asbestos paper-like material bound with sufficient cohesiveness and tenacity to undergo strand and yarn forming operations.

38. An asbestos yarn consisting of a plurality of helically arranged yarn elements, at least one of said elements comprising a reinforcing filament combined with asbestos paper-like material, the fibres of which are held together by binding material which permits the paper-like material to be worked.

39. An asbestos yarn consisting of a plurality of yarn elements, at least one of said elements comprising a reinforcing filament combined with asbestos paper-like material bound together with sufficient cohesiveness and tenacity to undergo strand and yarn forming operations.

40. An asbestos yarn consisting of a plurality of strands in helical arrangement, each of said strands comprising a metallic reinforcing filament having undulations or distortions and united therewith asbestos paper-like material bound with sufficient cohesiveness and tenacity to undergo strand and yarn forming operations.

In testimony whereof, I affix my signature.

JOHN ALLEN HEANY.