

June 19, 1934.

S. B. HAINSWORTH

1,963,898

MULTIPLE PLY TEXTILE FABRIC

Filed May 6, 1930

3 Sheets-Sheet 1

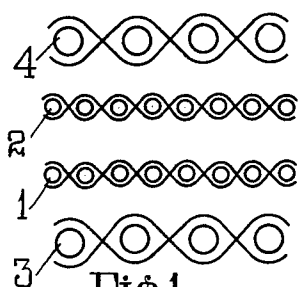


FIG. 1.

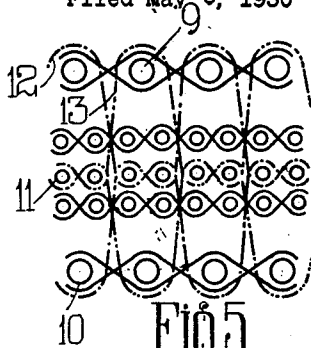


FIG. 5.

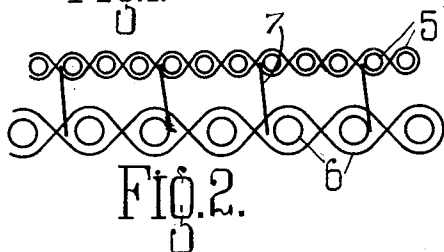


FIG. 2.

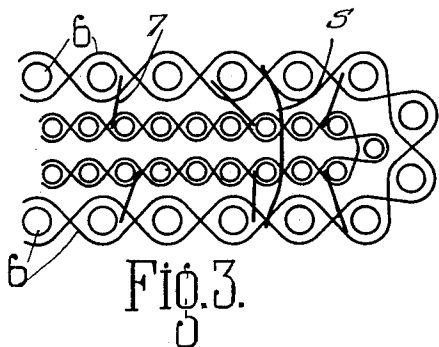


FIG. 3.

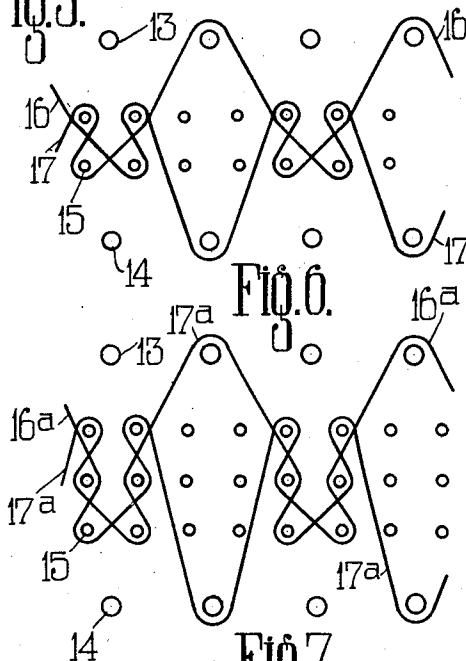


FIG. 6.

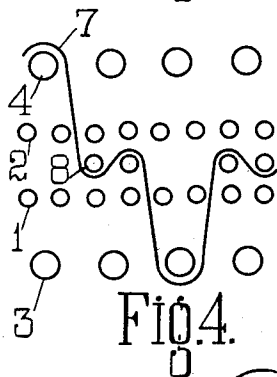


FIG. 4.

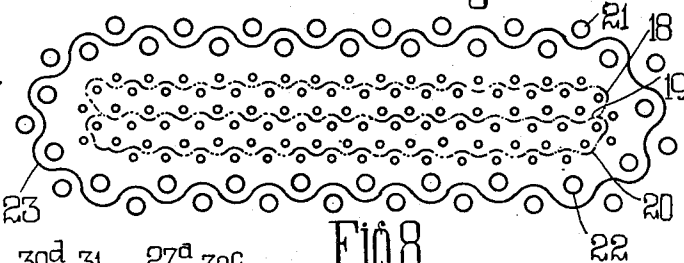


FIG. 8.

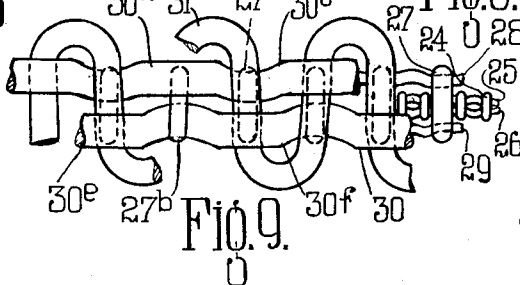


FIG. 9.

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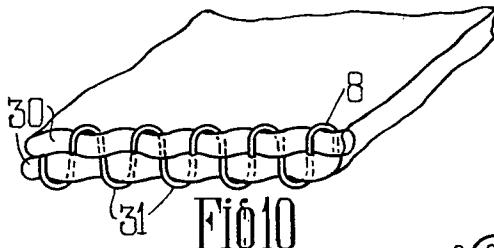


Fig. 10

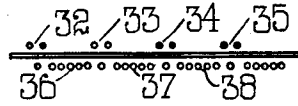


Fig. 14

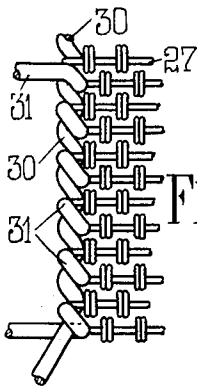


Fig. 11

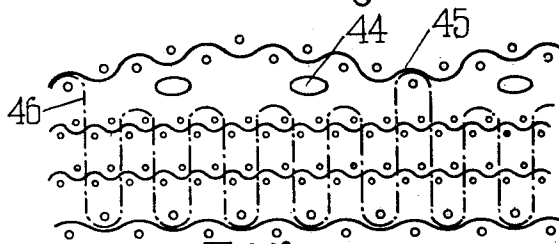


Fig. 16

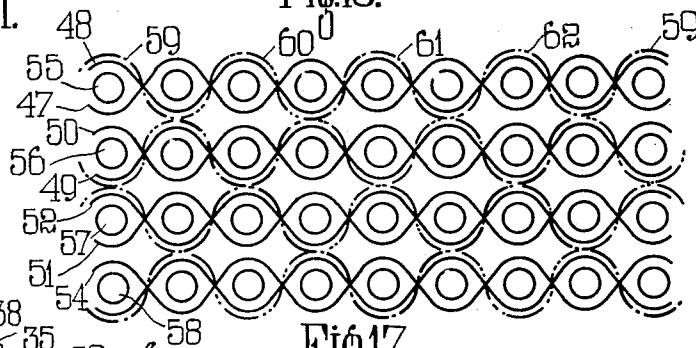


Fig. 17

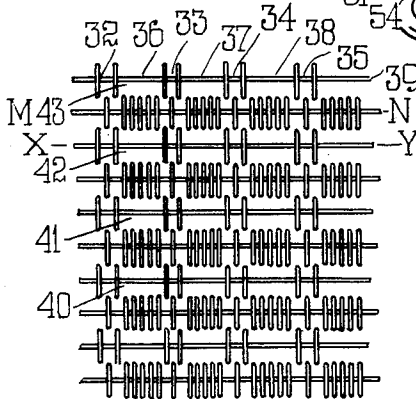


Fig. 12

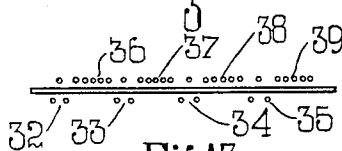


Fig. 13



Fig. 15

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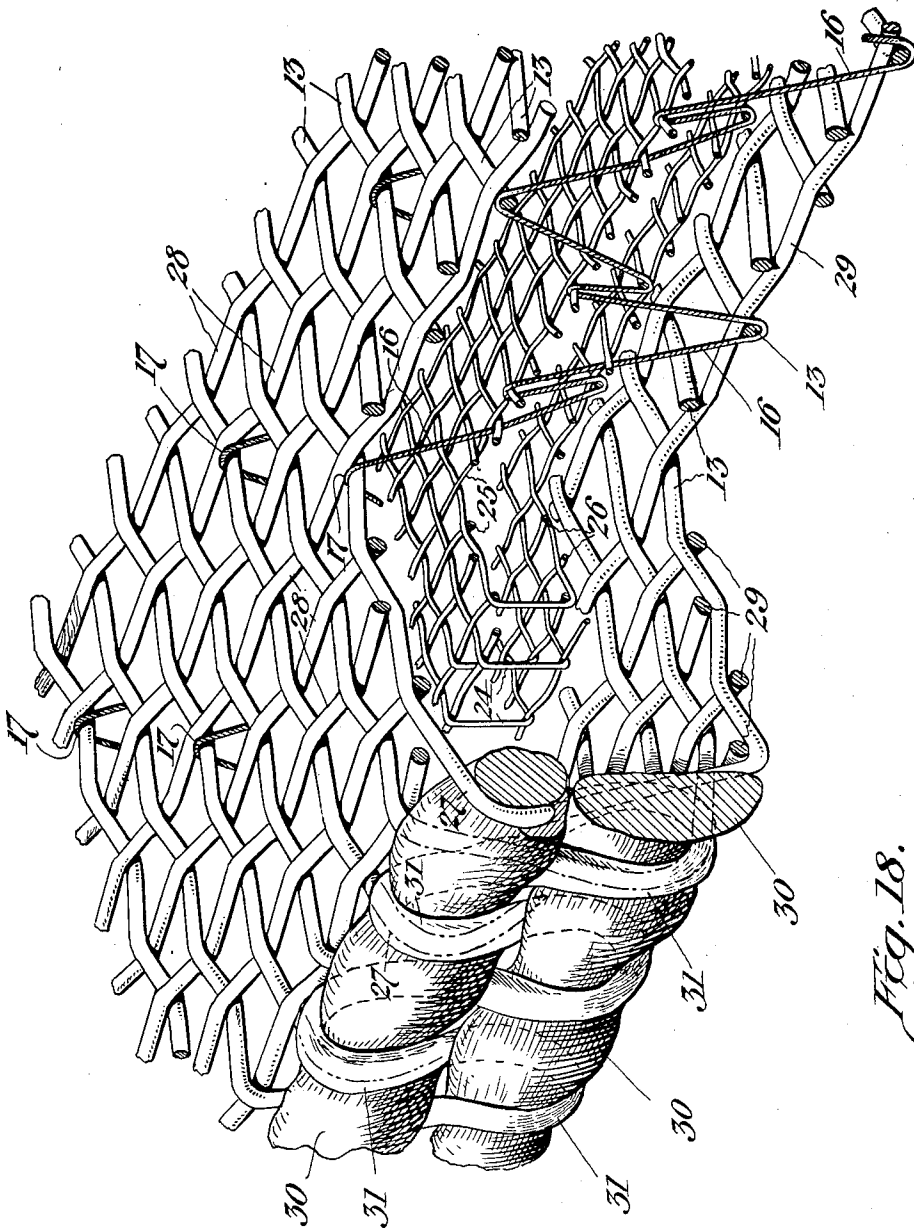


Fig. 18.

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UNITED STATES PATENT OFFICE

1,963,898

MULTIPLE PLY TEXTILE FABRIC

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Application May 6, 1930, Serial No. 450,231
In Great Britain May 8, 1929

8 Claims. (Cl. 139—408)

The present invention relates to improvements in multiple ply textile fabrics which, amongst other uses are suitable for power transmission belting, or for band conveyors, or again for friction linings for brakes or clutches.

One object of the invention is to provide a belt of increased strength and which will present increased resistance to fasteners against pulling through.

10 A further object of the invention is to provide a belt of increased flexibility and which will present a better gripping surface to pulleys or driving rollers.

15 According to the present invention a multiple ply textile fabric comprises two complete outer plies, at least one complete inner ply having a greater number of picks per unit length than said outer plies, and means for connecting said plies together.

20 The inner ply or plies may also have the weft threads lifted over the ground warps a greater number of times per unit width than the outer plies.

25 According to another feature of the invention one or more complete inner plies of a multiple ply textile fabric may be formed of wefts or warps and wefts of finer count than those of the outer warps.

30 Binder threads or warps extending between the outer plies may be provided for connecting said inner and outer plies together, and preferably each binder thread makes at least two crossings with the inner ply or plies or engages and passes around at least two wefts of said inner ply or plies during each crossing through the fabric.

35 If desired, a layer or layers of dummy weft threads having no ground warp may be provided in the fabric for engagement by said binder threads.

40 The selvage of the outer plies is preferably independent of the inner ply or plies, that of the inner ply being of finer count than the selvage of the outer plies.

45 Further, it is preferable to provide selvage cords along the sides of the fabric, said cords being engaged by the selvage wefts of the outer plies to form loops therein, a lacing thread or cord being passed sinuously through the loops so formed in said selvage cords so that the selvage wefts are completely covered.

50 The term "pick" is employed in this specification to denote the result of one shuttle-crossing during weaving of the fabric, and is independent of the number of threads carried by the shuttle or of the type of weave, i. e. whether plain, twill or

other kind of weave. Thus, the number of picks per unit length is equal to the number of times that the shuttle has crossed the warp during weaving, per unit length of the fabric.

The invention is more particularly described 60 with reference to the accompanying drawings which show various forms of fabric by way of example, and in which:—

Figure 1 is a diagrammatic weft sectional elevation through one form of belt or conveyor 65 band, the binding threads being omitted for the sake of clearness.

Figure 2 is a similar view of another form of weave at one stage in the manufacture of a belt or conveyor band.

70 Figure 3 is a part sectional elevation through a completed belt or band made up from the fabric of Figure 2.

Figure 4 is another view through a belt or band showing a binder thread.

75 Figure 5 is a diagrammatic weft sectional elevation showing a modified form of binder construction.

Figures 6 and 7 show further modified forms of binder threads, the ground warps being 80 omitted for the sake of clearness.

Figure 8 is a warp sectional elevation.

Figure 9 is a diagrammatic side view of a selvage.

Figure 10 is a side perspective view corresponding to Figure 9.

Figure 11 is a plan view corresponding to Figures 9 and 10.

Figure 12 shows diagrammatically the working 90 face of a belt having suction cups or pockets formed therein.

Figures 13 and 14 are warp sectional views on lines 13—13 and 14—14 respectively of Figure 12.

Figure 15 is a weft sectional view of an outer 95 ply of a belt having suction cups or pockets formed in the working face thereof.

Figure 16 is a weft sectional view of a modified form of suction cup construction.

Figure 17 is a weft section showing another form of binder thread construction.

Figure 18 is a composite perspective view showing a fabric containing the features of Figs. 1, 6, 9, 10 and 11.

A power transmission belt or band conveyor taken by way of example, may be formed of 105 a four-ply fabric, as shown in Figure 1, in which the two inner plies 1, 2, have a considerably greater number of picks per unit length of the finished fabric than the facing or outer plies 3, 4.

It will follow that it will be usual to use for 110

this purpose, weft or weft and warp ends of higher count in the inner plies than those in the outer plies; that is to say, the threads in the inner plies are of lesser diameter than those of the outer plies 3, 4.

In a modified method of construction, a two-ply fabric as shown in Figure 2, or a three ply or multi-ply fabric is formed where one face is formed on the ply or plies of warp and weft threads 5, having a larger number of ends and picks respectively to the inch than the warp and weft threads 6 of the other facing ply, so that when such a strip of textile fabric is folded back upon itself, as shown in Figure 3, the plies made up of weft picks of greater number will lie on the inside of the belt, whilst the plies made up of a lesser number per inch, such as 6, will lie on the outside of the belt or band.

The binder strands 7 shown in Figures 2 and 3 are merely illustrative of binders employed for joining the inner and outer plies, and it will be understood that the number of individual threads of the inner and outer plies located between two adjacent binders may be varied as desired.

The various plies in this form of construction may be united by stitches S or otherwise subsequent to weaving and folding.

In a belt of this type; that is to say, made up of one or more inner plies having a larger number of picks to the inch than the outer ply or plies, the various plies may be interlaced by means of binder strands, such as 7 on Figure 4, which make two or more crossings or interlacings with intermediate weft such as 8, on their traverse downwards and on their traverse upwards.

As shown in Figure 5, these binder strands passing from the weft 9 of one outer ply to the weft 10 of the other outer ply may be interlocked on two or more crossings, or interlacings, with a dummy centre ply or cloth in which the weft 11 has no ground warp and is solely held by the binder warp 12, 13. In Figure 5, thus a binder strand 13 is illustrated as passing around the upper right hand weft thread 9 downwardly between two weft threads of the adjacent inner ply downward between the aligned two weft threads of the dummy center ply, then upwardly and around an adjacent dummy weft thread 11, and thence downwardly again between two weft threads of the other complete inner ply and then down to and around a weft thread 10 of the other outer ply. Further, another binder strand passes in the reverse direction, so that the passage of the two binder strands around the dummy weft threads interlocks with these threads.

In Figure 6, which is a weft section, the outer wefts are shown at 13 and 14, the inner wefts at 15, and the binder strands or threads at 16 and 17, whilst in Figure 7 which shows a modified form of path of the binder strands, the binder strands or threads are illustrated at 16a and 17a.

It is obvious that numerous modifications may be made in the path of the binder strands from top to bottom of the fabric, and any number of crossings or interlacings with the weft may be effected, whilst further, the binder threads may be of braid as distinct from twisted yarn, such braid being either free from or containing a core as desired.

In composite belting of this type, it will be desirable to arrange that the inner plies 18, 19, 20, as shown, for instance in Figure 8, have their own independent and separate selvage made up with a similar count of yarn and that the outer ply or plies 21, 22 which may be of coarser weft

similarly have their own selvage 23 made up of yarn of similar or somewhat similar counts.

The selvages may be protected according to this invention, as illustrated in Figures 9 to 11, Figure 9 showing, by way of example, a four-ply fabric in which a weft 24 is common to the warps of inner plies 25, 26, and a weft 27 is common to the warps 28, 29 of the outer plies. This weft 27 is interwoven with braid or cord 30 to form a selvage, the loops so formed in the cord 30 being interlocked by means of a lacing 31 which, as will be seen, completely covers the weft 27.

It will be noticed that in the particular pattern illustrated (Figs. 9-11) one weft 27 is formed for each pair of wefts 24, whilst the weft 27a, which is one of the wefts 27, binds adjacent loops 30c and 30d of the groups of loops and the next adjacent weft 27b binds the loops 30e and 30f of said group.

Now it will be realized that the selvage of a textile belt or conveyor band is particularly subjected to wear owing to the rubbing against belt forks or the sides of a flanged pulley or the like, and that normally should one of two weft threads be worn through, the belt will very rapidly disintegrate.

It will further be noticed, that by this invention, it is possible to protect the whole side of the belt subject to the wear of a belt fork by adopting cords or threads 30, 31, which will be particularly resistant to wear.

Various suggestions have been made to cause a better adherence of a belt to driving pulleys. For this purpose it has been usual to indent the surface of a leather belt, or to apply rivets or the like thereto, with the object of forming suction cups or pockets in its surface.

According to the present invention however, a multiple-ply textile fabric belt is woven so that warp on the driving face is brought to the surface to form closed areas enclosing a space where all the warp is taken below the surface, thus causing the belt and this face to present a series of spaced suction pockets as shown diagrammatically in Figures 12 to 16.

The warp of a textile belt, shown in Figure 12, is brought to the surface along the lines indicated at 32, 33, 34, 35 . . . preferably at least three lines of adjacent warp co-operating in this manner along each line, whilst intermediate these lines of warp, warp threads 36, 37, 38, 39 . . . are depressed below the surface at points such as 40, 41, 42, 43 . . . to form suction pockets wholly enclosed by facing warp on all sides.

In an alternative method of forming suction cups on the face of a belt, as shown diagrammatically in Figure 16, a thick weft 44, and a thick warp yarn or braid is run at spaced intervals under the top ply, which is bound down to the other plies at points between pairs of said thick warp and weft to raise the top ply above the warp and weft, thus leaving wholly surrounded suction cups or pockets 45 on the face of the warp.

As shown, the binder warps 46 only engage the outer ply at points intermediate of said thick weft and warp.

In another form of binder thread for fabrics having four or more plies, the binder threads interlock with a weft of successive picks of weft of each ply in sequence from one outer ply to the other, and vice versa, that is to say, a binder thread after interlocking with pick "n" in one

ply, interlocks with pick " $n+1$ " in the next ply, " n " being any whole number.

In the arrangement shown in Figure 17, warp threads 47, 48; 49, 50; 51, 52; 53, 54; are interwoven with weft 55, 56, 57, 58, to form a multiple ply textile fabric, the plies of which are interlocked by means of binder threads 59, 60, 61, 62.

In the arrangement shown, it will be seen that the binder thread 59 repeats only after 32 picks, so that the fabric will be a very flexible one.

I declare that what I claim is:

1. A multiple ply belting fabric comprising a number of inner plies each formed of interwoven ground weft and ground warp threads, outer facing plies enclosing said inner plies each formed of a lesser number of weft threads per unit length than the number of weft threads per unit length in each of the inner plies, and formed of interwoven ground weft threads and ground warp threads which do not pass from ply to ply, and additional binder threads passing from facing ply to facing ply for binding all said plies together.

2. A multiple ply belting fabric comprising a number of inner plies each formed of interwoven ground weft and ground warp threads, outer facing plies enclosing said plies each formed of a lesser number of weft threads per unit length than the number of weft threads per unit length in each of the inner plies, and also a lesser number of warp threads per unit width than the warp threads of the inner plies and formed of interwoven ground weft threads and ground warp threads which do not pass from ply to ply, and additional binder threads passing from facing ply to facing ply for binding all said plies together.

3. A multiple ply belting fabric consisting of inner plies formed of interwoven ground weft and ground warp threads, which do not pass from ply to ply, facing plies formed of interwoven ground weft and ground warp threads of coarser count than the inner plies, and additional threads passing from an inner ply to the adjacent outer ply and passing from facing ply to facing ply for binding all said plies together.

4. A multiple ply belting fabric consisting of inner plies formed of interwoven ground weft and ground warp threads, which do not pass from ply to ply, facing plies formed of interwoven ground weft and ground warp threads of coarser count than the inner plies, additional binder

threads passing from facing ply to facing ply for binding all said plies together, a selvage on said outer plies, and a selvage on said inner plies of finer count than the warp and weft of the selvage of the outer plies.

5. A multiple ply textile fabric power transmission belt comprising a plurality of plies formed of interwoven ground weft threads and ground warp threads which do not pass from ply to ply, and including a facing ply having a lesser number of weft threads per unit length than an inner ply, additional binder threads passing between said plies, said fabric being folded back upon itself with the facing plies exposed, and stitches for securing said fabric when so folded back upon itself.

6. A multiple ply belting fabric comprising a pair of outer plies, a number of inner plies woven with a greater number of weft threads per unit length than the outer plies and binder threads passing from one outer ply to the other outer ply whilst interlacing two or more times with an inner ply.

7. A belting fabric comprising a number of first inner plies each formed of interwoven ground weft and ground warp threads, outer facing plies enclosing said inner plies each formed of a lesser number of weft threads per unit length than the number of weft threads per unit length in the inner plies, and formed of interwoven ground weft threads and ground warp threads which do not pass from ply to ply, a further inner ply formed of weft threads only and located between two of said first inner plies, and additional warp binder threads binding said plies and interlocking the weft threads of said further inner ply between said two first inner plies.

8. A multiple belting fabric comprising a plurality of inner and outer plies, each including a ground weft and a ground warp independent of the ground weft and ground warp of other plies, a number of selvage cords extending along the edge of the fabric, the wefts of the outer plies passing alternately outside one of said cords and inside another of said cords, and a lacing thread passing sinuously along the edge of the fabric and around said cords and covering the said outer ply wefts at points where these pass outside said cords.

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