May 18, 1926. 1,585,623

J. A. HEANY

FRICTION FABRIC AND PROCESS FOR MAKING SAME

Filed Dec. 12, 1923 2 Sheets-Sheet 1

Fig. 1.

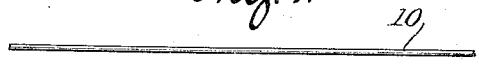


Fig. 2.

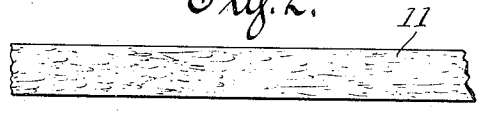


Fig. 3.

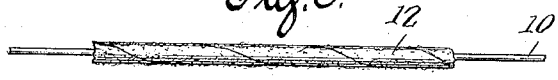


Fig. 4.

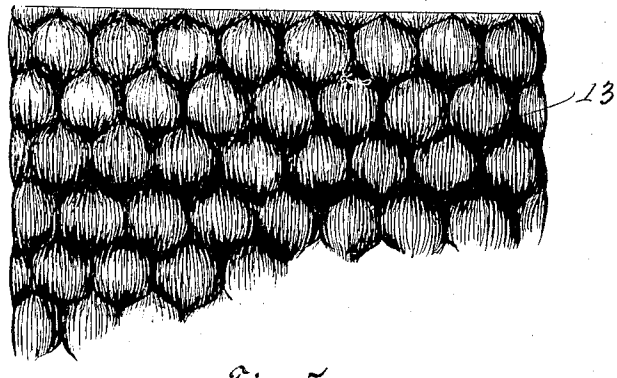
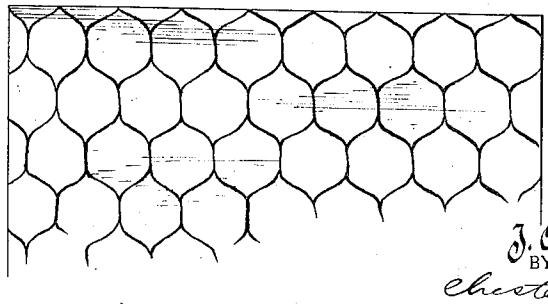


Fig. 5.



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Filed Dec. 12, 1923 2 Sheets-Sheet 2

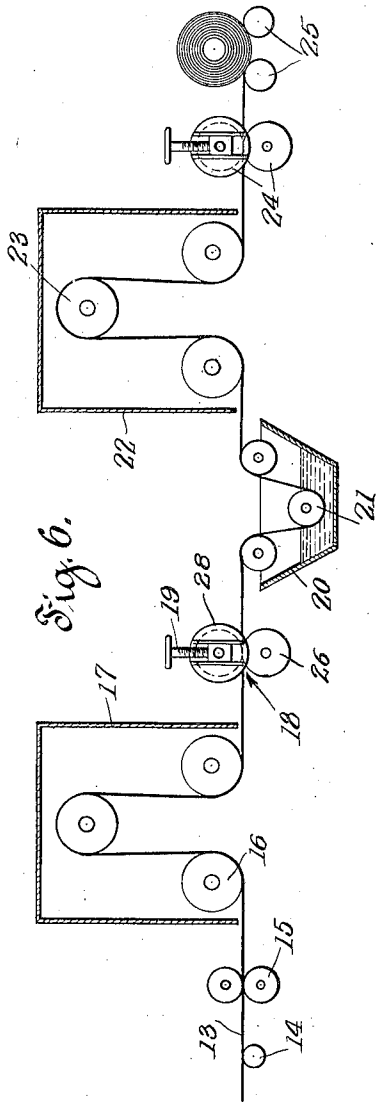


Fig. 6.

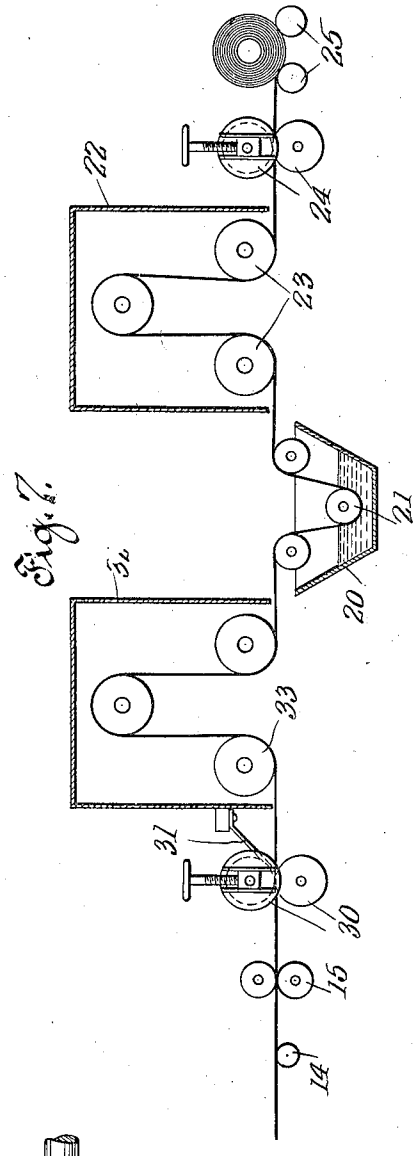


Fig. 7.

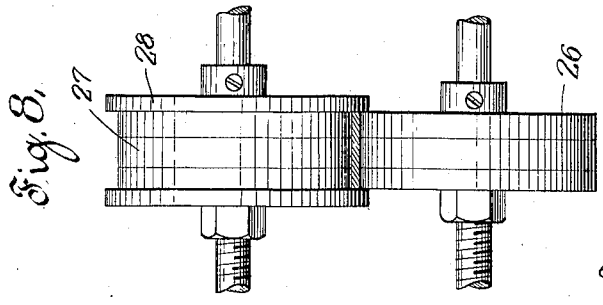


Fig. 8.

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UNITED STATES PATENT OFFICE.

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FRICTION FABRIC AND PROCESS FOR MAKING SAME.

Application filed December 12, 1923. Serial No. 680,186.

This invention relates to materials usable as friction elements in any type of machinery but having particular utility, however, in connection with the brake mechanism of automotive vehicles.

In general, the invention comprehends the use in a friction fabric of asbestos yarn formed of asbestos paper strip or tape, which is preferably reinforced by one or more strands or filaments of metal or of a fibrous material, such as cotton, the fabric formed of the yarn being shaped and compressed to render the fabric relatively dense and close in texture.

Among the objects of the invention, therefore, is the provision of a friction fabric in which is embodied asbestos paper-like material as one of the constituent elements.

Another important object is the provision of a friction fabric formed of material which is amenable to shaping when subjected to pressure and which by compression tends to become smoothly compacted and brought to a texture highly suitable for use as brake lining material.

Another object contemplated is the utilization in friction fabric of yarn in which is embodied at least one strengthening element or filament, either of metallic or of non-metallic material, having greater tensile strength than the asbestos paper.

Another object involved is the employment of a fabric containing binding material which may be readily loosened to permit working of the material and to permit adherent interengagement of the component yarns, and which subsequently will harden to give added tenacity and coherence to the fabric.

The above objects and other objects will become apparent from consideration of the mode of manufacture, which may be preferred, hereinafter detailed and illustrated in the accompanying drawings in relation specifically to brake lining fabrics, in which:

Fig. 1 is a view of the core element of an illustrative form of yarn used in forming a friction fabric according to the present invention;

Fig. 2 is a view of asbestos tape used in the construction of such yarn;

Fig. 3 shows such yarn in completed form;

Fig. 4 is an enlarged detail of a portion of a completed brake lining showing the type of weave;

Fig. 5 is a detailed view of a portion of the fabric formed in accordance with the process of the present invention;

Fig. 6 is a diagramatic showing of an apparatus for working fabric after it comes from the loom;

Fig. 7 is a diagrammatic view of a modified arrangement of the apparatus shown in Fig. 6;

Fig. 8 is a detail showing the specific type of calendering rolls employed.

One form of yarn used in making the fabric consists of a core element 10, which may be of metal, as brass, or of cotton or of any material having the requisite tensile strength, this core element being combined with asbestos paper strip or band 11, to form the completed yarn 12, as shown in Fig. 3. The method of application of the paper strip or band to the core is further brought out in applicant's co-pending applications as, for example, in application Serial No. 516,129, and need not be considered here in detail further than to state that the yarn making process includes generally a moistening step, and rubbing and twisting steps and that generally two or more strands are intertwisted to give the requisite binding and holding force, although any one or more of these steps may be omitted, depending upon the manufacturing requirements.

In the manufacture of the asbestos yarns use may be made of either long or short fibred asbestos material bound and formed into thin uniform paper-like strips or bands of sufficient cohesiveness and tenacity to undergo subsequent strand, yarn and fabric forming operations. As described in said co-pending application, Serial No. 516,129, 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 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 to withstand the stresses to which it is subjected in yarn and fabric making operations. In practice, the strips, as they are fed from the slitting machine, are wound into flat rolls for convenience in treating and handling the strips or bands. The strips or bands are then united with filaments, as by rubbing, and further united therewith, as by twisting. The yarn, shown in Fig. 3, is supplied from a sufficient number of spools to form a sheet of warp yarns and this sheet is wound on a warp beam which is then put into a loom (not shown) of usual construction. Such warp yarns together with a woof yarn supplied from a shuttle are then woven into the fabric having approximate dimensions of the brake lining desired. This fabric 13, Fig. 6, is carried over rollers 14 in a moistened condition the warp and the woof preferably being moistened just prior to the weaving operation, although in some instances, such moistening is omitted and the fabric comes through relatively dry. The material is then led through pressure rolls 15, which in practice may be of such shape as to determine the shape or size of the lining fabric and thence over drying rolls 16 in the drying tower 17, through calendering rolls 18, having a pressure regulating device 19 through the impregnating vat 20 over guide rolls 21, thence through a second drying tower 22 over drying rolls 23 through a second pair of calendering rolls 24 to reeling apparatus 25 where the fabric is in the final form of brake lining and ready for use.

The first calender 18 may also serve to give size or form to the fabric, the peripheries of the rolls having the conformation illustrated in Fig. 8. From this figure, it is evident that the lower roll 26 has a flat periphery and the upper roll 27 has a flanged periphery, the flanges 26 including the outer edge of the lower roll 26. The rolls 26 and 27 are sufficiently displaced relative to each other so as to permit the insertion of the brake lining 13 and due to the flanges 28 of the upper roll, the fabric is boxed and consequently sized or gauged, there being sufficient pressure applied to square off the face and the edge of the fabric and compact the material.

The pressure applied, however, in the calendering rolls 18 is insufficient to prevent absorption of the impregnating fluid in the vat 20 through which the fabric is passed. Any suitable impregnating solution may be employed such as linseed oil or gilsonite, and the fabric then thoroughly dried in the drying tower 22. The fabric is then subjected to a second pressure operation in the calendering rolls 24 which bring it to exact dimensions as required in the trade and the completed brake lining is then reeled for storage or shipment.

The process indicated in Fig. 7 is similar to the one above described with the exception that the material as it comes from the loom is moistened to a more or less plastic stage. While still moist, it is passed between calendering rolls 30 where the fabric is compacted and smoothed. After passing the calender rolls, there being used a stripper 31, to prevent adherence of the fabric to the calender rolls, the material is thoroughly dried in the drying tower 32, passing around the rolls 33, the fabric then going though the same apparatus as utilized in the first form of the process.

In certain aspects, the present invention involves the process of making asbestos friction fabric and the like, which consists in forming yarns from paper-like strips of asbestos material bound with sufficient cohesiveness and tenacity to undergo subsequent strand, yarn and fabric forming operations and adherently interengaging said yarns, preferably by weaving, into a fabric; and also involves such resulting fabric. But in its broadest aspect the invention resides in an asbestos fabric or the like, combining asbestos material present in the fabric in deformed, flexible paper-like strip formation, said material being bound together with sufficient cohesiveness and tenacity to undergo fabrication and to impart strength, cohesiveness and tenacity to the fabric.

It is important to note that the basic material of which the brake lining is composed is asbestos paper which is through the manufacturing steps brought at least once to a softened or plastic condition, but that the same retains its form by the employment of centering or holding cores. The susceptibility to softening permits the material to be readily compressed and sized to any degree of stiffness or shape desired and, inasmuch as asbestos is non-inflammable and little, if any, inflammable substance is used in the manufacture of the fabric, the final brake lining is such as to meet the most rigid requirements of active practice. Asbestos fibre lends itself also readily to impregnation and by the use of a proper impregnating solution, an additional body is given the material so that the final product is a highly condensed, moisture impervious and

durable material, usable either in connection with high temperatures or moisture and retaining the degree of flexibility desired by the trade. It is noteworthy also that it is not necessary to use long-fibred asbestos, although in many instances such use is desirable as due to the fact that the asbestos is formed as a paper strip in which the fibres of asbestos are held together by an adhesive binder, such as starch, it is immaterial whether the fibres of asbestos are short or long. Brake lining with asbestos of very short fibres has been used with marked success.

It should be noted that the asbestos paper-like material is such that it may be softened or rendered more plastic by suitable treatment to facilitate the manufacture of yarn and fabric made from such yarn. After the fabric is completed, it is treated to prevent such softening or plasticizing and to give the fabric such characteristics as are necessary for satisfactory service. In a specific form of carrying out the invention, use is made of binding material, including starch, which may be softened by moistening. The such capability of being softened by moistening is, however, undesirable in the final fabric. The fabric is therefore treated or impregnated with some material such as linseed oil or gilsonite, which tends to waterproof the material and therefore tends to prevent softening or plasticizing of the paper-like material. Such impregnating materials also possess certain lubricating qualities and serve to impart a certain degree of flexibility to the starch or other binding material, which would otherwise become so stiff as to crack easily in the yarn or finished fabric.

While I have described brake lining as being formed of a single strip of woven fabric, it is evident that a fabric of double or treble or any multiples of the desired width may be used, the same being folded over and compressed to the size desired. It is apparent also that where the greatest tensile strength is desired, it is essential to use a metal reinforced yarn and that instead of using a single strand of the same, the yarn formed of several strands twisted together, each strand having a metal core, should be used. The fabric built up of yarns of this type which have been subsequently moistened and impregnated and subjected to the pressure operations of the calender rolls, thus compacting the whole, will meet the severest requirements of brake lining usage. It is obvious also that the fabric is not necessarily limited in its uses to brake lining, but is usable as a friction element for any purposes, such, for example, as clutch facings.

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 the invention has been described as relating to a specific apparatus and process and fabric resulting therefrom and as applied specifically to brake lining fabrics, it should be understood that applicant does not hereby desire to limit the invention to the specific means and elements detailed, nor to the use of the fabric alone to brake lining, but to include such subject matter and equivalents as come into the scope of the claims hereunto appended.

What is claimed is:

1. An asbestos friction fabric or the like, containing a plurality of interengaged and deformed paper-like strips of asbestos material bound with sufficient cohesiveness and tenacity to undergo fabrication, said strips being present in the fabric in paper-like formation.

2. An asbestos friction fabric or the like, containing a plurality of interengaged strips of asbestos material present in deformed paper-like strip formation, each of said strips being bound together by binding material with sufficient cohesiveness and tenacity to undergo fabrication.

3. An asbestos friction fabric or the like, containing asbestos material present in the fabric in deformed, flexible paper-like formation, said material being bound together with sufficient cohesiveness and tenacity to undergo fabrication and to impart durability and tenacity to the fabric.

4. An asbestos friction fabric or the like, containing compacted and reinforced asbestos material present in the fabric in creased or deformed, flexible paper-like formation, the fibres of said material being united along their entire longitudinal lengths and bound together with sufficient cohesiveness and tenacity to undergo fabrication and to impart durability and coherence to the fabric.

5. An asbestos friction fabric or the like, containing asbestos material present in the fabric in deformed, flexible paper-like formation, said material being bound together by binding material with sufficient cohesiveness and tenacity to undergo fabrication and to impart durability and coherence to the fabric.

6. An asbestos friction fabric or the like, containing a plurality of interengaged strips of asbestos material, each of said strips being bound by binding material with sufficient cohesiveness and tenacity to undergo fabrication and to impart cohesive-

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ness, tenacity and strength to the fabric, and each of said strips also being present in the fabric in deformed, flexible paper-like formation.

7. An asbestos friction fabric or the like, containing asbestos material present in flexible paper-like formation, said material being bound together by binding material with sufficient cohesiveness and tenacity to undergo fabrication and having reinforcing filaments associated therewith to impart strength, tenacity and cohesiveness to the fabric.

8. An asbestos friction fabric or the like, containing a plurality of interengaged strips of asbestos material present in deformed flexible paper-like strip formation, each of said strips being formed and bound together by binding material with sufficient cohesiveness and tenacity to undergo fabrication and having one or more reinforcing filaments combined therewith to impart strength, tenacity and cohesiveness to the fabric.

9. An asbestos friction fabric or the like, containing a plurality of compacted, flexible and interengaged strips of asbestos material longitudinally arranged therein and present in deformed paper-like formation, the fibres of said strips being united along their entire longitudinal lengths and bound together with sufficient cohesiveness and tenacity to undergo fabrication and to impart cohesiveness, tenacity and strength to the fabric.

10. An asbestos friction fabric or the like, containing a plurality of compacted, flexible and interengaged strips of asbestos material longitudinally arranged therein and present in deformed paper-like formation, the fibres of said strips being united along their entire longitudinal lengths and bound together by binding material with sufficient cohesiveness and tenacity to undergo fabrication and to impart cohesiveness, tenacity and strength to the fabric.

11. An asbestos friction fabric or the like, containing a plurality of compacted, flexible and interengaged strips of asbestos material longitudinally arranged therein and present in deformed paper-like formation to render the same flexible, each of said strips having the fibres thereof formed and bound closely together by binding material with sufficient cohesiveness and tenacity to undergo fabrication and with one or more reinforcing filaments combined therewith to impart strength, tenacity and cohesiveness to the fabric.

12. An asbestos friction fabric or the like, containing a plurality of closely compacted, flexible and interengaged strips of asbestos material longitudinally arranged therein and present in longitudinally and transversely creased or deformed flexible paper-like formation, each of said strips having the fibres thereof united along their entire longitudinal lengths and bound closely together by binding material with sufficient cohesiveness and tenacity to undergo fabrication and also having one or more reinforcing filaments associated therewith to impart strength, tenacity and cohesiveness to the fabric.

13. An asbestos friction fabric or the like, containing yarns formed from paper-like strips of asbestos material bound together with sufficient cohesiveness and tenacity to undergo subsequent strand, yarn and fabric forming operations.

14. An asbestos friction fabric or the like, the major portion of which comprises adhering yarns formed from paper-like strips of asbestos material bound together with sufficient cohesiveness and tenacity to undergo subsequent strand, yarn and fabric forming operations.

15. An asbestos friction fabric or the like, the major portion of which comprises yarns, each of which is formed from a filament twisted with a paper-like strip of asbestos material bound together with sufficient cohesiveness and tenacity to undergo subsequent strand, yarn and fabric forming operations.

16. An asbestos friction fabric or the like, the major portion of which comprises adhering yarns formed from paper-like strips of asbestos material bound together with sufficient cohesiveness and tenacity to undergo subsequent strand, yarn and fabric forming operations, and reinforcing filaments combined with said strips.

17. An asbestos friction fabric or the like composed of interengaged yarns, the major portion of the yarns of said fabric comprising paper-like strips of asbestos material bound together with sufficient cohesiveness and tenacity to undergo subsequent strand, yarn and fabric forming operations.

18. A woven asbestos friction fabric or the like, the warp threads of which comprise adhering yarns formed from paper-like strips of asbestos material bound together with sufficient cohesiveness and tenacity to undergo subsequent strand, yarn and fabric forming operations, and reinforcing filaments combined with said strips.

19. An asbestos friction fabric or the like composed of adherently interengaged yarns, each of said yarns being formed from at least one filament twisted with at least one paper-like strip of asbestos material bound together with sufficient cohesiveness and tenacity to undergo subsequent strand, yarn and fabric forming operations.

20. An asbestos friction fabric or the like, the warp threads of which comprise adhering yarns formed from paper-like strips of asbestos material bound together with sufficient cohesiveness and tenacity to undergo

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subsequent strand, yarn and fabric forming operations, and reinforcing filaments interassociated with said strips.

21. An asbestos friction fabric or the like composed of a plurality of adhering yarns, each of said yarns comprising a filament combined with a paper-like strip of asbestos material having workable binding material therein.

22. An asbestos friction fabric or the like comprising yarns, the major portion of which comprises adhering yarns formed from paper-like strips of asbestos material bound together with workable binding material with sufficient cohesiveness and tenacity to undergo subsequent strand, yarn and fabric forming operations.

23. The process of making asbestos friction fabric and the like, which comprises the following steps: of forming asbestos material united with workable binding material into paper-like strips or bands of sufficient cohesiveness and tenacity to undergo subsequent strand, yarn and fabric forming operations; of forming yarns from said strips or bands; of adherently interengaging such yarns to form a fabric; and of thereafter compacting said fabric.

24. The process of making asbestos friction fabric and the like, which comprises the following steps: of forming asbestos material united with workable binding material into paper-like strips or bands of sufficient cohesiveness and tenacity to undergo subsequent strand, yarn and fabric forming operations; of forming yarns from said strips or bands; of interengaging such yarns to form a plastic fabric; of compacting said fabric while in plastic condition; and of destroying its plastic condition.

25. The process of making asbestos friction fabric and the like, which comprises the following steps: of forming asbestos material united with workable binding material into paper-like strips or bands of sufficient cohesiveness and strength to undergo subsequent strand, yarn and fabric forming operations; of uniting said strips or bands with filaments to form yarns; of interengaging and moistening such yarns to form a fabric; of compressing said fabric while in a moistened condition; and of drying said fabric.

26. The process of making asbestos friction fabric and the like, which comprises the following steps: of forming asbestos material united with workable binding material into paper-like strips or bands of sufficient cohesiveness and tenacity to undergo subsequent strand, yarn and fabric forming operations; of moistening said strips or bands to render the binding material more workable; of uniting the moistened strips with filaments to form yarns; of interengaging such yarns while moist to form a fabric; of compressing said fabric while moist; and of drying said fabric.

27. The process of making asbestos friction fabric or the like, which comprises the following steps: of binding and forming asbestos material into paper-like strips or bands of sufficient cohesiveness and tenacity to undergo subsequent strand, yarn and fabric forming operations; of forming asbestos yarns from said strips or bands while retaining the strip or band formation therein; and of adherently interengaging yarns, including such asbestos yarns, to form a fabric containing a substantial proportion of asbestos material.

28. The process of making asbestos friction fabric or the like, which comprises the following steps: of forming asbestos material united with workable binding material into paper-like strips or bands of sufficient cohesiveness and tenacity to undergo subsequent strand, yarn and fabric forming operations; of forming asbestos yarns from said strips or bands; of interengaging yarns, including such asbestos yarns, to form a plastic fabric containing a substantial proportion of asbestos material; of compacting said fabric while in plastic condition; and of destroying such plastic condition.

29. The process of making asbestos friction fabric or the like, which comprises the following steps: of binding and forming asbestos material into paper-like strips or bands of sufficient cohesiveness and tenacity to undergo subsequent strand, yarn and fabric forming operations; of uniting said strips or bands with filaments to form asbestos yarns; and of adherently interengaging yarns, including such asbestos yarns, to form a fabric containing a substantial proportion of asbestos material.

30. The process of making asbestos friction fabric or the like, which comprises the following steps: of forming asbestos material united with workable binding material into paper-like strips or bands of sufficient cohesiveness and tenacity to undergo subsequent strand, yarn and fabric forming operations; of moistening said strips or bands to render the binding material more workable; of uniting the moist strips or bands with filaments to form moist asbestos yarns; of interengaging yarns, including such moist asbestos yarns to form a moist asbestos fabric containing a substantial proportion of asbestos material; of compressing said fabric while moist; and of drying said fabric.

31. The process of making asbestos friction fabric or the like, which comprises the following steps: of binding and forming asbestos material into paper-like strips or bands of sufficient cohesiveness and tenacity to undergo subsequent strand, yarn and fabric forming operations; of uniting said

strips or bands with filaments to form moist asbestos yarns; of interengaging yarns, including such moist asbestos yarns, to form a moist asbestos fabric; of compressing said moist asbestos fabric; and of drying said fabric.

32. The process of making asbestos friction fabric or the like, which comprises the following steps: of binding and forming asbestos material into paper-like strips or bands of sufficient cohesiveness and tenacity to undergo subsequent strand, yarn and fabric forming operations; of forming asbestos yarns from said strips or bands; of moistening and binding warps of such asbestos yarn into a moist fabric; and of compacting said fabric while in moistened condition.

33. The process of making asbestos friction fabric or the like, which comprises the following steps: of forming asbestos material united with workable binding material into a paper-like strip or band of sufficient cohesiveness and tenacity to undergo subsequent strand, yarn and fabric forming operations; of uniting at least one of such strips or bands with at least one filament to form an asbestos yarn; of interengaging and moistening yarns, including such asbestos yarns, to form a fabric containing a substantial proportion of asbestos material; and of compressing said fabric while in a moistened condition.

34. The process of making asbestos friction fabric and the like, which consists in forming yarn from paper-like strips of asbestos material united with workable binding material, moistening said yarn, forming said yarn while moist into a fabric, and subsequently compressing and drying the fabric.

35. The process of manufacturing asbestos friction fabric and the like, which consists in forming reinforced yarn from cores and paper-like strips of asbestos material bound with sufficient cohesiveness and tenacity to undergo subsequent strand, yarn and fabric forming operations, moistening the yarn, forming said yarn while moist into a fabric, and subsequently compressing and drying said fabric.

36. The process of making asbestos friction fabric and the like, which consists in forming reinforced yarn from filaments and moist paper-like strips of asbestos material bound with sufficient cohesiveness and tenacity to undergo subsequent strand, yarn and fabric forming operations, forming said yarn while moist into a fabric, and subjecting said fabric to pressure and drying operations.

37. The process of making asbestos friction fabric and the like, which consists in forming yarns from paper-like strips of asbestos material bound with sufficient cohesiveness and tenacity to undergo subsequent strand, yarn and fabric forming operations, and adherently interengaging said yarns into a fabric.

38. The process of making asbestos friction fabric and the like, which consists in forming yarns from paper-like strips of asbestos material bound with sufficient cohesiveness and tenacity to undergo subsequent strand, yarn and fabric forming operations, forming said yarns into a fabric, and effecting an adherent engagement between individual yarns.

39. The process of making asbestos friction fabric and the like, which consists in forming yarns from paper-like strips of asbestos material bound by workable binding material with sufficient cohesiveness and tenacity to undergo subsequent strand, yarn and fabric forming operations, weaving said yarns into a fabric, and effecting an adherent engagement between individual yarns.

40. The process of making asbestos friction fabric or the like, which includes forming asbestos material united with binding material, which may be softened or plasticized, into paper-like strips or bands of sufficient cohesiveness and tenacity and adapted for yarn manufacture; forming asbestos yarns from such strips or bands; interengaging yarns, including such asbestos yarn, to form a fabric containing a substantial proportion of asbestos material; and treating said fabric to prevent subsequent softening or plasticizing of the binding material and to impart greater durability to the fabric.

41. A flexible asbestos friction fabric or the like, containing reinforcing filaments combined with asbestos paper-like material present in the fabric in paper-like formation, said material being bound with sufficient cohesiveness and tenacity to undergo fabrication.

42. A flexible asbestos friction fabric or the like, a substantial proportion of the weft threads of which consists of yarns formed from one or more reinforcing filaments combined with asbestos material present in the fabric in paper-like formation, and bound with sufficient cohesiveness and tenacity to undergo strand and yarn manufacture.

43. A flexible asbestos friction fabric or the like, a substantial proportion of the warp threads of which consists of yarns formed from one or more reinforcing filaments combined with asbestos material present in the fabric in paper-like formation, and bound with sufficient cohesiveness and tenacity to undergo strand and yarn manufacture.

44. A flexible friction fabric, containing asbestos material present in paper-like formation and bound together with sufficient co-

hesiveness and tenacity to undergo fabrication and to retain its paper-like characteristics in the fabric, and reinforcing filaments or strands associated with said asbestos material for reinforcing said fabric.

45. A friction fabric or the like, including longitudinal filaments and weft yarn formed from asbestos paper-like material bound with sufficient cohesiveness and tenacity and adapted for yarn manufacture.

46. A friction fabric or the like, including longitudinal filaments and weft yarn formed from at least one filament and at least one strip or band of asbestos material bound together with sufficient cohesiveness and tenacity and adapted for yarn manufacture.

In testimony whereof, I affix my signature.

JOHN ALLEN HEANY.

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