July 1, 1969 O. STOUSLAND ETAL 3,452,561

NOVELTY YARNS AS SEWING THREADS IN STITCH BONDED FABRICS

Filed Jan. 29, 1968 Sheet 1 of 3

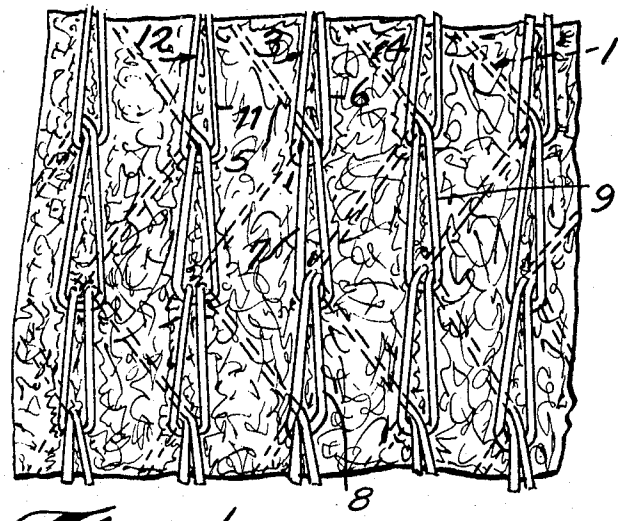


Fig. 1.

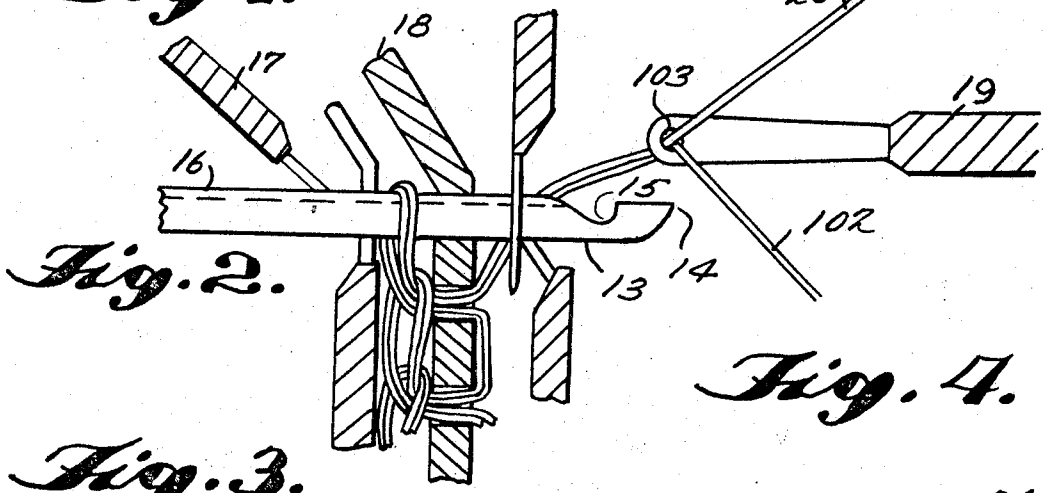
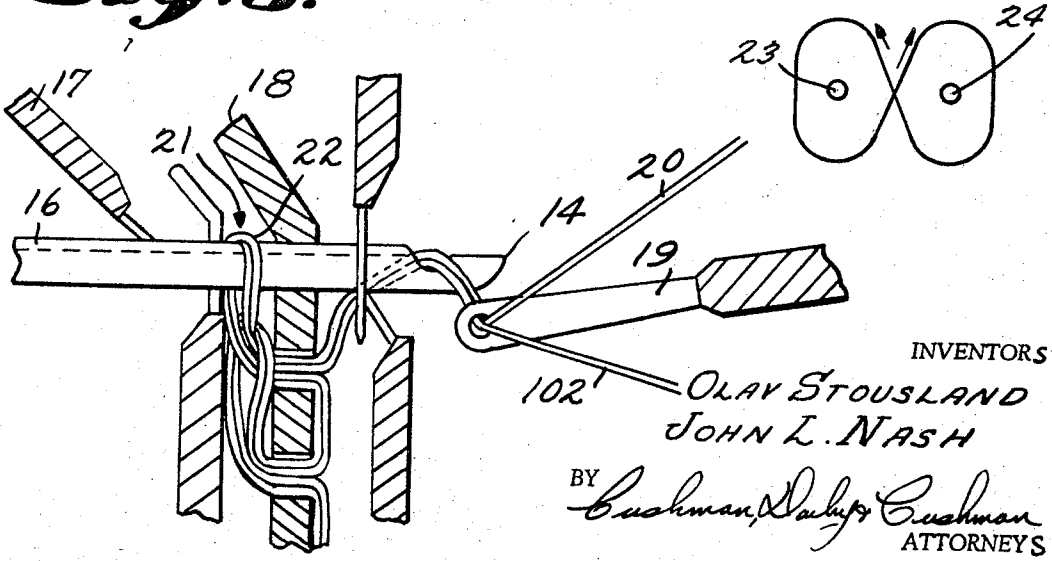


Fig. 2.

Fig. 4.

Fig. 3.



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Filed Jan. 29, 1968 Sheet 2 of 3

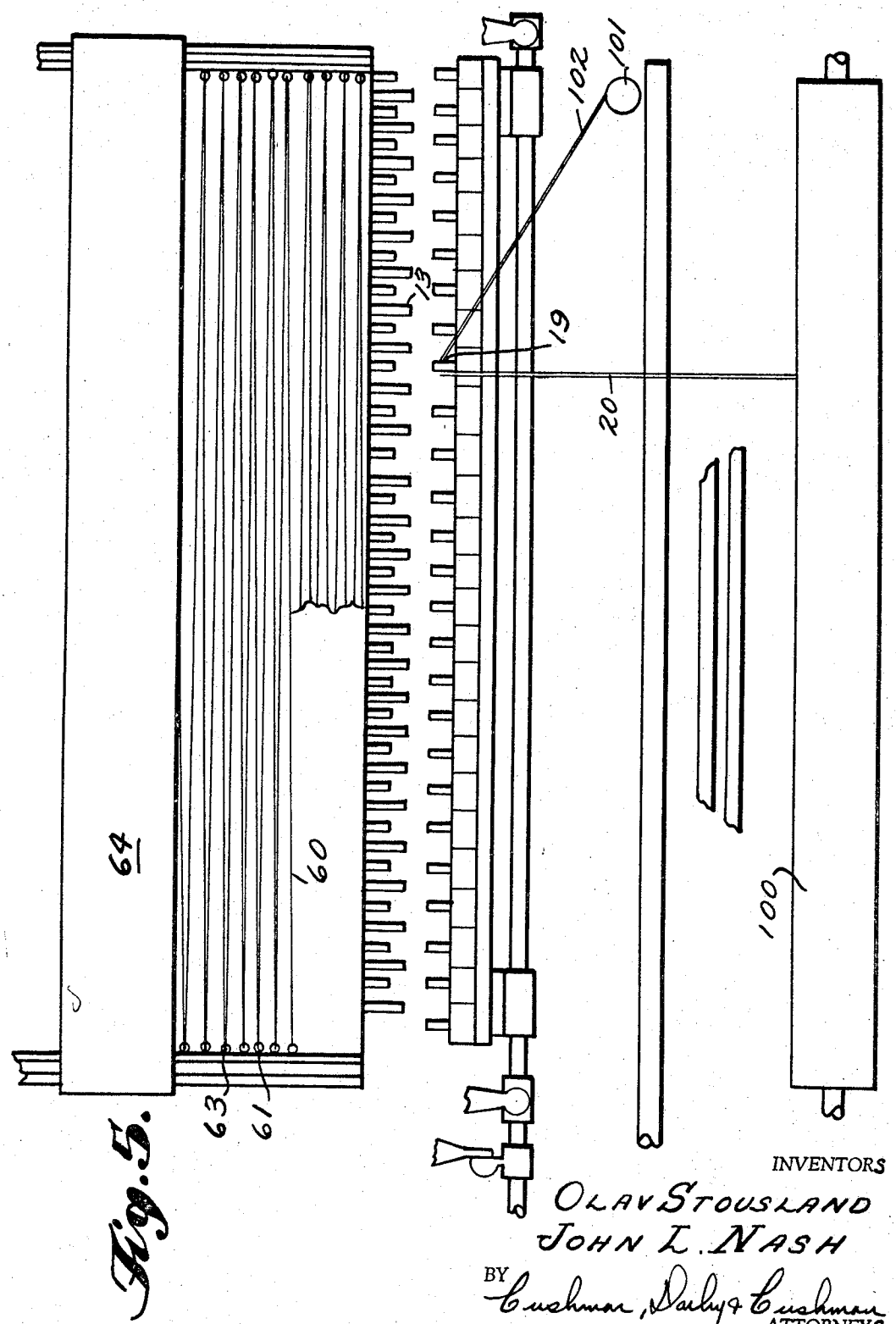


Fig. 5.

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Fig. 6.

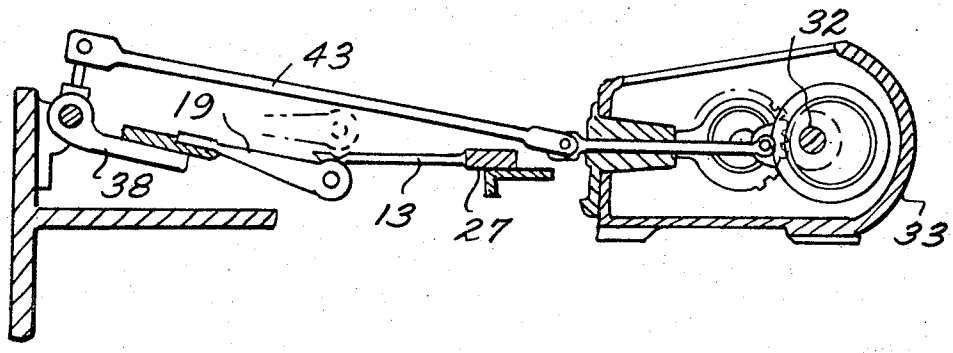
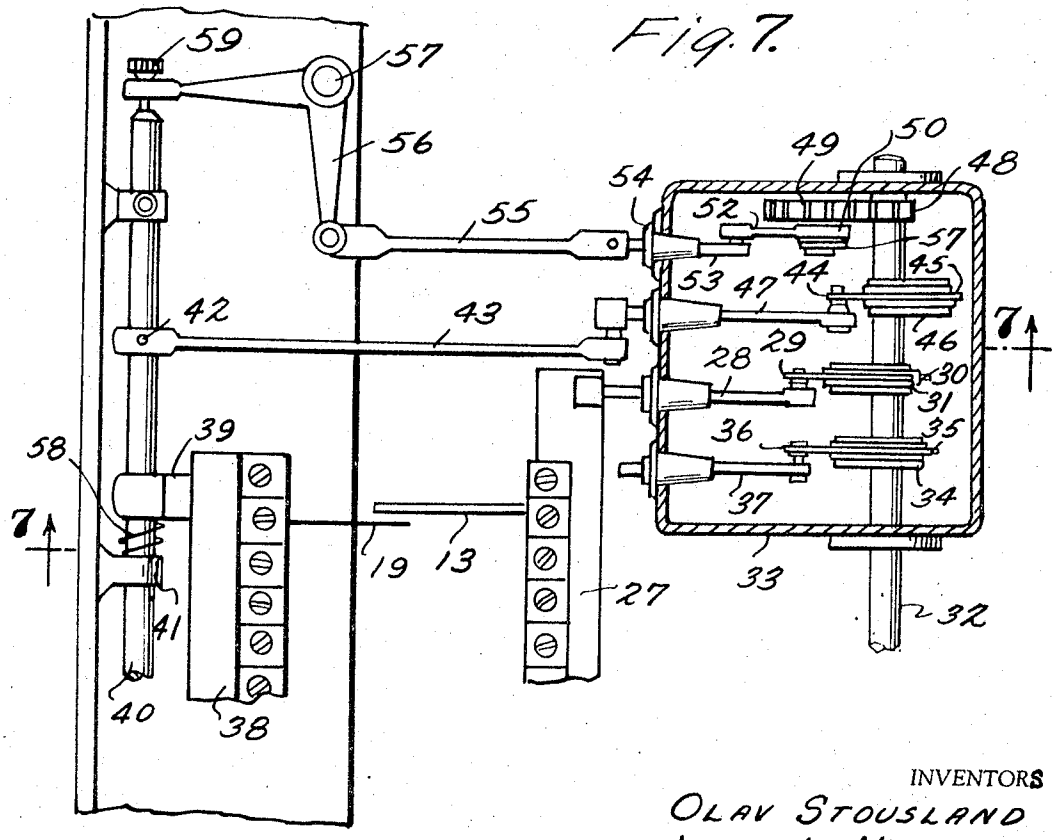


Fig. 7.



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United States Patent Office 3,452,561
Patented July 1, 1969

3,452,561

NOVELTY YARNS AS SEWING THREADS IN STITCH BONDED FABRICS

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Filed Jan. 29, 1968, Ser. No. 701,297
Int. Cl. D04b 21/00
U.S. Cl. 66—195 5 Claims

ABSTRACT OF THE DISCLOSURE

A knit fabric having a base fabric or material whereby warp knitted chains of loops are knit through the base fabric or material, some of said loops, but not all, contain a plural number of yarns therein.

The present invention relates to a fabric and a method for making a fabric. More specifically, it pertains to a kind of fabric having loose fibers, filling yarn or other filling materials through and along which have been formed chain stitches produced by warp knitting.

For purposes of simplicity, the term "sewing" will be used herein to refer to the warp knitting operation. This term has found use in the textile industry in connection with this kind of fabric and avoids confusion because the word "warp" is used to refer to another yarn employed in this type of fabric, as will be explained below. Similarly, for convenience, the threads which form these loops are referred to as "sewing thread," and the equipment may be referred to as "stitch bonding" rather than "warp knitting."

Fabrics of this type can be made by forming a plurality of chain stitched rows of loops of sewing thread along a variety of filling materials, including an array of loose fibers, e.g., a batting, loose filling yarn, woven fabrics and other sheet-like materials. For present purposes, this material will be referred to as the filling. The stitches pass through the material at spaced points along the machine direction of the fabric and gather loose filling yarn, and to a certain extent loose fibers in a batting, into a plurality of clusters separated by spaces corresponding to the stitch insertion points. A plurality of stitches are formed simultaneously across the material, so that the spaces tend to be more or less continuous across the fabric, especially where yarns are used as the filling.

In a particularly important form of these fabrics, the stitches of adjacent loop chains are interlocked, that is the warp knitting uses a tricot stitch. This effect may be obtained by the manner in which the sewing thread is supplied to loop forming needles. The thread passes through guides which oscillate between adjacent needles, so that each sewing thread end is alternately supplied to adjacent sewing needles, and each chain contains loops alternately formed from two different threads. This type of stitch has several advantages. First, the interknitting of the two sewing ends increases the durability of the fabric. If simple chain stitching is used, one break in a sewing thread may result in an entire chain of loops being pulled out. In the interlocking stitch described above, each sewing thread is interlocked with two others; therefore, a broken thread will be held by two others.

Another advantage of this type of stitch is that it facilitates the use of "warp" yarns. It is known that dimensional stability of the fabric can be improved by laying yarns against one side of the filling material and fastening them down with sewing thread. In the interlocking stitch, zigzagging of sewing thread between adjacent chains of loops provides a convenient means for holding the warp yarn in place. The warp yarn is simply laid against the fabric before the sewing thread is moved over it by the sewing thread guide.

A principal object of the present invention is to provide ornamental patterns such as stripes in this type of fabric. It is known to produce such effects by use of various types of warp yarns of different sizes, colors, etc. However, it has been considered impractical to produce such effects with variations of sewing thread. It has been thought that the stitch bonding equipment, for efficient high speed operation, required all sewing thread ends to be of a single size and either spun or continuous filament type. In addition, it has been thought impossible to use novelty yarns.

In accordance with the present invention, a single type of yarn is used in the conventional manner but additional sewing threads are supplied through some of the needles to produce various ornamental effects. The respective yarns are supplied from separate packages to the yarn guides which lay yarns in the sewing needles, but the additional threads reach the needles independently so as to not interfere with the tension on the uniformly used yarn. For convenience, the first-mentioned sewing thread, supplied to all sewing needles, will be referred to as the "uniform" or "uniformly used" yarn. The additional yarn will be referred to as the "effect" yarn.

Various types of filling material can be formed into a fabric by sewing in accordance with the present invention. One preferred form of material is described in U.S. Patent 2,890,579. A plurality of loose filling yarns are provided from continuous yarns which are wound back and forth across a kind of tenter frame by a carriage, and around heddle hooks on moving conveyor belts at either side of the frame. The conveyors are moving while the carriage traverses the space between them, so that the filling threads are more or less oblique to the machine direction and in two sets which are oblique to each other. That is, after a set of parallel threads are caught on the hooks of one of the conveyors, the carriage moves directly across to the other conveyor. While the carriage moves across, the conveyors are moving perpendicularly to the carriage and, by the time the carriage reaches the other conveyor, that other conveyor has moved a short distance. Therefore, the heddle hooks on which the threads are caught on the second conveyor are not directly opposite the hooks used on the first conveyor, and the threads are oblique to the machine direction. When the carriage returns to the first conveyor, an opposite effect is observed, and the threads laid down are oblique to the machine direction and to the threads laid down in the previous traverse. The filling threads mentioned above are cast off the heddle hooks after they are caught up by loops of sewing threads which rather them into clusters, separated by spaces where the sewing thread passes through the fabric.

Another type of loose filling material which can be used in this type of fabric is a batting or non-woven fiber web. This is a web of loosely arrayed fibers, extending more or less randomly in various directions. Webs of this type may be formed by depositing atmospherically suspended fibers onto a moving screen, for example by suction applied through the screen. Webs also can be produced by carding a picker lap, or other well-known means, and thickness can be increased by cross-laying a web in known manner. Strictly speaking, a batting or the like cannot be described as loose filling because the fibers are arranged more or less randomly in all directions. However, since a portion of the fibers will be more or less transverse or oblique to the loop chains, especially when derived from a cross-layed carded web, it can be

considered to comprise loose filling for purposes of the present invention.

It also is possible to apply the loop chain sewing to previously woven fabrics, plastic films and any other sheet-like material.

Substantially any textile fibers can be used for the warp, filling and/or sewing thread, and/or in a batting or other textile fill material. These include natural fibers such as cotton, wool, sisal, linen, jute and silk, man-made fibers and filaments such as regenerated cellulose rayon, polynosic rayon, cellulose esters, e.g., cellulose acetate, cellulose acetate/butyrate and cellulose triacetate and synthetic fibers and filaments such as acrylics, e.g., polyacrylonitrile, modacrylics such as acrylonitrile-vinyl chloride copolymers, polyamides, e.g., polyhexamethylene adipamide (nylon 66), polycaproamide (nylon 6) and polyundecanoamide (nylon 11), polyolefin, e.g., polyethylene and polypropylene, polyester, e.g., polyethylene terephthalate, rubber and synthetic rubber, saran, glass, and the like. Sewing yarn sizes ordinarily are 15 to 1100 denier and filling yarns 15 to 3300 denier. Warp yarns, when used, may be, e.g., 15 to 5000 denier. However, it may be necessary to use warp yarns of fibers identical with the filling to prevent interference with ornamental effects provided. Normally, stitches will be .4 to 4.5 mm. apart along the warp and about 1 to 7 mm. apart across the fabric. Typically, the sewn fabric weighs 1 to 24 ounces per square yard. In a batting, fibers may be 1.5 to 15 denier and 1" to 4" long, with batting weights of, e.g., 1 to 12 ounces per square yard.

As explained above, a single end of conventional sewing yarn is used uniformly in all the needles, and at least one effect yarn of different color or type is separately supplied to one or more of the needles. Various combinations of yarn may be used. Preferably, the effect yarn is a novelty yarn, which, as used herein, refers to a single or ply yarn which differs in construction from an ordinary single or ply yarn. The structure in a novelty yarn is such that irregular effects or patterns are produced in the yarn. Examples are flake, boucle, bead, knickerbocker, slub, bug, nubs, etc. The effect yarn may be of larger size than the first yarn so as to conceal the uniform yarn in stitch lines containing the effect yarn. However, very interesting effects are obtained when two or more yarns of about equal size but different color are used in a stitch line. In addition, it is possible to use, as a uniform yarn, a spun yarn and a continuous filament yarn as the effect yarn or vice versa, pairs of yarns differing in surface smoothness, or size, etc. The effect yarn may be used with a feeder yarn to protect it from tension, etc.

The invention will be better understood from the following detailed description of preferred embodiments, reference being made to the drawings, in which:

FIGURE 1 is a plan view of the fabric;

FIGURE 2 is a vertical section through a portion of the apparatus used to produce the fabric, showing the formation of stitches;

FIGURE 3 is a view similar to FIGURE 2, showing another step in the formation of stitches;

FIGURE 4 is a schematic view showing the paths of movement of sewing thread guides;

FIGURE 5 is a plan view, partly schematic, of the apparatus;

FIGURE 6 is a plan view, partly schematic, of the apparatus, showing the drive mechanism; and

FIGURE 7 is a section along lines 7—7 of FIGURE 6.

As seen in FIG. 1, the sewing thread in the fabric is formed into interlocked chain stitching substantially along the warp or machine direction. Each sewing thread **1** is formed into a plurality of loops **2** spaced along the length of the fabric, each loop passing through the fabric. The loops are formed into parallel chains, but each chain is formed from two threads which alternately are formed into stitches of adjacent chains. For example, one chain of loops, designated **3** in the drawing, is formed from two threads **4** and **5**. A first loop **6** is formed from thread **4**, the next loop **7** is formed from thread **5** and the next loop **8** is formed again from thread **4**, etc. Thread **4** also is formed into loops **8** in the chain **10** on one side of chain **3**, alongside loop **7** and other loops in chain **3** which are formed into loops **9** in thec hain **10** on one side of chain into loops **11** in a chain **12** on the other side of chain **3**, alongside loops **6** and **8** in chain **3**. The arrangement is such that each sewing thread is interlocked with two others in adjacent stitch lines so that, if a thread breaks, it will not pull out a succession of stitches as it would if each chain were formed from a single thread.

The formation of this chain stitching is illustrated in FIGS. 2 and 3. A needle **13** is provided which has a point **14** at one end and a hook **15** adjacent the end. There is a groove **16** in the upper surface of the needle in which slides part of a bent wire latch **17**. The needle is mounted for horizontal reciprocating motion.

A web **18** moves downwardly across the path of the needle, and as the needle reciprocates, it alternately pierces and is withdrawn from the web, the web being advanced downwardly while the needle is withdrawn.

A thread guide **19** is provided to insert the sewing thread **20** into the hook **15** when the needle extends through the filling material. As can be seen by comparing FIGS. 2 and 3, the thread guide moves up alongside the needle, across it and down on the opposite side, laying the thread in the hook **15** as it moves across. Then the needle is retracted and the latch **17** moves across the hook. At the same time, the web **18** moves down past the needle. As the needle moves forward to receive sewing thread again, the thread previously placed in the hook slides back onto the shank of the needle as seen at **21** to form a loop **22**. When the needle retracts again and the latch **17** closes, the loop **22** slides forward toward the tip of the needle, pushed if necessary by the upright portion of latch **17**. Since the hook **15** is closed by the latch, the loop **22** slides over the hook and is cast off the point **14** of the needle. At the same time, the thread in the hook is pulled through loop **22**.

The thread guide **19** is mounted to alternately move up and across two needles, designated **23** and **24** in FIG. 4. Therefore, it describes a figure eight path **26**.

For rapid machine operation, it is advisable to use circular eccentric cams for actuating the needles and the thread guides. As shown in FIG. 6, a needle bar **27** carrying the needles **13** is actuated by a connecting rod **28** extending from an eccentric rod **29** linked by a strap **30** of an eccentric cam **31** which is rotated by the motor-driven shaft **32** supported by a housing **33**. Similarly, the reciprocating movement of the latches **17** required for closing the hooks of the needles is obtained by means of an eccentric cam **34** cooperating with a strap **35** actuating, through an eccentric rod **36**, a connecting rod **37** that actuates the brackets to which the latches **17** are attached through a cam. The holders of the thread guides **19** are fastened to a guide bar **38** which, by means of suitably attached lever arms **39**, is fixedly mounted on a shaft **40**. This shaft, being rotatably mounted within bearings **41**, is adapted to slide longitudinally back and forth and carries a short lever **42**.

Lever **42** is connected with a coupling rod **43** linked to an eccentric rod **44**. Rod **44** with its strap **45** encloses the eccentric cam **46** which, by means of an intermediate connecting rod **47**, moves the thread guides up and down. Aside from this reciprocating movement, the thread guides must undergo an axially transverse back and forth movement in order to insert threads into the hooks of the needles and to alternate between needles. For this purpose, the thread guides **19** and the shaft **40** carrying the same are operated to perform one complete back and forth movement while the needles are moved twice in and out. To accomplish this, a pinion **48** keyed to the shaft **32** engages a spur wheel **49** of twice its size. Consequently, the spur wheel rotates at half of the speed of the shaft **32**.

Spur wheel **49** is fixedly connected with an eccentric cam **50** whose strap member **51** is linked by an eccentric rod **52** to a connecting rod **53** axially slidable in a bearing **54**. When in operation, the rod **53** and its linkage **55** impart axial reciprocation to the shaft **40** by actuating an angle lever **56** rotatably mounted to a pivot **57**. The tension spring **58** fastened about the shaft **40**, between one of the bearings **41** and the adjacent lever arm **39** of the guide bar **38**, aids the axially oscillating movement by forcing the shaft against an adjusting screw **59** connecting the free end of angle lever **56** to that of the shaft **40**.

A filling yarn supply for use when loose yarn is employed as the filling, is illustrated in FIG. 5. For simplicity, a single yarn is shown, indicated by the numeral **60**. At opposite sides of the apparatus, there are chains **61** and **62**, each trained around sprocket wheels and driven by a motor, not shown. On each of the chains **61** and **62** there are a plurality of upright heddle hooks **63** around which the yarn is wound. Filling yarn is laid in place by a yarn guide mounted on a mobile carriage **64** which is traversed back and forth above the chains **61** and **62**. The arrangement is such that as the carriage moves a bit past the hooks on one side of the chains, the chain moves and the yarn is turned around one or more hooks. Then the carriage moves in the opposite direction across to the other chain and past that chain so that the procedure is repeated.

In actual practice, the carriage **64** carries several yarn guides and a plurality of yarn ends are laid down as superimposed layers, each layer being at an angle to the layer next to it. The filling yarn remains in this position until loops are formed by the sewing operation, and the filling is cast off the chains **61** and **62**. Then the filling takes the form of generally parallel clusters of yarn separated by spaces at sewing thread stitch insertion points.

In lieu of loose filling yarns, various types of sheet-like materials may be used, as described above. They may be supplied from a beam and carried to the sewing needles by the chains **61** and **62**.

FIG. 5 also illustrates the sewing thread supply. A yarn package is shown at **100** which carries the uniform sewing thread, supplying one end to each of the guides **19**. In addition, a yarn cone is shown at **101** which supplies an effect yarn **102** to the same thread guide **19** as one of the ends of uniform thread. The thread **102** is supplied independently of the thread end **20** through appropriate thread guides and tension up to the point where they enter the eye **103** of the thread guide **19**. By this means, the effect yarn **102** does not unbalance tension on the yarn package **100** or otherwise interfere with high speed operation of the apparatus.

Any warp yarns used are conveniently applied against the filling as the latter moves down to the line of sewing needles. They are then caught by the sewing thread and tied down against the filling. They are supplied conveniently from a package above the sewing needles and move downwardly through a yarn guide.

The following are examples of fabric constructions made in accordance with the present invention. In these, the gauge is the number of needles per inch. The stitch is the distance in millimeters between stitches along the machine direction. The yarn is described with conventional designations.

Example I

14 gauge machine, 1.6 mm. tricot stitch.
Warp: (30/1+7/1)/2 rayon spiral yarn.
Filling: 1050/70/½Z—MBC—textured nylon.
Sewing: 140/30/¼Z—6 bright—T–700 fortrel polyester.
Sewing effect yarn: 1050/70/½Z—MBC—textured nylon.
No "feeder" yarn was used.

Example II

14 gauge machine, 1.0 mm. chain stitch.
Warp: None.
Sewing: 140/30/¼Z—6 bright—T–700 fortrel polyester.

Sewing effect yarns: 31/2 and 31/1 65% polyester/35% cotton. Colors: Blue and pink. Both 31/2 and 31/1 ran as one through the same needle.
No "feeder" yarn was used.

Example III

14 gauge machine, 1.0 mm. chain stitch.
Warp: None.
Sewing: 140/30/¼Z—6 bright—T–700 fortrel polyester.
Sewing effect yarn: #8B—10/1 spun rayon—Color: Avocado.
No "feeder" yarn was used.

Example IV

18 gauge machine, 1.4 mm. tricot stitch.
Warp: None.
Filling: 1/28 orlon polyacrylonitrile—T–75.
Sewing: 70/30/¼Z—T–700 fortrel polyester.
Sewing effect yarn: 20/1 spun rayon.
70/30/¼Z—T–700 fortrel polyester was used as "feeder" yarn for the 20/1 spun rayon.
Five (5) yards were dyed in colors red and yellow.

Example V

14 gauge, 1.6 mm. tricot stitch.
Warp: None.
Filling: 16/1 rayon.
Sewing: 70/34/¼Z—T–700 fortrel polyester.
Sewing effect yarn: A—13/1 rayon slub yarn. B—5.5/1 84% rayon/16% acetate.

Example VI

14 gauge, 1.5 mm. tricot stitch.
Filling: 5 oz./square yard, 100% rayon batting.
Sewing: 140/30/¼Z—Bright T–700 fortrel polyester.
Sewing effect yarn: M.S.—30A 14/30/2 Wedgwood blue rayon nub.

Example VII

14 gauge, 1.5 mm. tricot stitch.
Filling: 5 oz./square yard, 100% rayon batting.
Sewing: 140/30/¼Z—Bright T–700 fortrel polyester.
Sewing effect yarn: M.S.—30B 1/200/32 denier textured acetate—Color: Dragon green.

Example VIII

14 gauge, 1.5 mm. tricot stitch.
Filling: 5 oz./square yard, 100% rayon batting.
Sewing: 140/30/¼Z—Bright T–700 fortrel polyester.
Sewing effect yarn: M.S.—30C Frizette Lurex-Color-Silver.

Example IX

14 gauge, 1.5 mm. tricot stitch.
Filling: 5 oz./square yard, 100% rayon batting.
Sewing: 140/30/¼Z—Bright T–700 fortrel polyester.
Sewing effect yarn: M.S.—30D 18/1 bright triacetate.

When using a batting, as in Examples VI–IX, very interesting patterns result on the "reverse" side of the fabric, i.e., the side on which sewing thread connects between loops on the "front" side of the fabric. Using the "effect" yarn in single stitch lines, in a color contrasting with the batting and the "uniform" sewing yarn, the "effect" yarn forms a zigzag line along the fabric with dots at points where the tips of loops of the effect yarn show through the fabric, i.e., opposite the turning points in the zigzag line. This is produced in a batting because the sewing process, when applied to the batting, leaves needle holes at stitch insertion points. Unlike the fabrics made with loose filling yarns, in which the filling yarns are gathered into distinct bundles between spares along stitch insertion points, in the fabrics made from battings, the fibers appear to be gathered into tufts with perforations showing through the fabric at insertion points. (On

the front of the fabric, the loop chains gather the fibers into ribs, giving a corduroy effect.)

Since the perforations coincide with the tips of the loops of effect yarn, dots of the contrasting color effect yarn show through the batting, as illustrated in FIG. 1.

It will be obvious that the embodiments described are for purposes of illustration only and that various changes may be made in the apparatus and method without departing from the scope of the invention, as defined in the appended claims.

The invention provides the basic advantage of a capability of widely broadening the styling possibilities on stitch bonding machines. It is possible to obtain stripe effects in the warp direction by cross-dyeing different types of yarns and blends or through the use of differently colored yarns and fibers. Novelty yarns will in addition add texture to otherwise plain looking fabrics. Coarse and fine yarns combined will produce novelty effects. Another important factor is that warp direction stripes will not ravel as is the case when warp yarns must be used to get warp directional effects. The invention can be used with the tricot stitch for a zigzag kind of stripe or the chain stitch for straight stripes. Therefore, the invention provides numerous practical advantages in the manufacture of stitch bonded fabrics.

What is claimed is:

1. In a knit fabric comprising a plurality of substantially parallel chains of loops formed from a sewing thread and a filling material, said chains of loops extending along one side of said filling material with threads connecting between loops extending through said loops and said filling material and along the other side of said filling material,

the improvement in which an effect yarn different from said sewing thread is included in the loops of some but not all of said chains in addition to said sewing thread, said sewing thread being used in the loops of substantially all of said chains.

2. A fabric as set forth in claim **1** in which said filling material comprises loose filling yarns gathered into substantially parallel clusters generally perpendicular to said chains and separated by spaces where said sewing thread passes through said filling.

3. A fabric as set forth in claim **1** in which said filling comprises a batting.

4. A fabric as set forth in claim **3** in which said effect yarn is of contrasting color to said batting, and the stitch in said loop chains is a tricot stitch with the threads and effect yarns formed alternately into loops in a pair of adjacent chains and alternate loops in each chain are formed of different threads,

whereby, on said other side of said filling material, there appears a zigzag stripe formed of said effect yarn accompanied with dots of color of said effect yarn sewing through needle insertion points in said batting.

5. A method of producing a textile fabric having a filling material, a plurality of substantially parallel chains of loops of sewing thread along one side of said filling material with sewing thread connecting between loops extending through said loops and along the other side of said filling,

said method comprising inserting a row of needles through said filling material, supplying sewing threads to each of said needles with a yarn guide which inserts the sewing thread in a thread engaging means in each needle, withdrawing said needle from said filling material, thereby drawing said sewing threads through said fabric and forming them into loops, advancing said filling past said needles, and repeatedly reinserting and withdrawing said needles through said filling at spaced points along the filling as it is advanced, the loops being cast off said needles when the needles are withdrawn, pulling other loops through substantially all of the cast off loops, as they are cast off, all of said needles being supplied with substantially the same sewing thread,

and supplying an effect yarn to some but not all of said yarn guides for simultaneous insertion with said sewing thread into some but not all of said needles, said effect yarn being supplied to said guides from separate supply means and independently of tension on said sewing thread.

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