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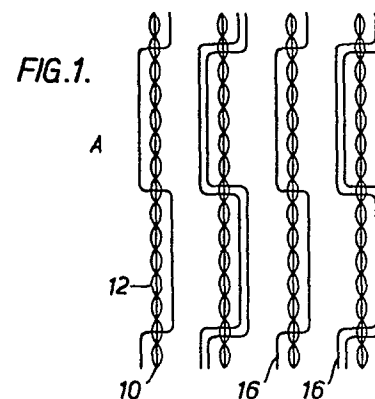
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(54) **Bulked fabric, method of making it, and apparatus therefor.**

(57) A bulked fabric having pile loops resembling an astrakan fabric is made on a crochet warp knitting machine by feeding ground yarns to the needles to knit pillar stitches therewith; feeding filling yarns to the needles in such a manner that they lap at least two needles; and feeding heavy count pile yarns such that they are knitted in, stitched through, or both.



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BULKED FABRIC, METHOD OF MAKING IT,
AND APPARATUS THEREFOR

This invention relates to a bulked fabric and to a method of making the same.

Various types of knitted pile or 'fur' fabrics are available, e.g. sliver knit fabrics. However fabrics in which heavy gauge yarns are used in the pile, e.g. for 'astrakan'-type or other textured effects, are difficult or impossible to make by machine knitting since the knitting needles cannot handle the heavy gauge yarns.

The invention seeks to provide a method of making a bulky, textured or pile fabric having one surface of heavy gauge yarn by a machine knitting technique.

According to the present invention there is provided a method of making a bulked fabric on a warp knitting machine which comprises feeding ground yarns to the needles to knit pillar stitches therewith; feeding filling yarns to the needles in such a manner that they lap at least two needles; and feeding heavy count pile yarns to the needles such that they are knitted in or stitched through, or both.

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The invention also provides a fabric from pillar stitches of ground yarns connected coursewise by filling yarns and having on one surface heavy count pile yarns giving a bulky or textured effect.

5 The term "pile" is used herein for convenience (although fabrics encompassed may not always be true pile fabrics in the normal sense of the word) to denote the yarns used to give the surface effect to the fabrics and distinguish them
10 from the ground and filling yarns. The surface effect may vary from bubbly loops of coarse pile yarn resembling an "astrakan" fabric, to a textured fabric resembling lengths of the coarse pile yarn laid side by side. In each case however
15 the distinctive feature of the fabric comprises the heavy count pile yarns.

 According to the present invention there is also provided an apparatus which comprises a
20 crochet warp knitting machine having carbine needles and at least two laying-in bars carrying thread tubes, in which at least one bar carries thread tubes larger than the separation between adjacent needles, the said bar being adjusted
25 such that the extremities of the tubes remain clear of the needles throughout the travel of the bar.

 The ground yarn knits the basic pillar stitches of the fabric and may be any suitable textile yarn of natural or synthetic fibres,
30 although the use of carbine needles will normally mean that a fine count yarn will be selected. Accordingly mono filament or multifilament synthetic yarns of fine denier are preferred, e.g. polyamide or polyester filaments, although
35 other yarns or threads may be employed.

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5 The ground yarns pass through a guide bar to the needles, and the guide bar is programmed to cause the needles to knit a pillar stitch. The pillar stitch may be open or closed, where the machine used gives a choice.

10 The filling yarns may be virtually any textile yarns or filaments formed from staple or continuous fibres. Their chief function is to bind the pillar stitches into a coherent fabric and to present a reverse face for the finished fabric. The yarns may be of natural or synthetic fibres, e.g. polyester, polyamide, ethylenic, polyvinyl chloride (PVC) acrylic, regenerated cellulosics, cotton, and keratinous fibres such as wool. For many purposes acrylic yarns are preferred.

15 The filling yarns bind the pillar stitches of ground yarns into a fabric and may have any of the stitch constructions; tuck-lap, inlay-lap, pillar-lap, or float-lap. For most uses an inlaid filling yarn is preferred, since this type of construction gives the fabric dimensional stability in the course-wise direction.

20 In one embodiment of the invention, the heavy count pile yarns extend over at least one course and preferably they extend over several courses, e.g. five or six, between attachments. The pile yarns are fed from the large thread tubes, and are under low tension as they are knitted into the fabric where they cross a wale of pillar stitches. This in turn has the result the float lengths of the pile yarns tend to loop and 'bubble' up from the surface of the knitted fabric giving an astrakan effect. The pile yarns are of heavy count, i.e. they are heavier than can normally be knitted with the type of machine being employed.

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Thus the thread tubes are enlarged and, in order to inlay the pile yarns into a backing fabric of the required gauge, at the gauge (i.e. number of needles per inch) selected the thread tubes will preferably be larger than the needle separation. In order to prevent the tubes fouling the needles during knitting, the laying-in bar carrying these tubes is adjusted so that the tubes do not intersect with the needles' path, but are, at their lowest position, tilted forward to feed the pile in between the lines of movement of, but in front of, adjacent needles.

Often, owing to the preferred long float stitches of pile yarn and low operating tension, the pile yarn will 'wander' into the path of an adjacent needle. Owing to the use of carbine needles, this results in the needle penetrating the yarn and stitching through it, thus providing an additional point of attachment of the pile yarn to the fabric. Although this occurs randomly, it occurs often enough to provide substantial extra anchoring points for the pile yarn, which is therefore far more firmly fixed into the fabric than would be apparent from the nominal one inlay stitch every few courses.

In a second embodiment of the invention, by programming the ^{guide bar or} laying-in bar carrying pile yarn thread tubes to hold the tubes in front of the needles (but above them) a textured or pile fabric is produced in which the 'stitched-through' attachments predominate and indeed the pile yarn will only be knitted-in occasionally and need not be knitted at all, reversing the conditions obtained with the fabric of the first embodiment. The fabric produced by this embodiment of the present

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invention is an equally useful and attractive textured or pile fabric.

5 In order to make fabrics according to the second embodiment there is no need to adjust the laying-in bar so that the extremities of the tubes remain above and to the front of the needles throughout the travel of the bar. Instead, it is preferred to adjust the laying-in bar so that the tubes are well towards the back of the needle
10 travel, although still above the needles to prevent interference between the tubes and the needles. Further it is also preferred to feed the pile yarns under some tension so that they are held reasonably firm allowing the carbine needles to
15 penetrate them, in contrast to the virtually tensionless feed preferred in our above method.

The laying-in bars carrying the pile yarn need not be racked at all, in which case, the 'pile' yarns would be stitched in at every
20 course and a textured fabric would be produced with no 'pile' as such at all. By racking to one side or the other, the pile yarn avoids being stitched in at selected courses and thus loops of it appear in the fabric. If the pile yarn thread tubes are
25 racked as far as the next adjacent needle the pile yarns will be stitched in at that needle. Therefore in order to give a more bulky effect it is often preferable to rack the guide bar by less than the distance between adjacent needles.

30 The racking of the laying-in bars carrying the pile yarns may be achieved simply on the preferred crochet machines used in the practice of the invention by, for example, programming the laying-in bar for 10 gauge operation while
35 setting the needles and remaining yarn feeds for

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5 gauge operation. Thus the pile yarn thread tubes will only move a small distance on either side of their corresponding needle - half the distance they would if programmed for 5-gauge operation.

5 The heavy count pile yarns may be stitched through every few courses. The pile yarns are fed from the large thread tubes and are under tension as they are stitched through into the fabric, where they are in front of a carbine needle.

10 Owing to the relatively heavy count of the pile yarns in relation to the needle separation or gauge, adjacent wales of pile yarn tend to touch one another thereby giving a total cover of pile yarn to the fabric, the filling and ground yarns
15 being unnoticeable from the front of the fabric. Depending on the number of attachments of the pile yarn (whether by stitching through or knitting in) float lengths of it may tend to rise above the fabric surface increasing the textured or
20 bulky effect.

 The pile yarns are of heavy count, i.e. they are heavier than can normally be knitted at the gauge (i.e. number of needles per inch) being employed. Thus the thread tubes are enlarged
25 and, in order to inlay the pile yarns into a backing fabric of the required gauge, at the gauge selected the thread tubes will preferably be larger than the needle separation. In order to prevent the tubes fouling the needles during knitting, the laying-in bar
30 carrying these tubes is adjusted so that the tubes do not intersect with the needles' path, but are, at their lowest position, above the locus of the needles' movement, but preferably towards the back of the needles' travel, feeding the pile
35 yarn in front of the needles rather than in between

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them as in conventional laying-in.

The pile yarn will be in the path of its corresponding needle and this results in the needle penetrating the yarn and stitching through it, thus attaching the pile yarn to the fabric. Should the yarn 'wander' further than the programmed racking, it may also cross an adjacent wall of pillar stitches and thus be knitted into the fabric, and this provides additional points of attachment.

Since the intended use of the fabric is for decorative outerwear or home furnishings, the pile yarns will be chosen to give an attractive resultant fabric. However any heavy count yarn natural or synthetic, staple or filament may be used. It is preferred to use bulky woolen-spun staple fibre yarns of acrylic or wool fibres, which may of course be dyed to any desired colour, or be uncoloured, or be naturally coloured, e.g. berber yarns.

The pile yarns may be singles or folded yarns. Alternatively a bundle of single or folded yarns may be fed to each needle, for greater bulk.

Generally any warp knitting machine having three or more guide bars may be used to produce the fabric of the invention, but machines having carbine needles rather than latch needles, are preferred to result in the desirable stitching through of stray pile yarns. Crochet warp knitting machines are preferred. In these the first 'guide bar' is replaced by a mechanism automatically programmed to knit pillar stitches and the machine has "laying-in" bars equivalent of the second and subsequent guide bars.

Naturally the various yarns used in the fabric may be coloured or plain, but since the principal end-use of the fabric is likely to be in outerwear

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coloured or decorative yarns are likely to be used. Decorative effects are quite possible by varying the colour of some or all of the pile, filling or elastic yarns.

5

The fabric of the invention may be made up into garments, mainly, but not exclusively, to be worn as outer clothing, e.g. 'fur' coats. Such garments help keep the wearer warm under adverse conditions, and are decorative and fashionable. Other uses include the home furnishing field, e.g. upholstery and curtains, and the fabric of the invention may be used alone or backed with another fabric or other material.

10

15

The invention will be described further in the following examples, which refer to the accompanying drawings, the two figures of which are lapping diagrams of one type of fabric according to the invention.

Example 1

20

The fabric illustrated in Figures 1 and 2 was knitted on a Comez M.T.B. crochet machine using the pillar stitch mechanism and the first two laying-in bars of the available five. The machine was used with a half needle set at 5-gauge. A full set of threads was supplied each needle as follows:

25

ground yarn:	2/150 denier polyester
filling yarn:	3/16's c.c. acrylic yarn
pile yarn:	0.5's w.c. lofty wollen yarn

30

35

The machine is set to knit closed pillar stitches 12 with the ground threads 10. The first laying-in bar, carries the acrylic filling yarns 14 and performs a 3 and 1 inlay lap; the second laying-in bar carries the pile yarns 16 under low tension through enlarged thread tubes in front

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of and between the needles, and performs an inlay lap as illustrated in Figure 1. It can be seen that one yarn and two yarns are employed alternately at adjacent needles.

5 The fabric so made has a 'bubbly' pile astrakan appearance and may be used to make, for example, a simulated fur coat. The pile yarns are both knitted into the base structure and, randomly, stitched through as well.

10 Example 2

 Using the machine, yarns and threading of Example 1, the second laying-in bar is adjusted so that the thread tubes are in line with their respective needles but are above them and
15 towards the back of the needles' travel. The pile yarns are fed under tension, and the second laying-in bar is adjusted to rack alternately to each side of the needles according to 10 gauge operation.

20 A textured fabric with a loop pile is produced in which the pile yarns are attached chiefly by being stitched through, only occasionally being knitted in to the base fabric structure. The fabric is useful in the home furnishings field.

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Claims:-

1. A method of making a bulked fabric on a warp knitting machine which comprises feeding ground yarns to the needles to knit pillar stitches therewith; feeding filling yarns to the needles in such a manner that they lap at least two needles; and characterised by feeding heavy count pile yarns to the needles such that they are knitted in or stitched through, or both.
2. A method according to claim 1 in which the pile yarns are fed through thread tubes on the guide bar of a warp knitting machine characterised in that the thread tubes are larger than the separation between adjacent knitting needles and the guide bar carrying the tubes is adjusted so that the tubes do not intersect the needles' path but are, at their lowest position, tilted forward to feed the pile yarn in between the lines of movement of, but in front of, adjacent needles.
3. A method according to claim 1 in which the pile yarn is fed through thread loops on the guide bar of a warp knitting machine characterised in that the guide bar is aligned so that the thread tubes remain above and to the front of the needles throughout the travel of the bar.
4. A method according to claim 3 characterised in that the laying-in bar is adjusted so that the tubes are well towards the back of the needle travel although above the needles to prevent interference between the tubes and the needles.
5. A method according to any of claims 1 to 4 characterised in that the ground yarns are fine

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denier synthetic yarns, the filling yarns are staple acrylic yarns, and the pile yarns are heavy count woolen spun yarns.

5 6. A fabric formed from pillar stitches of ground yarns connected course wise by filling yarns characterised by having on one surface heavy count pile yarns attached, at least in part, to the fabric by being stitched through, forming a bulky or textured effect on that surface.

10 7. A fabric according to claim 6 characterised in that it is attached to the surface by being knitted in as well as being stitched through.

15 8. An apparatus which comprises a crochet warp knitting machine having carbine needles and at least two laying in bars carrying thread tubes characterised in that at least one bar carries thread tubes larger than the separation between adjacent needles, the said
20 bar being adjusted such that the extremities of the tubes remain clear of the needles' path throughout the travel of the bar.

9. An apparatus according to claim 8 in which the said at least one bar is adjusted
25 so that the tubes are, at their lowest position, tilted forward between the lines of movement of, but in front of, adjacent needles.

10. An apparatus according to claim 9 characterised in that the said at least one bar
30 is adjusted so that the tubes are in line with their respective needles but are, at their lowest position, above the locus of the needles' movement towards the back of the needles' travel.

11. An apparatus as claimed in claim 10
35 characterised in that the said at least one bar is racked to a smaller extent than the needles' separation during operation.

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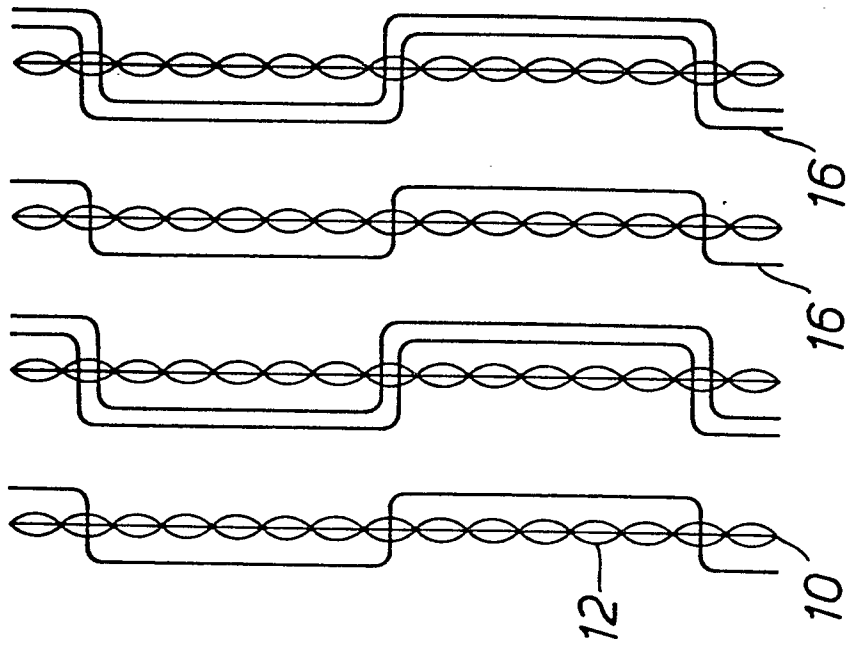


FIG. 1.

A

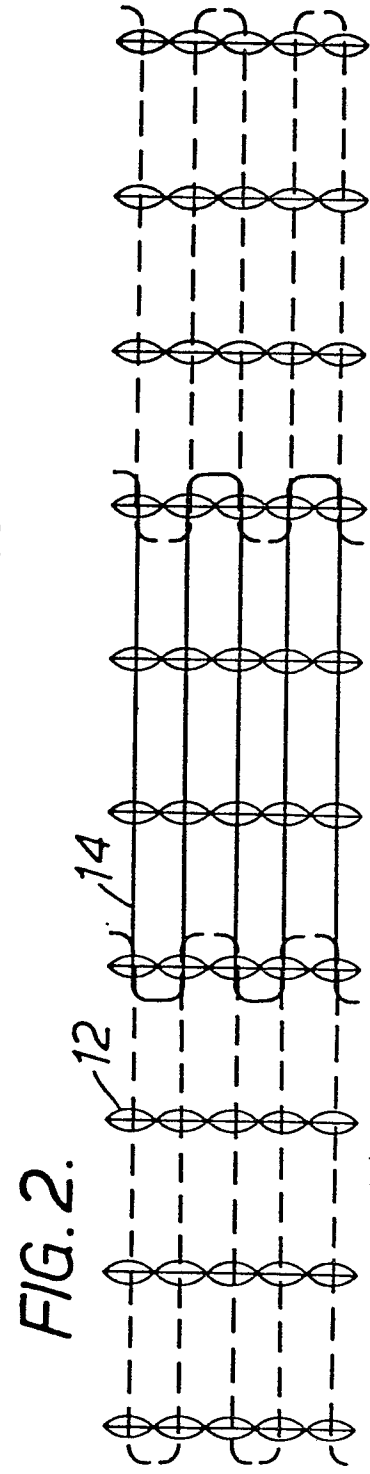


FIG. 2.

B



DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
	FR - A - 1 189 829 (AUGUST BUNGER BOB-TEXTILWERK) * Page 2, right-hand column, line 54 - page 3, right-hand column, line 18; page 4, left-hand column, line 47 - right-hand column, line 4; figure 2 * & GB - A - 822 184 & GB - A - 822 185 --	1	D 04 B 21/02// 25/08
	FR - A - 2 313 486 (I.W.S. NOMINEE) * Page 2, lines 25-36; page 4, lines 1-10; figure 1 * --	1,5	TECHNICAL FIELDS SEARCHED (Int. Cl. ³)
P	GB - A - 2 044 309 (WIRKMASCHINEN-BAU KARL-MARX-STADT) * Page 1, lines 109-111; page 2, lines 15-22; figures 1,3 * --	1,11	D 04 B
A	GB - A - 1 557 328 (DALEMAR) * Whole document * --	1	CATEGORY OF CITED DOCUMENTS
A	GB - A - 1 188 965 (APOLDA) * Whole document * --	1	X: particularly relevant A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: conflicting application D: document cited in the application L: citation for other reasons
A	GB - A - 2 012 828 (WIRKMASCHINEN BAU KARL-MARX-STADT) * Whole document * -- . / .	1	&: member of the same patent family, corresponding document
X The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		24-04-1981	V. GELDER



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EUROPEAN SEARCH REPORT

Application number
EP 81 30 0212
-2-

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl.)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
A	DE - A - 2 735 329 (WIRKMASCHINEN-BAU KARL-MARX-STADT) * Whole document * ----	1	
			TECHNICAL FIELDS SEARCHED (Int. Cl.)