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WOVEN FABRIC

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Fig. 1.

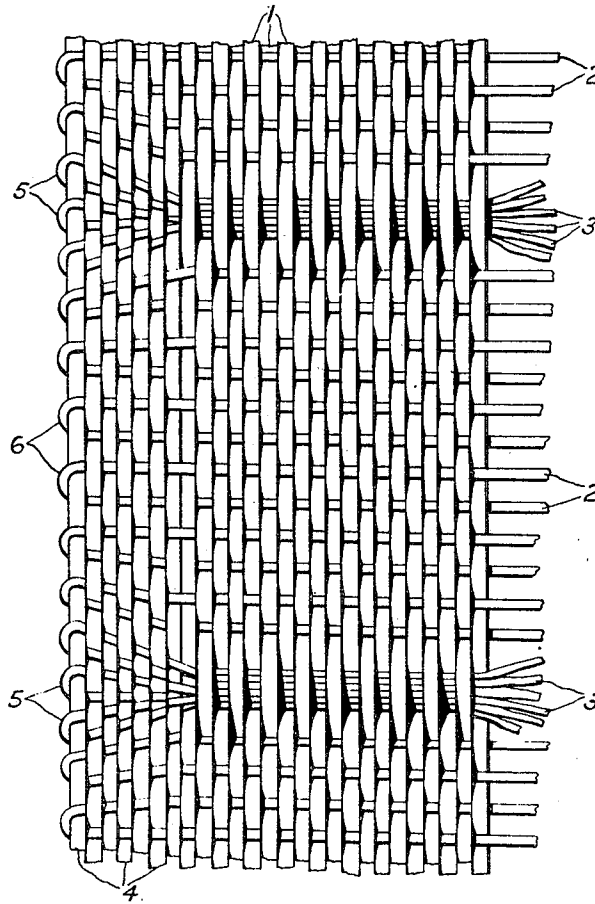
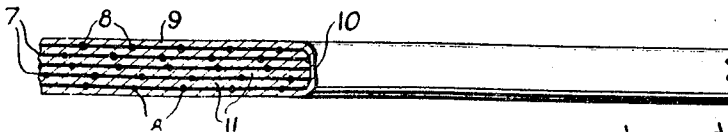


Fig. 2.



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This invention relates to woven fabrics and is particularly concerned with heavy, canvas-like fabrics designed for use in belts and belting, for example conveyor belts and power transmission belts.

In conveyor belts and belts for power transmission having a basis of woven fabric, difficulty frequently arises in making a strong and secure joint between the ends of the belt. The stress in the continuous part of the belt is carried by the warp yarns running parallel to the length of the belt but at the point where the ends are joined, the stress must also be taken by the weft yarns near the ends and by the cohesion between these weft yarns and the warp yarns. This commonly necessitates the use of a greater quantity of weft, to provide the necessary strength at the joint, than would otherwise be desirable. But for the joint, it would be desirable to keep the weight and number of the weft threads down to a minimum both to facilitate manufacture, and also to make full use of the strength of the warp yarns and to give a fabric which will not stretch unduly in use. It is an object of the present invention to provide a belting fabric which, without containing an undue quantity of weft, enables a strong joint to be made between the ends of a belt containing the fabric.

According to the present invention, a belting fabric comprises heavy warp yarns and weft yarns woven together and is provided, at short intervals along the length of the fabric, with a weft of several times the weight of the weft employed elsewhere in the fabric. The heavy wefts thus occurring at intervals along the length of the fabric are preferably in the form of several picks (for example from four to ten) inserted, over substantially the whole width of the fabric, in the same shed by appropriate arrangements in the plan or system by which the warps are shedded.

With a belting fabric of this character it is possible to arrange that a heavy pick or a group of picks is presented to the belt-fastening means in each of the ends that are to be joined together. This is found to give a much higher tear-out strength at the fastening than when a uniformly woven fabric containing the same weight of weft is employed. Or, for the same or even a somewhat higher tear-out strength the total weight of weft employed in the fabric may be reduced, enabling better use to be made of the tensile strength of the warp yarns. Thus the ratio of the total weight of weft to the total weight of warp in the fabric, instead of being from about

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0.6 to 0.35 depending chiefly on the weight of the fabric (heavier fabrics tending to have a lower ratio) may in the fabrics of the present invention be reduced to from about 0.5 to 0.2.

The invention is of particular advantage in belts in which a fabric foundation, generally in the form of several layers of fabric secured together by means of rubber or other flexible adhesive, is provided with a covering of rubber or like flexible material to give a smooth surface of the desired texture and consistency. The ends of such belts may be joined by various means, e. g. a simple lacing passing through holes punched in the belt at a little distance from each of the ends to be joined, or a metal fastener presenting a series of hooks or points to each of the ends of the belt. Care should be taken to include, within the scope of the fastening means at each of the ends to be joined, a heavy weft in the majority, and preferably in each, of the fabric layers of the belt. This can be done by making the scope of the fastener at each end to be joined at least as great as the distance between the heavy picks or the groups of picks in the fabric. This distance may be, for example, from $\frac{1}{2}$ " to 2" according to the character of the belt.

The invention is also of particular advantage where the yarns employed in the fabric, and particularly in the warp, are made of continuous artificial filaments, e. g. filaments of high tensile strength made by stretching filaments of cellulose acetate or other organic derivative of cellulose in the presence of wet steam or other agent adapted to facilitate stretching. Where the filaments that are stretched are of cellulose acetate or other ester of cellulose, they are preferably saponified after being stretched. Continuous filament yarns, and particularly yarns of highly stretched continuous filaments, have a very slippery character so that there is a marked tendency for weft yarns close to the cut end of the fabric to slip. In addition warp yarns which are of high tensile strength on account of having been stretched are particularly liable to a diminution of their effective strength through being woven with too dense a weft. Both of these difficulties are overcome or substantially reduced by the present invention. The invention may also be applied with advantage to belts containing other kinds of yarn, e. g. to belts in which the warp yarns or the weft yarn or both are of linen, cotton or artificial staple fibres made by cutting continuous filaments into staple lengths.

While the belting fabrics to which the present invention relates may be classified generally as

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heavy fabrics, this class of fabrics covers a fairly wide range of weights. Thus, it includes a light canvas, having warp yarns of about 500 denier spaced at about 50 ends per inch, woven with a weft of, say, 350 denier at an average spacing of 40 picks per inch. On the other hand, a heavy fabric may be woven having warp yarns of 5000 denier or more, spaced at 22 ends per inch or less according to the denier, and woven with a weft of, say, 2500 denier at an average spacing of about 12 picks per inch. The distribution of weft between the heavy and the light picks can be arranged so that from a quarter, up to as much as two-thirds of the weight of the weft is in the heavy picks, and the remainder uniformly distributed along the length of the fabric.

A belting fabric according to the present invention, and belts made therefrom, may be employed for most purposes in which joined belts are required. One particularly important application of the invention is for conveyor belts as used underground in coal mines. Belts used for this purpose work under very severe conditions giving rise to frequent breakage, often require changes of length as the circumstances of their use alter, and need to be joined by fastenings of the simplest type. Each of these factors makes the belts and belting fabrics according to the present invention, particularly advantageous.

The following are given as examples of a belting fabric in accordance with the invention:

Example I

The fabric is made with a warp of continuous filament yarn made by stretching continuous filament cellulose acetate yarn in the presence of wet steam to ten times its original length and then saponifying the stretched yarn. Each warp yarn is made by doubling together three ends each of 1100 denier. The warps are spaced in the fabric at 28 ends per inch. This warp is woven with a weft of similar material, but made by doubling together three ends of about 750 denier. The wefts are inserted in the fabric at an average density of 18 picks per inch but of these 18 picks 12 are inserted in separate sheds and, except at the selvages, the remaining 6 picks are inserted all in the same shed. At each of the selvages, a narrow band of fabric six ends in width is formed, in which all the picks are in separate sheds. This is done in order to secure, at the edges of the fabric, the six picks that are inserted in a single shed for the remaining and major part of the width of the fabric.

In this way a fabric is produced having, across almost the whole of its width, a heavy pick, of 6 times the weight of the picks used elsewhere in the fabric, occurring once every inch of fabric and alternating with a series of 12 single picks. A comparative test was made between such a fabric and a fabric exactly similar except that the wefts were uniformly spaced in separate sheds. In the test a cord lacing was passed through a hole punched near the cut edge of the fabric, and a load was applied to the cord in a fabric strength testing machine. The tear-out strength in the fabric according to the invention was 412 lbs., against a tear-out strength of only 108 lbs. in the comparative fabric, notwithstanding that the warp-tensile strengths of both fabrics were substantially equal at 430 lbs. per inch width.

Example II

A belting somewhat lighter than that of Example I is prepared from a warp of singles yarns

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of 2200 denier, spaced in the fabric at 32 ends per inch. As in Example I the yarns consist of stretched and saponified cellulose acetate continuous filaments. The weft yarns are of the same kind and denier as the warp yarns, and are spaced at an average density of 18 picks per inch, woven in the same way as in Example I.

In the drawing, Fig. 1, which is a diagrammatic view of a portion of fabric near the edge thereof, shows generally the structure of the belting fabric in accordance with the invention, and agrees in detail with Examples I and II, and

Fig. 2 is a diagrammatic edge view partly in section of a multi-ply belt in accordance with the invention.

The warps 1 are as closely spaced as conveniently possible, so as to give the maximum warp strength per inch width of fabric. The wefts are less closely spaced, and comprise single picks 2, groups of 12 which alternate with heavy multiple picks 3 each consisting of 6 yarn ends. At the edges of the fabric, however, for a distance of 6 warp ends 4, all the weft yarns 2 and 3 are separate so that the weft yarns 3 are securely bound at the edges of the fabric at the points 5, in the same way as the weft yarns 2 at the points 6.

The fabrics described above can be made up into multi-ply belts of from two to six plies or more, according to the weight of the individual fabric and the desired weight of the product. The individual fabrics are given a friction coating of rubber; that is they are passed between the two lower bowls of a calender of which the middle bowl carries a thin layer of rubber stock and rotates faster than the lower bowl, so that the stock is ground into the fabric, which travels at the same speed as the lower bowl. If desired, the frictioned fabric may be given a further coating, or "skim" coating by a calendering operation in which the two lower bowls rotate with the same surface speed as the fabric passing between them, and in which a thin layer of rubber carried by the middle bowl is caused to adhere firmly to the friction coating. The coating or coatings of rubber thus imparted serve to bind the several layers of fabric together in the multi-ply belt. The assembled and adhering layers are given an external coating of rubber or the like of substantial thickness, e. g. from $\frac{1}{8}$ " to $\frac{3}{8}$ ", extending round the edges as well as over the surfaces of the assembled layers. A 5-ply belt of this kind is shown diagrammatically in Fig. 2 in which the individual fabrics are indicated at 7, and the heavy wefts therein at 8. The external coating of rubber 9 extends round the edge of the belt as indicated at 10. Thin layers of rubber at 11, between the fabrics 7, firmly unite the several fabrics together, the rubber being ground into the fabric as indicated above.

Having described my invention, what I desire to secure by Letters Patent is:

1. A belting fabric comprising single wefts and heavy and closely spaced warp yarns woven together, and having at short intervals along the length of the fabric and extending at least across the whole width of the fabric between the selvage bands thereof, grouped wefts, inserted in one shed, of the yarn employed as the single wefts elsewhere in the fabric.

2. A belting fabric comprising single wefts and heavy and closely spaced warp yarns woven together, and having at short intervals along the length of the fabric, grouped wefts, inserted over the greater part of the width of the fabric in one shed, of the yarn employed as the single wefts

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elsewhere in the fabric, said latter wefts being inserted, over a narrow selvage band at each edge of the fabric, all in different sheds.

3. A belting fabric consisting of continuous filament yarns of high tensile strength made by stretching continuous filaments in the presence of a softening agent for the substance of the filaments, said fabrics comprising weft yarns and heavy and closely spaced warp yarns woven together, and having at short intervals along the length of the fabric and extending at least across the whole width of the fabric between the selvage bands thereof, an isolated weft of several times the weight of the weft employed elsewhere in the fabric.

4. A belting fabric consisting of continuous filament yarns of high tensile strength made by stretching continuous filaments of cellulose acetate in the presence of moist steam and saponifying the stretched filaments, said fabric comprising weft yarns and heavy and closely spaced warp yarns woven together, and having at short intervals along the length of the fabric and extending at least across the whole width of the fabric between the selvage bands thereof, an isolated weft of several times the weight of the weft employed elsewhere in the fabric.

5. A belting fabric consisting of continuous filament yarns of high tensile strength made by stretching continuous filaments of cellulose acetate in the presence of moist steam and saponifying the stretched filaments, said fabric comprising single wefts and heavy and closely spaced warp yarns woven together, and having at short intervals along the length of the fabric, grouped wefts, inserted over the greater part of the width of the fabric in one shed, of the yarn employed as the single wefts elsewhere in the fabric, said latter wefts being inserted, over a narrow selvage band at each edge of the fabric, all in different sheds.

6. Belts and belting materials comprising a plurality of layers, united together, of belting fabric comprising single wefts and heavy and closely spaced warp yarns woven together, and having at

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short intervals along the length of the fabric, grouped wefts, inserted over the greater part of the width of the fabric in one shed, of the yarn employed as the single wefts elsewhere in the fabric, said latter wefts being inserted, over a narrow selvage band at each edge of the fabric, all in different sheds.

7. Belts and belt materials comprising a plurality of layers, united together, of belting fabric consisting of continuous filament yarns of high tensile strength made by stretching continuous filaments of cellulose acetate in the presence of moist steam and saponifying the stretched filaments, said fabric comprising single wefts and heavy and closely spaced warp yarns woven together, and having at short intervals along the length of the fabric, grouped wefts, inserted over the greater part of the width of the fabric in one shed, of the yarn employed as the single wefts elsewhere in the fabric, said latter wefts being inserted, over a narrow selvage band at each edge of the fabric, all in different sheds.

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