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54 **Process for manufacturing a run-resisting fabric and a knitted fabric structure obtained thereby.**

57 The process comprises the provision, in a rectilinear knitting machine, of two beds arranged substantially in the shape of an inverted V, one bed comprising a plurality of feed tubes for warp threads, the other bed comprising a corresponding plurality of needles, each tube being operatively associated with each needle and receiving an individual warp thread; the selection of preset needles of the plurality of needles by means of carriage means which are alternately movable along the needle bed, the selected needles being caused to protrude from the vertex of the V by a preset extent; feeding the selected needles with a weft thread by means of thread-guiding means controlled by the carriage and the simultaneous feeding of the selected needles with further warp threads fed by respective associated tubes, and finally dropping the needles with the threads engaged thereon to form a longitudinal row of knitting.

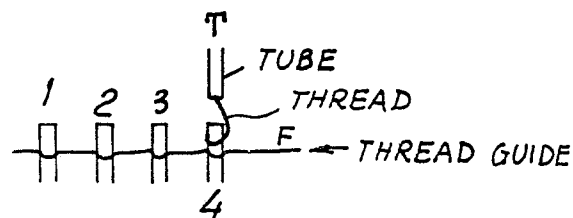


Fig. 3

PROCESS FOR MANUFACTURING A RUN-RESISTING FABRIC AND A KNITTED FABRIC STRUCTURE OBTAINED THEREBY

The present invention relates, according to one of its aspects, to a process for manufacturing a run-resisting fabric, and a knitted fabric structure obtained thereby, and in particular to a process for manufacturing a run-resisting, high-stability, reproducible, knitted fabric, with patterns variable within a wide range, and which is industrially stackable in packs.

According to another aspect, the invention relates to a structure of knitted fabric manufactured by means of the process according to the invention.

The Italian patent No. 1,057,978 in the name of Toshikazu ITO (of Japanese nationality) discloses a knitted fabric comprising stitches connected in the direction of the warp and stitches connected in the direction of the weft, characterized in that a plain stitch of the knitting is formed using weft threads, in each longitudinal row of knitting a warp thread is knit-in into one of every two transverse rows in the form of a locking stitch, to form chain stitches, and sinker loops of said chain stitches are exposed for a long portion on the reverse side.

In said known knitted fabric the colors of the warp thread are changed appropriately in the longitudinal rows of knitting to form a striped configuration on the reverse side of said fabric.

In particular in said known fabric all the chain stitches are connected by means of sinker loops of a plain stitch, so as to thus prevent an excessive elongation of the knitted structure in the direction of the weft and provide the tight knitting of said knitted structure.

The aim of the abovementioned Italian patent was to provide a knitted fabric having an optional warp strip formed on its reverse, changing the warp color in the vertical rows, i.e. in the longitudinal rows of stitches.

Another object was to provide a tight-knitted fabric wherein the structure was not excessively elongated in the direction of the weft, preventing at the same time the forming of open gaps between the stitches, connecting all the chain stitches in the direction of the weft.

Another object of the abovementioned Italian patent was to provide a knitted fabric having a warp strip also on the front side by using a colored thread for stitches appearing on the front side every two transverse rows.

Said known fabric, specifically provided for the manufacture of stockings, was satisfactorily stable, but it was substantially affected by two disadvantages: the first of said disadvantages resided in the

poor flexibility in the execution of the patterns obtainable on said fabric, indeed due to the use of a colored thread for stitches appearing on the front face every two transverse rows.

The other disadvantage resided in that the stability of said fabric, though satisfactory, was however not optimum, so as to allow the industrial stacking in packs of the manufactured fabric, which stacking, as is known, requires an extremely high and optimum stability of the configuration of the formed knitting both structurally and regarding the patterns.

Still another disadvantage ascribable to the knitted fabric described in the abovementioned Italian patent resides in the fact that said fabric cannot be manufactured with extremely fine mesh variable within a wide range.

Therefore, in view of the above, the aim of the present invention is to provide a process for forming an run-resisting, reproducible fabric with high stability and with patterns which are variable within a wide range.

An object of the present invention is to provide a process of the indicated type which allows to manufacture a knitted fabric which can be stacked industrially in packs.

Another object of the present invention is to provide a process of the indicated type which allows to manufacture a knitted fabric having extremely fine mesh which is variable within an extremely wide range.

Still another object of the present invention is to provide a process for manufacturing a knitted fabric of the indicated type which permits extremely high productivity.

Yet another object of the present invention is to provide a process of the indicated type which allows to manufacture a knitted fabric which can have various patterns in various colors, and this without being limited to the production of stripes according to preset transverse rows of the knitting.

According to one aspect of the invention the above described aim and objects, and others which will become apparent hereinafter, are achieved by a process for manufacturing a run-resisting fabric as defined in claim 1. According to another aspect of the invention, the above described aims and objects, and others which will become apparent hereinafter, are achieved by a knitted fabric structure obtained by means of said process, as defined in claim 7.

Further advantages of the process according to the invention and of the structure of knitted fabric produced thereby will become apparent hereinafter

from the following detailed description of an embodiment thereof, illustrated only by way of non-limitative example in the accompanying schematic drawings, wherein:

figure 1 is a schematic view of a conventional plain knitting structure as seen from the front side thereof;

figure 2 is a view of the same fabric structure in conventional plain knitting as figure 1, seen from the reverse side;

figure 3 is a schematic view illustrating the main steps of the process according to the invention for manufacturing the knitting structure according to the invention;

figure 4 is a view of a possible procedure for locking the stitches of the knitted fabric structure according to the invention;

figure 5 is another schematic view of another possible procedure for locking the stitches of the knitting structure according to the invention;

figure 6 is a schematic view of the procedures illustrated in figures 4 and 5;

figure 7 is a view of the knitted fabric structure according to the invention, seen from the reverse side;

figure 8 is a view of a possible configuration of the knitted fabric structure according to the invention, seen from the front side; and

figure 9 is a schematic view of a configuration of the fabric according to the invention.

With more specific reference to figures 1 and 2, said figures schematically illustrate a conventional plain-knitted fabric, in particular a knitted fabric of the so-called "chain" type, which is obtained on machines fed not by a single reel but by a series of parallel threads which are arranged so as to form as many longitudinal rows of loops: the linking, in particular, is executed both in the direction of the weft and in the direction of the warp or chain, so that each longitudinal row of loops is linked to the nearby longitudinal row. The obtained knitting is of the run-resisting type, and is constituted by a transverse series of rows of knitting or transverse rows and by a longitudinal series of lines of stitches.

Said known plain knitting is very loose, and the only possible variation is a variation in colors or based on appropriate selections of appropriate types of needles, said selection being generally obtained by means of cams acting on said needles.

Said known knitting is furthermore not very stable and cannot be industrially packaged in packs, this defect adding to the abovementioned looseness of said knitting and to the poor versatility of patterns obtainable.

According to the invention, and with specific reference to figure 3, a process has been specifi-

cally conceived to provide a plain knitting which however has high stability, such as to allow it to be packed, and afford a high degree of versatility regarding patterns as well as high degrees of fineness.

In particular, the process according to the invention, which can be carried out on a rectilinear knitting machine of the type having means for the simultaneous feeding of at least two threads to the needle, and more specifically of a thread F, which can be generally likened to a weft thread, and a thread F1, which can be generally likened to a warp thread, said threads F and F1 possibly having preset different colors.

Specifically, during the forming of the knitting with the process according to the invention, each individual needle 1, 2, 3, 4 is loaded, besides with the thread F carried by a thread-guiding element controlled by the carriage of the machine, also by a further thread F1 guided by a tube-like element which is part of a bar of tubes (not illustrated) which constitute a bed of tubes which forms, together with the needle bed, a configuration which is substantially in the shape of an inverted V and has been specifically described in the abovementioned type of rectilinear knitting machine.

In particular a respective tube T for the feeding of individual warp threads has been associated with each needle 1, 2, 3, 4 in the machine according to the abovementioned type of rectilinear knitting machine.

With such a structure of the machine, the process according to the invention is as follows:

in a first step, the carriage of the machine (not illustrated) selects, by virtue of its cam means and according to the program of the machine, preset needles of the plurality of needles which form the needle bed, the selected needles being caused to protrude from the vertex of the inverted-V configuration of the needle bed.

Then the selected needles are fed with the weft thread F by means of thread-guiding means, not illustrated specifically and controlled by the carriage (also not shown), and further warp threads F1 are simultaneously fed to the selected needles by means of said tubes T. Then the needles, with the threads engaged thereon, are dropped, e.g. during the return stroke of the carriage, to form a transverse row of knitting constituted by so-called "locked" stitches, i.e. stitches formed by means of the association of the thread F of the thread-guide and of the thread F1 of the corresponding tube.

To form said locked stitches according to the invention each individual tube can be moved, after being raised, according to the configurations shown in figure 6, i.e. according to an open loop or according to a closed loop; said tubes, as mentioned, are all supported by a common bar which is

not illustrated.

The locking configurations in the two cases are shown respectively in figure 4, which relates to the open-loop movement of the tube, and in figure 5, which relates to the closed-loop movement of said tube.

The configurations of the formed knitting are correspondingly and respectively illustrated in figures 7 and 8; figure 7 illustrates the reverse side of the knitting while figure 8 illustrates the front side of the knitting according to the invention.

In the above description, the process for forming the knitted fabric according to the invention has been specifically described with reference to each individual tube which feeds each individual respective needle. Naturally, according to a possible variation of the process according to the invention, only preset needles may be fed by respective tubes, and this allows to obtain extensively variable patterns, though they are generally comprised within a substantially rectangular and/or square and/or striped configuration.

Figure 9 schematically illustrates the structure of knitted fabric manufactured with the previously described process according to the invention.

From said figures it can be seen that the knitting structure according to the invention is rather tightly knitted and has, in a vertical direction, for the specific illustrated execution, striped regions with locked stitches, e.g. variously colored ones, which besides imparting stability to the fabric, also impart pleasant color effects thereto.

From the above it can be seen that the invention fully achieves the intended aim and objects.

In particular by virtue of the described process it is possible to manufacture a structure of knitted fabric which is very tightly knit and therefore has high degree of stability, and can therefore be packaged industrially in packs.

Said run-resisting knitting structure is furthermore greatly versatile from the point of view of obtainable patterns and furthermore, by virtue of the fact that a respective tube is associated with each needle on two generally very wide needle beds which comprise a large number of tubes and needles, it is possible to obtain a very fine degree of mesh, variable in any case within an extremely wide interval.

Though the invention has been described with specific reference to a currently preferred embodiment thereof, it should be noted that it is susceptible to numerous modifications and variations, all of which are within the scope of the concept of the invention.

Claims

1. Process for manufacturing a reproducible run-resisting knitted fabric with high stability, with patterns variable within a wide range and industrially stackable in packs, characterized in that it comprises the steps of:

a) providing, in a rectilinear knitting machine, two beds arranged substantially in the shape of an inverted V, one bed comprising a plurality of feed tubes for warp threads, the other bed comprising a corresponding plurality of needles and, operatively associating each said tube with each said needle and receiving an individual warp thread;

b) selecting preset needles of said plurality by means of carriage means which are alternately movable along said needle bed, the selected needles being caused to protrude from the vertex of said V by a preset extent;

c) feeding said selected needles with a weft thread by means of thread-guiding means controlled by said carriage and, simultaneously with said step c), the further step of:

d) feeding said selected needles with further warp threads fed by said respective associated tubes, and

e) dropping, by means of said carriage, the needles with said threads engaged thereon to form a longitudinal row of knitting.

2. Process according to claim 1, characterized in that said step d) comprises the further steps consisting of:

f) raising said tubes which feed said selected needles;

g) causing each said tube and the thread guided thereby to trace a loop-like path around the respective selected needle;

h) causing each said tube to unload the thread guided thereby onto said respective selected needle and returning each said tube to its initial position.

3. Process according to claim 2, characterized in that said loop-like path of each of said tubes around the respective selected needle is an open-loop path.

4. Process according to claim 2, characterized in that said loop-like path of each of said tubes around the respective selected needle is a closed-loop path.

5. Process according to claim 1, characterized in that each tube of said bed of tubes feeds a respective selected needle.

6. Process according to claim 1, characterized in that only preset needles are fed by the respective tubes.

7. Knitted fabric manufactured by means of the process according to any one of the preceding claims, comprising stitches connected in the direction of the warp and stitches connected in the direction of the weft, characterized in that each stitch of said knitting is formed as a locked stitch constituted by the association of two threads fed to each needle selected by associated tube means and by thread-guiding means.

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8. Knitted fabric according to claim 7, wherein the thread fed by said tube means is a warp thread of a preset color, a said warp thread being knitted into each longitudinal row of knitting for each transverse row in the form of a locking thread.

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9. Knitted fabric according to claims 7 and 8, wherein preset stitches of said knitting are locked by said warp threads in preset colors to form substantially rectangular and/or square and/or striped patterns.

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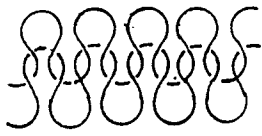


Fig. 1

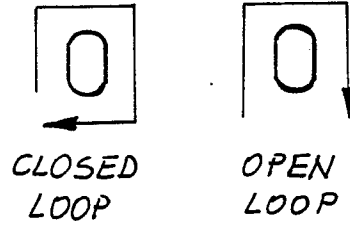


Fig. 6



Fig. 2

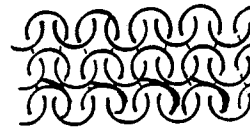


Fig. 7

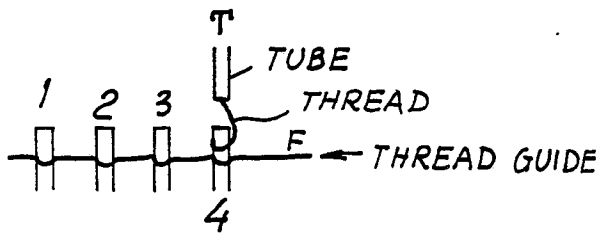


Fig. 3

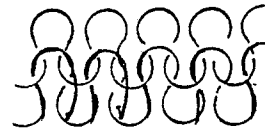


Fig. 8

OPEN
LOOP



Fig. 4

CLOSED
LOOP



Fig. 5

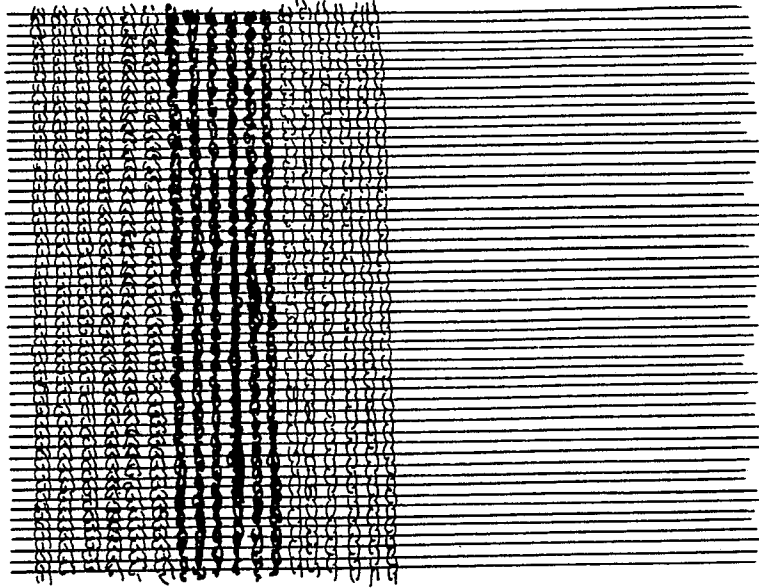
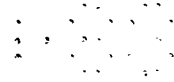


Fig. 9

POOR QUALITY