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J. A. HEANY

YARN AND PROCESS FOR MAKING THE SAME

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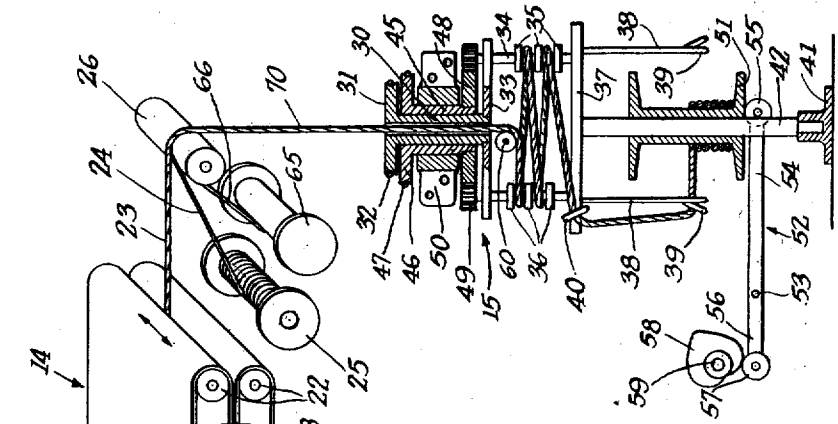


Fig. 1.

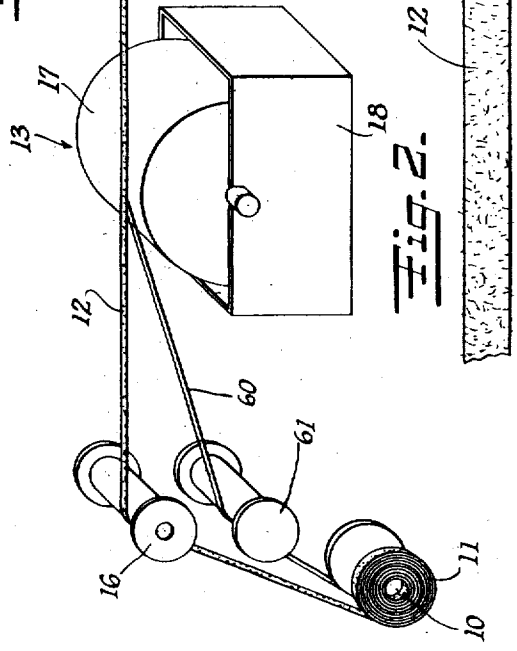


Fig. 2.



Fig. 3.

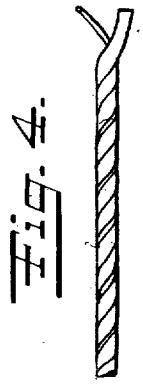


Fig. 4.

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UNITED STATES PATENT OFFICE.

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YARN AND PROCESS FOR MAKING THE SAME.

Application filed January 9, 1924, Serial No. 685,091. Renewed January 28, 1926.

This invention relates to asbestos yarn and a process for manufacturing the same from asbestos paper-like material which may be in the form of paper-like strips or bands. More specifically, the invention contemplates working and forming into a strand a paper-like strip or band of asbestos material bound together with sufficient cohesiveness and tenacity and adapted for yarn manufacture, and subsequently uniting the strand with a filamentary body such as a wire and twisting the two elements together so that the filament is wrapped and twisted about the exterior of the strand to form a completed yarn.

An object of the invention therefore, is the provision of a process by means of which a stable and tenacious yarn is formed by the application of a filamentary body to a yarn strand, subsequent to the formation of a strand of the material used. Another object of the invention is the utilization of a method of manufacture for yarns of non-coherent asbestos material, in which a reinforcing filament is applied to the material in such a way as to bind the material together and prevent stripping and disintegration of the completed fabric through friction. Another object contemplated is the utilization of a process in which the number of essential steps required in the manufacture of the yarn is reduced to a minimum. An object of the invention also is the utilization in a yarn making process of non-coherent asbestos material in the form of paper strip and the subsequent binding of this strip to give reinforcement and strength thereto. An object also contemplated is the provision of a method of manufacture for yarns in which a more or less rigid supporting or reinforcing element such as metal wire is applied preferably in helical arrangement to the body material of the yarn while still moist, so that the wire binds into and masses the material in a closely compacted fabric.

Further objects are contemplated in the provision of mechanism wherein the application of a reinforcing member to a yarn structure is simplified; in the utilization of mechanism involving simplified means for loosening the binder of the paper constituting the body element of the structure, and in the production of an article of manufacture in which a tenacious and flexible filament is twisted with or twined around the body material to hold the same properly compacted and unified.

For the purpose of this disclosure there is shown a specific embodiment of mechanism for carrying out the invention, in which

Figure 1 is a view partly in perspective and partly in section, showing diagrammatically the various essential steps of the process;

Figure 2 is a section of the paper strip employed in the process;

Figure 3 is a section of the strand of asbestos material prior to the application of the reinforcing element, and

Figure 4 is a view of the final yarn structure with the end unravelled to show the separate composite elements.

In a co-pending application of the present inventor, Serial No. 516,129, filed November 18, 1921, a process and mechanism is described by means of which yarn is manufactured from asbestos material, reinforced by a filament, the filament in this instance, however, being incorporated as a core within the yarn body material which is formed of thin asbestos paper. In making the asbestos paper, 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, is separated by a slitting machine into narrow strips to be utilized in the manufacture of yarn. Satisfactory results are obtained by combining with the asbestos material in the pulp suitable binding material, which serves to increase the strength of the finished web or paper thus rendering it suitable for manipulation in the yarn making operation. In the asbestos paper thus formed the asbestos material may be bound together with sufficient cohesiveness and tenacity to undergo subsequent strand and yarn forming operations. In this process, application is made of a rubbing belt mechanism which manipulates the material in such a manner as to completely coat the core. While yarn made according to this process is useful, in some instances however, it has been found disadvantageous, especially where a single strand was desired, to have the core com-

pletely covered by fibrous material, inasmuch as the outer surfaces of the yarn were being constantly subjected to frictional influences and to impacts from oustide bodies, thus tending to disintegrate the fabric. In the present application, applicant has provided a mechanism and process by means of which the reinforcing element is applied to the exterior of a non-coherent body material in such a way as to hold the same constantly in position and tend to retard disintegration by wear and tear.

Referring to Figure 1 of the drawing, there is shown a spindle 10, upon which is mounted a plurality of rollers 11, of tape, the same being in the form of paper 12, in narrow strips.

The paper 12 used in the process herein described is formed preferably of fibrous mineral material such, for example, as asbestos material. For the manufacture of yarn for use in brake lining, friction clutches, and various heat insulating fabrics, a paper made of asbestos fibre held together by a binder, such as starch, as described in my co-pending application, Serial No. 692,947, filed Feb. 15, 1924, has been found highly desirable.

The paper strip 12, as placed upon the spindle 10, is adapted to be subjected to a series of operations, the major of which includes action of a moistener 13, a rubber 14, and a twister 15, these various mechanisms being placed in juxtaposition suitable for consecutive operation upon the tape or paper strip 12. The strip 12 passes to the moistener 13, over the guide roll 16, and in the moistener is subjected to the action of a roller 17 which has bearings in the walls of a container 18. Within the container 18, liquid is placed, water, for example, and the rotation of the roller 17 carries the liquid on its surface up into contact with the paper strip 12, thereby moistening the same and loosening the binder which, in the manufacture of the paper has been mixed up with the fibres to hold the same together. From the moistener, the strip is carried to the condenser 14, and is there subjected to the action of two adjacent belt structures, 18 and 19. These belt structures are each formed of a single continuous web 20, mounted upon rollers 21 and 22, and are adapted to have movement not only in a forward direction, as indicated by the arrows, but also transversely to the direction of forward movement, the one belt reciprocating relative to the other. This combined lateral reciprocation and forward movement of the belts when applied to the yarn 12 traversing the same, subjects the moist body material of the paper to a rolling and compacting operation which tends to form the paper into the shape of a strand, having a circular cross section as indicated at 23 in Figs. 1 and 3. During the shaping into a strand, the paper strip is closely creased or crinkled.

The strand 23, while in this moistened condition, is then united with a filament 24, as, for example, a flexible metal wire, the same being wound upon a bobbin 25, positioned adjacent the rubber 14, as indicated in Fig. 1. Both wire 24 and strand 23 are passed over a guide roll 26, and thence into the twister 15, where the two combined elements are subjected to a twisting operation for the purpose of twining the filament closely about and into the material of the fibre constituting the yarn, the final product being as indicated in Fig. 4 of the drawings.

The twisting mechanism employed, includes apparatus controlling the twisting of the strand, as well as the feed or the number of twists per unit length. To a hollow sleeve 30, through which the combined strand and filament are adapted to have passage, is attached at its upper end a pulley 31, grooved at its periphery to receive a drive belt 32. The base of the sleeve 30 is attached to a cross bar 33, the ends of which support stub shafts 34, these shafts serving as means of support for the guide rollers 35 and 36. The bases of the shafts 34 rest upon a second cross bar as 37 subtending from which on its ends are guide rods 38, terminating in guide loops 39. A guide loop 40 also is fixed to the cross bar in 37. The twist mechanism, as above described, is supported from a base 41 by means of a standard 42, the same being attached to the central portion of the cross bar 37.

The mechanism of the twister is embodied in a sleeve 45 to the top of which is attached a pulley 46 grooved at its periphery to receive a drive belt 47. On the base of this sleeve 45 is attached a gear wheel 38, adapted to mesh with pinions 49 secured to the tops of the stub shafts 34. Bracket plate 50 holds the sleeve 45 in proper relationship to the rest of the mechanism.

From the description above indicated, it is apparent that the strand elements are subjected to a combined action, a twisting operation induced by the rotation of the pulley 31, and a secondary twist operation dependent upon the speed at which the yarn is fed into the twister, this speed being dependent upon the rotation of the pulley 46; and to attain this result, the combined units are led through the sleeve 30 about a guide roller 50 around loops 35 and 36, and through guide loops 40 and 39, and thence to the spool 50 upon which the completed yarn is wound in layers.

The mechanism for facilitating the winding of the yarn about the spool 51 is indicated as including a lever 52 pivotally mounted at 53, the longer arm 54 terminating in a roller 55 adapted to have contact with the base of the spool 51, and the shorter

arm 56 terminating in a roller 57 adapted to have operative contact with a heart-shaped cam 58, pivotally mounted at 59. In view of the fact that the spool 51 is slidably mounted upon the standard 42, it is obvious that with proper dimensioning and timing of the apparatus, full layers of yarn are deposited uniformly and regularly upon the spool as it comes from the twister.

Emphasis should be laid upon several important characteristics of the invention. For the purpose of this disclosure, the means for loosening the binder of the strip has been indicated as a moistener 13, but other means may also be provided which accomplishes a closely similar result. For example, by mechanical manipulation of the paper, including flexure without moistening the same, the binder may be readily removed from the paper, or where asbestos strip is employed, the binder may be completely removed by the application of heat. It is further pointed out that in the process herein involved, it is not essential that the binder be completely removed from the paper. In fact, in some instances it is desirable that a portion of the binder remain in the fibre, inasmuch as after the process has been completed and the product dried, the binder resets and tends to add greater rigidity to the structure. Moreover, it is possible to fabricate a yarn without loosening the binder in the strip, merely subjecting the paper to the rubbing action which tends to loosen the paper structure and subsequently twisting the same with a reinforcing cord. The specific method utilized in the process by means of which a wire is incorporated with the paper at the inception of the twisting operation, tends markedly to heighten the degree of success attainable in this variation of the process.

Still another consideration is involved in the number of elements constituting the final yarn. As indicated in Fig. 1 it is possible to use two or more paper strips, a second paper strip 60 being shown as fed over a roller 61. Beneath is the roller 16, the strip of paper 12 being directly above strip 60 and entering the rubber 14, one beneath the other and these being subjected to a simultaneous manipulation. Likewise two or more filaments may be utilized to form the single complete yarn, an additional spool 65 and filament 66 being shown in Fig. 1. Where a final yarn of very great tensile strength and coherence is desired, the addition of a number of additional paper strips and filamentary wires is desirable, the number of said added elements being readily modified in the manufacture of the yarn.

Attention is directed to the fact that the twisting operation is not limited to the strand within the twister, but the twisting effect is transmitted above the twister to section 70 of the strand, intermediate the roller 26 and the top of the twister. This section of partially twisted material is a desirable characteristic of the process, inasmuch as the material is more or less non-coherent at this point and subject to rupture, the twist of the wire, however, serving as a reinforcement to maintain the material in position. Subsequent to its entry into the twister, the filament is wrapped closely around the fibrous material of the strand in accordance with the nature of the feed of the mechanism, thus closely compacting and binding the two elements together in their final form.

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.

It should also be understood that the term "coreless strand" wherever it appears in the specification and claims, is intended to refer to a strand in which there is no reinforcement of the asbestos paper-like material by means such as metallic or non-metallic filaments, threads, and the like.

Other variations and modifications will be apparent to those skilled in the art to which the invention pertains and it is therefore desired to cover the same broadly as well as specifically, as indicated by claims hereto appended.

Furthermore, it is to be expressly understood that I do not in any wise limit myself to the apparatus herein illustrated and described in the practice of my method. The apparatus shown is for illustrative purposes and to enable others to understand the invention and to practice the method. Obviously apparatus, other than that shown herein, may be therefore employed in practicing my invention.

What is claimed is:

1. A process for making yarn of paper strip which consists in loosening the binder therein subjecting the strip to the action of forwardly progressing and transversely reciprocating surfaces to form a strand, uniting the strand with a filament, and finally twisting the strand with the filament to form a yarn.

2. The process for making yarn or paper strip which consists in loosening the binder of the paper strip, transversely manipulating the strip to form a yarn, uniting the strand with a filament, and finally twisting the strand and filament together.

3. A process for making yarn of paper

strip which consists in moistening the strip, subjecting the moistened strip to the action of laterally reciprocating surfaces to form a strand, combining the strand with the filament, and twisting the strand and filament together.

4. A process for making yarn of paper strip which consists in moistening the strip, subjecting the moistened strip to the action of forwardly moving and laterally reciprocating adjacent surfaces to form a strand, uniting the strand with a filament, and finally twisting the strand with a filament to form a yarn.

5. The process for making yarn of paper strip which consists in partially removing the binder of said strip, subjecting the strip to the action of laterally reciprocating surfaces to form a strand, combining the strand with the filament, and subsequently twisting the filament about the strand to form a yarn.

6. The process for making yarn or paper strip which consists in subjecting the strip to the action of forwardly moving and laterally reciprocating adjacent surfaces to form a strand, and twisting the strand with a filament.

7. The process for making yarn of paper strip which consists in laterally rubbing the strip to form a strand, and twisting said strand simultaneously with a filament to form a yarn.

8. The process for making yarn of paper strip which consists in rubbing the strip laterally to form a strand, uniting the strand with a filament, and loosely twisting the filament and strand together.

9. The process for making yarn of paper strip which consists in laterally rubbing said paper strip to form a strand, combining the strand with a plurality of filamentary reinforcing elements, and twisting together said elements and strand to form a yarn.

10. The process for making yarn of paper strip which consists in subjecting the paper strip to the action of forwardly progressing and laterally reciprocating surfaces to form a strand, uniting the strand with a plurality of reinforcing elements, and twisting the strand and elements together to form a yarn.

11. The process for making yarn of paper strip which consists in loosening the binder of said strip, subjecting the strip to the action of forwardly moving and laterally reciprocating surfaces to form a strand, uniting the strand with a filament, and subjecting said united filament and strand to an initial loose twist and a subsequent close twist to form a yarn.

12. A process for making yarn out of a plurality of paper strips which consists in loosening the binder of said strips, simultaneously subjecting the strips to the action of forwardly moving and laterally reciprocating surfaces, uniting the strips with a filament, and twisting said strips and filament together to form a single yarn.

13. A process for making yarn out of a purality of paper strips which consists in loosening binder in the strips, subjecting the strips to the action of forwardly moving and laterally reciprocating adjacent surfaces, combining the strips with a plurality of reinforcing filamentary elements, and finally twisting said reinforcing elements and strips together to form a yarn.

14. A process for making yarn out of a plurality of paper strips which consists in loosening binder in the strips, subjecting the strips to the action of forwardly moving and laterally reciprocating adjacent surfaces, combining the strips with a plurality of reinforcing filamentary elements, and finally twisting said reinforcing elements and strips simultaneously together to form a yarn.

15. The process of making yarn of paper like strip which comprises moistening and rubbing said strip to form an unreinforced yarn and twisting said yarn with a reinforcing filament, while still moist and to twine said filament closely about and into said yarn.

16. The process for making yarn of a strip of asbestos paper including binding material to hold together the fibres thereof, which consists in treating the strip to render the binding material more workable, directly shaping the strip to form a coreless strand, and thereafter twisting the coreless strand with a reinforcing element.

17. The process for making yarn of asbestos paper strip containing binding material to hold together the fibres thereof, which consists in directly subjecting the strip to the action of forwardly moving and laterally reciprocating adjacent surfaces to form a coreless strand, and thereafter twisting the coreless strand with a filament.

18. The process for making yarn of asbestos paper strip containing binding material for holding together the fibres thereof, which consists in laterally rubbing the strip to form a coreless strand, twisting said coreless strand to form a coreless preliminary yarn, and thereafter twisting said coreless preliminary yarn with a reinforcing element to form a final yarn.

19. The process for making the yarn of asbestos paper strip containing binding material for holding together the fibres thereof, which consists in forming the strip into a round coreless strand in which the strip retains its paper formation, twisting the coreless strand to form a coreless preliminary yarn, and thereafter combining the coreless preliminary yarn with a reinforcing element to form a final yarn.

20. A continuous process of forming yarn which consists in forming an asbestos paper

strip directly into a coreless strand, twisting said coreless strand between two fixed points as the strand is advanced, and applying to the coreless strand at an intermediate point a reinforcing element to be twisted therewith to form a yarn.

21. A continuous process of forming yarn consisting in shaping an asbestos paper strip into a round coreless strand, twisting the coreless strand between the point where the shaping operation terminates and a fixed point, and applying to the coreless strand at an intermediate point a reinforcing element to be twisted with the coreless strand already formed.

22. The process of making yarn which includes forming a paper-like strip of asbestos material in which the fibres are held together by suitable workable binding material, directly forming said strip into a coreless strand, and thereafter combining said coreless strand with a filament to form a yarn.

23. The process of making yarn which includes forming a paper-like strip of asbestos material in which the fibres are held together by workable binding material, moistening the strip to render the asbestos material and binding material more workable, directly forming said strip into a coreless strand, and thereafter twisting a filament with said coreless strand to form a yarn.

24. The process of making yarn which includes forming a paper-like strip of asbestos material in which the fibres are held together by workable binding material, directly forming the strip into a round coreless strand in which the strip retains its strip formation, and forming a yarn from said coreless strand by twisting a filament with the same.

25. In a process of making asbestos yarn, the following steps; forming paper from asbestos material and sufficient workable binding material as to permit slitting the paper; slitting the paper into strips; and shaping and twisting a strip of such paper to form a coreless preliminary yarn therefrom, and thereafter combining a filament therewith to form a final yarn.

26. In a process of making asbestos yarn, the following steps; forming paper of asbestos material and workable binding material securing together the fibres of said asbestos material; slitting the finished paper into strips; shaping one of said strips to form a coreless strand; and combining the coreless strand thus formed with a filament to form a yarn.

27. In a process of making asbestos yarn, the following steps; forming a pulp containing asbestos material and a workable binder; passing the pulp through a paper making machine and winding the finished asbestos paper into a roll; running the paper from said roll through a slitting machine and rewinding the strips thus formed; forming a coreless strand from each of said strips, and thereafter twisting a filament with each of said coreless strands to form final yarns.

28. 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, forming said strip or band into a coreless strand, and thereafter combining said coreless strand with a filament to form a yarn.

29. 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, forming said strip or band into a coreless strand, twisting said coreless strand to form a coreless preliminary yarn, and thereafter twisting said coreless preliminary yarn with a reinforcing filament to form a final yarn.

30. 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 cohesivness and tenacity to undergo subsequent strand and yarn forming operations, working said strip or band to form a coreless strand, twisting said coreless strand to form a coreless preliminary yarn, and thereafter combining said coreless preliminary yarn with a filament to form a final yarn.

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

32. 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 unedrgo subsequent strand and yarn forming operations, softening said strip or band, working said softened strip or band to form a coreless strand, and thereafter twisting the coreless strand with a filament to form a yarn.

33. 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, softening said strip or band, and forming a coreless preliminary yarn from the softened strip or band by working and twisting the same, and thereafter twisting the coreless preliminary yarn with a filament to form a final yarn.

34. 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, working said strips or bands to form coreless strands, and thereafter twisting each of said coreless strands together with one or more filaments to form a yarn.

35. 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, working said moistened strips or bands to form moistened coreless strands, and thereafter twisting each of said coreless strands together with one or more filaments to form a yarn.

36. The process of making asbestos yarn, which consists in binding and forming asbestos material into a paper-like strip of sufficient cohesiveness and tenacity to undergo subsequent strand and yarn forming operations, forming said strip or band into a loosely twisted coreless preliminary yarn, and thereafter tightly twisting said preliminary yarn with a filament to form a final yarn.

37. A process of making asbestos yarn, which consists in binding and forming asbestos material into a 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, forming said band while moist into a loosely twisted preliminary yarn, and thereafter tightly twisting said preliminary yarn with a filament to form a final yarn.

38. An asbestos yarn consisting of a coreless strand formed of a twisted strip or band of asbestos material bound into paper of sufficient cohesiveness and tenacity to undergo strand and yarn forming operations, and a filament twisted about said coreless strand.

39. An asbestos yarn consisting of a coreless strand formed of a twisted group of strips or bands as asbestos material bound into paper of sufficient cohesiveness and tenacity to undergo strand and yarn forming operations, and a filament twisted about said coreless strand.

40. An asbestos yarn consisting of a coreless strand formed of a twisted group of strips or bands of asbestos material bound into paper of sufficient cohesiveness and tenacity to undergo strand and yarn forming operations, and at least one filament twisted about said group.

41. An asbestos yarn consisting of a twisted coreless strand formed of at least one strip or band of asbestos material bound into paper of sufficient cohesiveness and tenacity to undergo strand and yarn forming operations, and a plurality of filaments twisted about said coreless strand.

42. An asbestos yarn consisting of a twisted coreless strand formed of at least one strip or band of asbestos material bound into paper of sufficient cohesiveness and tenacity to undergo strand and yarn forming operations, and at least one filament twisted about said coreless strand.

43. An asbestos yarn consisting of a rounded coreless strand formed of at least one strip or band of asbestos material bound into paper of sufficient cohesiveness and tenacity to undergo strand and yarn forming operations, and at least one filament combined with said coreless strand.

44. An asbestos yarn which comprises a coreless strand formed of strips or bands interengaged to retain the strand formation and formed of asbestos material bound into paper of sufficient cohesiveness and tenacity to undergo strand and yarn forming operations, and at least one filament combined with said coreless strand.

45. An asbestos yarn which comprises a rounded strand without internal reinforcement and formed from a strip or band of asbestos material bound into paper of sufficient cohesiveness and tenacity to undergo strand and yarn forming operations, and a reinforcing filament twisted about and impressed into said strand.

46. The process for making yarn of a paper-like strip or band of asbestos material bound together with sufficient cohesiveness and tenacity to undergo strand and yarn forming operations, which includes directly shaping the strip or band to form a coreless strand, and thereafter combining the coreless strand with a filament to form a yarn with the filament arranged helically around the coreless strand.

47. The process of making asbestos yarn from asbestos paper-like material bound with sufficient cohesiveness and tenacity and adapted for yarn manufacture, which comprises mechanically forming said paper-like material directly into a coreless strand, and mechanically uniting said coreless strand and one or more metallic filaments in a gen

erally helical arrangement to form a final yarn.

48. A method of making asbestos yarn from asbestos paper-like material bound with sufficient cohesiveness and tenacity to undergo subsequent mechanical strand and yarn forming operations, which comprises mechanically rounding said paper-like material without reinforcement, and thereafter mechanically applying one or more filaments helically about said rounded paper-like material.

49. A method of making asbestos yarn from paper-like strips or bands of asbestos material bound with sufficient cohesiveness and tenacity and adapted for yarn manufacture, which comprises mechanically bringing together a plurality of said strips or bands into a group, mechanically rounding said group of strips or bands without reinforcement, and thereafter mechanically applying one or more filaments helically about such rounded group of strips or bands.

50. A method of making asbestos yarn from paper-like strips or bands of asbestos material bound with sufficient cohesiveness and tenacity to undergo subsequent strand and yarn forming operations, which comprises forming a coreless group of a plurality of said strips or bands, and combining said coreless group with one or more external binding filaments to form a yarn.

51. A method of making asbestos yarn from asbestos paper-like material bound with sufficient cohesiveness and tenacity and adapted for yarn manufacture, which comprises mechanically forming said paper-like material without tension reinforcement into a strand, and thereafter mechanically combining said strand with one or more reinforcing filaments to form a yarn.

52. A method of making asbestos yarn from asbestos paper-like material bound with sufficient cohesiveness and tenacity and adapted for yarn manufacture, which comprises moistening said paper-like material, forming said paper-like material without tension reinforcement into a strand, and thereafter mechanically combining said strand with one or more filaments to form a yarn.

53. A method of making asbestos yarn from asbestos paper-like material bound with sufficient cohesiveness and tenacity to undergo subsequent mechanical strand and yarn forming operations, which comprises mechanically advancing said paper-like material, moistening said paper-like material as it advances, mechanically forming the moist paper-like material without tension reinforcement into a strand, and thereafter mechanically combining the strand with one or more reinforcing filaments in helical arrangement to form a yarn.

54. An asbestos yarn comprising a coreless strand of asbestos material present in paper-like formation, bound with sufficient cohesiveness and tenacity to retain such paper-like formation and combined with one or more reinforcing filaments.

55. An asbestos yarn comprising a coreless strand of asbestos material, containing binding material, present in paper-like formation, and combined with one or more reinforcing filaments.

56. An asbestos yarn comprising a coreless strand of asbestos paper-like material bound with sufficient cohesiveness and tenacity to undergo strand and yarn forming operations and having one or more filaments combined therewith in helical arrangement.

57. An asbestos yarn comprising a coreless strand of asbestos material, containing binding material, present in paper-like formation and combined with one or more metallic reinforcing filaments.

58. An asbestos yarn comprising a coreless strand formed of a plurality of strips of asbestos material present in paper-like formation, containing binding material and combined with one or more reinforcing filaments in helical arrangement.

59. An asbestos yarn for the manufacture of fabrics and other purposes, comprising a coreless strand formed of a plurality of uniform paper-like strips or bands of asbestos material bound together with sufficient cohesiveness and tenacity to undergo strand and yarn forming operations, and one or more binding filaments arranged around said strand.

60. An asbestos yarn for the manufacture of fabrics and other purposes comprising a coreless strand formed of a plurality of paper-like strips or bands of asbestos material bound together with sufficient cohesiveness and tenacity to undergo subsequent strand and yarn forming operations, at least one of said strips or bands containing binding material, and one or more binding filaments arranged helically around said strand.

61. An asbestos yarn for the manufacture of fabrics and other purposes, comprising a coreless strand of at least one paper-like strip or band of asbestos material bound together with sufficient cohesiveness and tenacity to undergo subsequent strand and yarn forming operations, and one or more metallic binding filaments associated with and embedded in said strand in helical arrangement.

62. An asbestos yarn for the manufacture of fabrics and other purposes comprising a coreless strand formed of a plurality of uniform paper-like strips or bands of asbestos material bound together with sufficient cohesiveness and tenacity to undergo strand and yarn forming operations, at least one of said strips or bands containing binding

material, and one or more metallic reinforcing filaments combined with and embedded in said strand in twisted arrangement.

63. An asbestos yarn consisting of a twisted strip of asbestos paper of sufficient cohesiveness and tenacity to undergo strand and yarn forming operations and having at least one reinforcing filament wrapped around and helically embedded in the surface thereof.

64. An asbestos yarn consisting of a strand of a twisted strip or band of asbestos material bound into paper of sufficient cohesiveness and tenacity to undergo strand and yarn forming operations and having at least one reinforcing filament wrapped around and helically embedded in the surface thereof.

65. An asbestos yarn consisting of a twisted strand without internal reinforcement formed from a strip or band of asbestos material bound into paper of sufficient cohesiveness and tenacity to undergo strand and yarn forming operations and having at least one reinforcing filament wrapped around and spirally embedded in the surface thereof.

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material, and one or more metallic reinforcing filaments combined with and embedded in said strand in twisted arrangement.

63. An asbestos yarn consisting of a twisted strip of asbestos paper of sufficient cohesiveness and tenacity to undergo strand and yarn forming operations and having at least one reinforcing filament wrapped around and helically embedded in the surface thereof.

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65. An asbestos yarn consisting of a twisted strand without internal reinforcement formed from a strip or band of asbestos material bound into paper of sufficient cohesiveness and tenacity to undergo strand and yarn forming operations and having at least one reinforcing filament wrapped around and spirally embedded in the surface thereof.

In testimony whereof, I affix my signature

JOHN ALLEN HEANY.

Certificate of Correction.

It is hereby certified that in Letters Patent No. 1,585,618, granted May 18, 1926, upon the application of John Allen Heany, of New Haven, Connecticut, for an improvement in "Yarn and Processes for Making the Same," errors appear in the printed specification requiring correction as follows: Page 4, line 23, claim 6, for the word "or" read *of;* page 5, line 122, claim 32, for the misspelled word "unedrgo" read *undergo;* page 6, line 65, claim 39, for the word "as" read *of;* and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 24th day of August, A. D. 1926.

[SEAL.]

M. J. MOORE,
Acting Commissioner of Patents.

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