Oct. 11, 1960 G. E. HERRNSTADT ET AL 2,955,446

KNITTED PILE FABRIC

Filed June 4, 1956

4 Sheets-Sheet 1

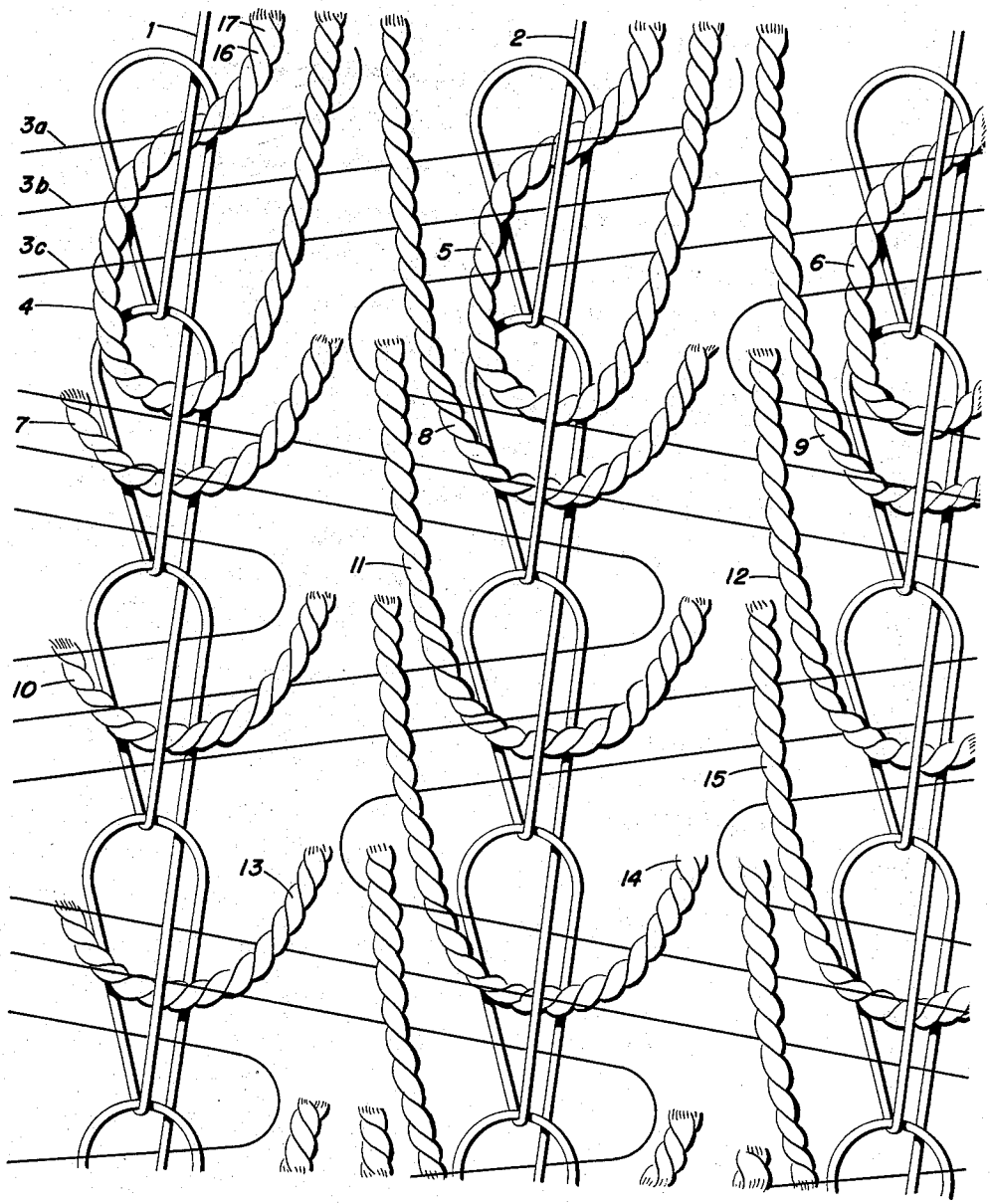


FIG. 1.

INVENTORS
GERALD E. HERRNSTADT
RUSSELL R. MATTHEWS

BY Leech and Radue

ATTORNEYS

Oct. 11, 1960 G. E. HERRNSTADT ET AL 2,955,446

KNITTED PILE FABRIC

Filed June 4, 1956

4 Sheets-Sheet 2

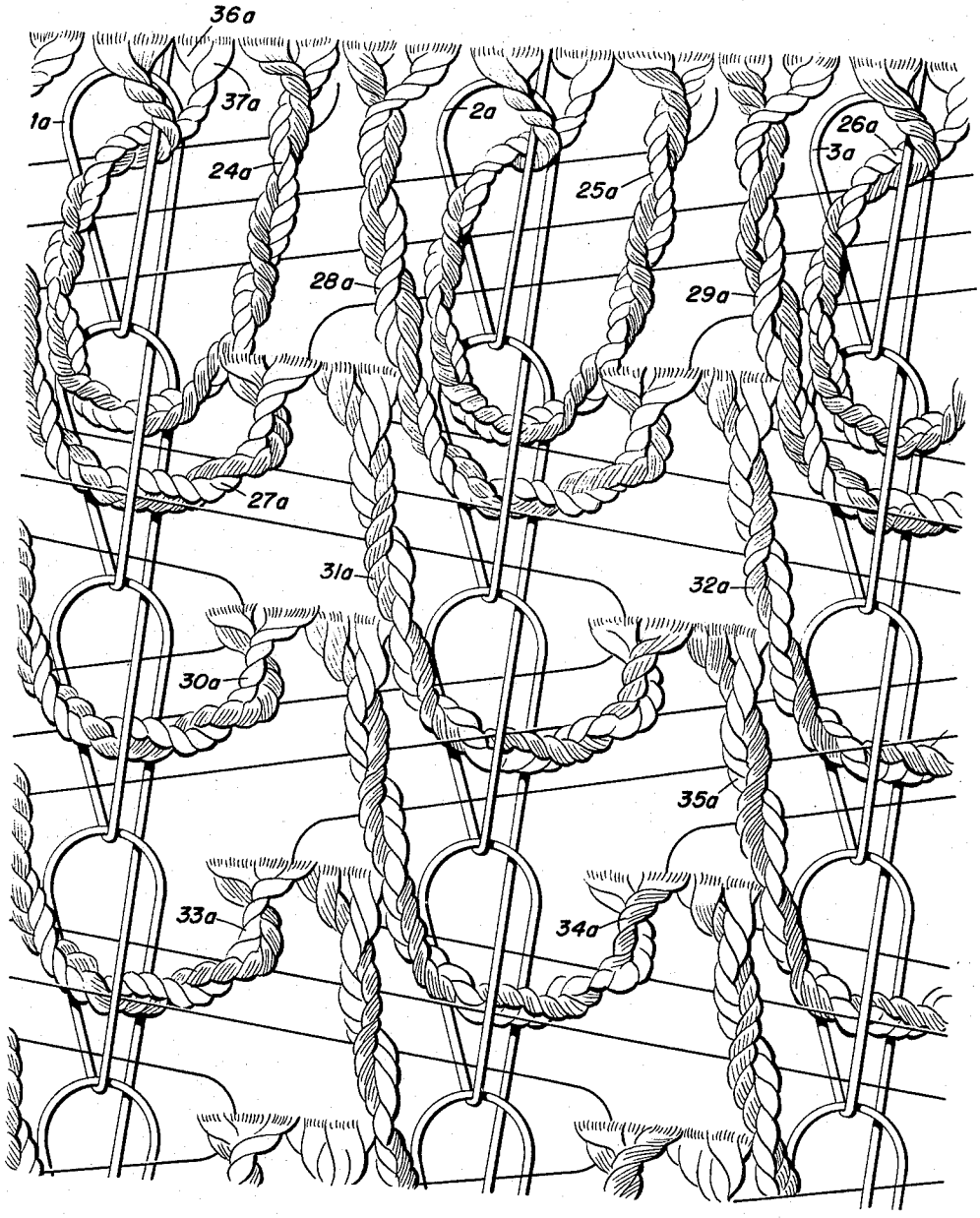


FIG. 2.

INVENTORS
GERALD E. HERRNSTADT
RUSSELL R. MATTHEWS

BY Leech and Radue

ATTORNEYS

Oct. 11, 1960 G. E. HERRNSTADT ET AL 2,955,446

KNITTED PILE FABRIC

Filed June 4, 1956

4 Sheets-Sheet 3

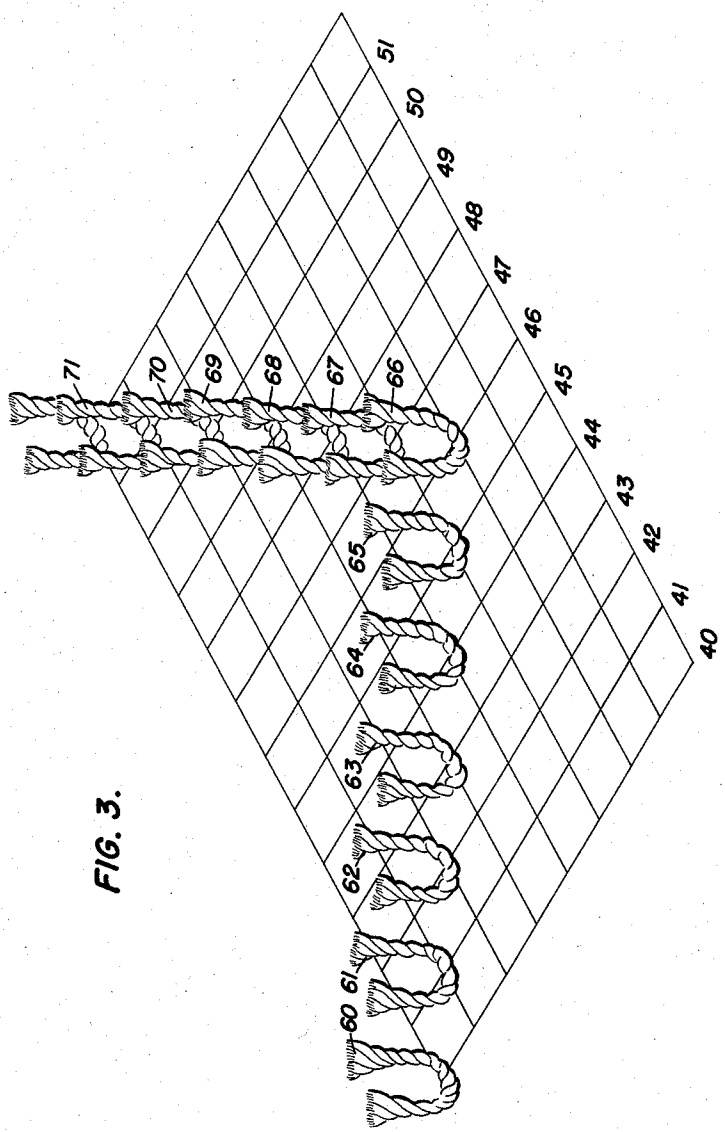


FIG. 3.

INVENTORS
GERALD E. HERRNSTADT
RUSSELL R. MATTHEWS

BY Leech and Radue

ATTORNEYS

Oct. 11, 1960 G. E. HERRNSTADT ET AL 2,955,446

KNITTED PILE FABRIC

Filed June 4, 1956

4 Sheets-Sheet 4

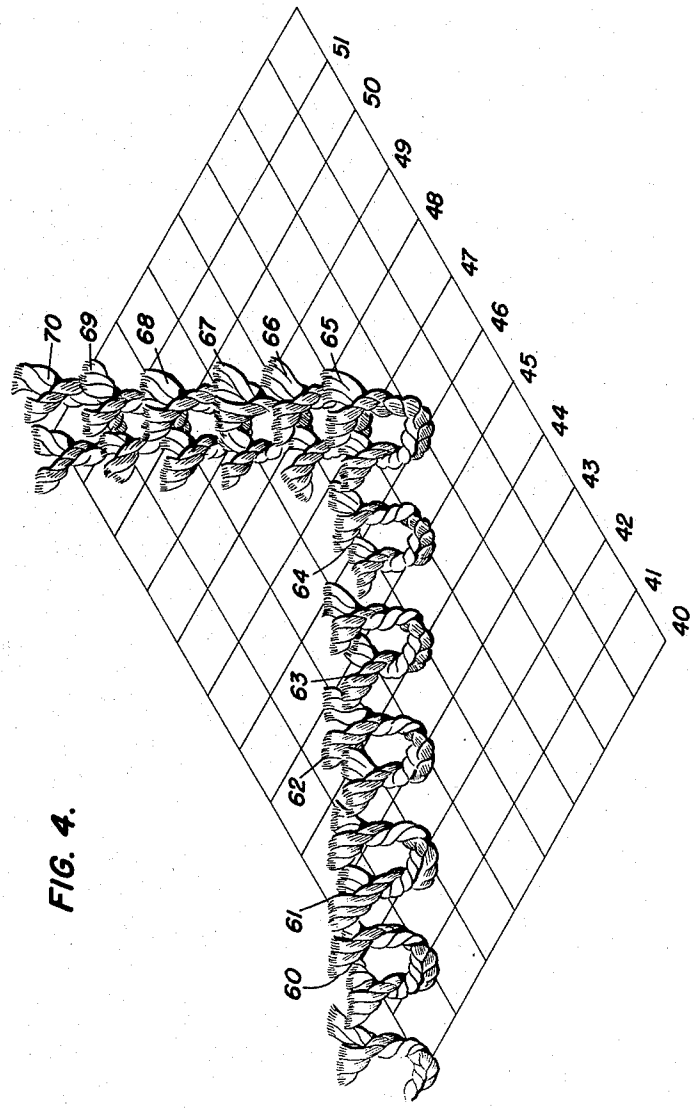


FIG. 4.

INVENTORS
GERALD E. HERRNSTADT
RUSSELL R. MATTHEWS

BY Leech and Radue

ATTORNEYS

United States Patent Office 2,955,446 Patented Oct. 11, 1960

2,955,446

KNITTED PILE FABRIC

Gerald E. Herrnstadt, Cornwall, and Russell R. Matthews, Cornwall on the Hudson, N.Y., assignors to The Firth Carpet Company, Inc., New York, N.Y., a corporation of New York

Filed June 4, 1956, Ser. No. 589,173

1 Claim. (Cl. 66—191)

This invention relates to knitted pile fabrics, such as are made on circular and flat bed knitting machines, and is concerned more particularly with pile fabrics of such type having a pile of novel construction.

Coarse pile fabrics, such as are used in the upholstery and floor covering field, are receiving increasing emphasis with regard to construction of the pile and the texture effects achieved thereby. The present invention is primarily concerned with improvement of knitted fabrics such as described in W. A. Rice Patent 2,531,718 and G. E. Herrnstadt Patent 2,718,132. The fabric construction of the Herrnstadt patent may have a face of either loop or cut pile.

In the production of such knitted pile fabrics the twist in the pile yarn is usually a balanced twist and, therefore, the feeding of the yarn to the point of pile formation in the knitted fabric presents practically no problem. But with the increased demand for texture effects in fields such as the upholstery and floor covering, the balanced type yarn not only fails to serve the purpose but avoids the creation of textures, such as are achievable by the novel teachings of this invention.

In all pile fabrics it is essential that the backing material be fully concealed. Adequate coverage of the backing is a minimum requirement. One of the most popular types of floor coverings is the Axminister carpet. In a five-row Axminster carpet there are usually thirty-five pile tufts per square inch of a yarn that runs, roughly, 50–60 yards per ounce. To make a comparable fabric on a knitting machine either a heavier yarn is necessary to give full coverage of the warp chain stitches, or a yarn of the novel type construction hereinafter disclosed will provide sufficient coverage for a good appearance and wearing quality with a minimum number of face tufts or loops.

Therefore, it is a primary objective of this invention to provide a novel pile yarn for knitted fabrics that is capable of opening up a new field of manufacture for knitted fabrics having a texture and appearance equal to woven fabrics.

Furthermore, an additional object of this invention resides in the use of a back twisted yarn in a knitted pile fabric, said back twisted yarn consisting of a one-ply, twisted core and another ply wrapped around said core to form a fluffier and thicker appearing end within the twist.

It is a still further object of this invention to provide a yarn which appears to be moresque when in a fabric, even though there are two singular colors running parallel to each other within the knitted faric, and where such moresque is created by the indirect tangling which the yarn achieves by virtue of its inherent twist of each color rather than of two colors twisted together.

For a better understanding of the invention, reference may be made to the accompanying drawings, in which:

Fig. 1 shows an enlarged top plan view of a prior art pile fabric construction having cut pile as outlined in

Herrnstadt Patent 2,718,132, the pile thereof being made with conventional plied pile yarn;

Fig. 2 shows in enlarged top plan view a pile construction having the same base construction as Fig. 1 embodying pile of essentially different characteristics;

Fig. 3 is a top perspective and semi-diagrammatic view of a knitted fabric made with balanced twist face yarn, in which the cut tufts of balanced twist face yarn are enlarged for clarity; and

Fig. 4 is a view similar to Fig. 3 in which the knitted fabric embodies a unidirectional plied yarn the single ends of which have opposite turns of twist in accordance with this invention and provides means for attaining a moresque effect.

The prior art knitted fabric illustrated in Fig. 1 comprises chain stitch warps **1**, **2**, etc., base wefts **3***a*, **3***b*, **3***c*, and cut pile tufts **4**, **5**, **6**, **7**, **8**, **9**, **10**, **11**, **12**, **13**, **14**, **15**. The yarn used for pile tuft in Fig. 1 is of the balanced twist type. The yarn of tuft **4** has two single ends **16** and **17** of balanced twist and, as can be seen from the enlarged drawing, the yarn, even when cut, does not open up and, therefore, exposes the background of the fabric through the opening left between the two ends of the yarn. Such a condition is referred to as "grinning" in the pile fabric industry. Grinning may of course be eliminated by putting more or heavier face yarns into the pile of a knitted fabric, or by having a sufficiently large number of courses per inch within the knitted fabric to provide complete pile coverage and stop the grinning. But since the major cost of such pile fabrics today is the cost of the pile yarn, one would increase the pile yarn cost to such a point that it would be impossible to find a market of sufficient size to justify the added expense.

By "balanced yarn" there is intended a yarn which, in case of two-ply twist, has about 4½ t.p.i. **S** twist in each single and 2 t.p.i. **Z** twist in the two-ply.

To avoid the above mentioned grinning of the fabric there has been developed the new pile yarn, which is shown in Fig. 2 of the drawings where, again, there are warp chain stitches, **1***a*, **2***a*, and **3***a* and pile tufts **24***a*, **25***a*, **26***a*, **27***a*, **28***a*, **29***a*, **30***a*, **31***a*, **32***a*, **33***a*, **34***a*, and **35***a*.

The pile yarn used in the tufts **24***a* to **35***a* as shown in Fig. 2 is of a novel construction. This pile yarn, during the spinning process, is a back twisted yarn. In the preferred form of this invention a two-ply yarn is employed, with one single of said yarn having three t.p.i. of **S** twist, the other single having three t.p.i. of **Z** twist, and the ply having one t.p.i. of **Z** twist. This preferred form is used with coarser yarns, such as the ones used in a type of pile fabric where there are five warp chain stitches per inch and five courses per inch. As may be seen in Fig. 2, the two-ply yarn upon being cut opens up into two singles **36***a* and **37***a*, and thereby avoids grinning of the fabric and gives a much fluffier appearance.

As is well known by those familiar with this art, most cut pile fabrics made on a knitting machine are first made into loops and cut thereafter. When this back twisted yarn is used in the loop, the loop becomes quite curly after being steamed, due to the opposite twist in each single of the yarn. Therefore, quite a nice texture appears also with back twisted yarn whether cut or left in loop form.

To some who are acquainted with this art it will appear difficult how one can use such a twisted and plied yarn during the feeding thereof in the knitting machine. The reason back of the apprehension is based on the fact that from the time it comes off a cone or tube to the time the yarn becomes the actual pile in the fabric is a substantial distance and, being very crinkly, the thus twisted yarn tends to tangle and give trouble to the knitting operation. For this reason the following method of treating the yarn before putting it in the knitting machine is used when

such yarn is highly back twisted and gives trouble during the feeding operation. First the yarn is skein dyed to set the twist, it is wet wound and dried thereafter on tubes, third, the yarn is knit into the pile fabric, and fourth and finally, the fabric incorporating the yarn is steamed and dried during the finishing process to recover the crinkles of the twist that were originally set during the dyeing process.

It has been found, however, that this yarn treatment is required only in the case of back twisted yarns that are to be used for cut pile fabrics and which have an original S twist of five or more t.p.i. in the single twist, and two or three t.p.i. or more of S twist in the ply.

Fig. 4 supplements Fig. 3 inasmuch as both show U tufts held on chain stitches **40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50** and **51**. Tufts **60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70**, and **71** in Fig. 3 are made of the type yarn that is not back twisted, whereas the tufts **60, 61, 62, 63, 64, 65, 66, 61, 68, 69** and **70** of Fig. 4 are made of yarns that are back twisted. These two figures show cut pile tufts which prior to being cut were loops, for instance, tuft **60** in Fig. 3 was prior to being cut a loop between the adjacent warp stitches **40** and **41** with the right leg of U tuft **60** and the left leg of U tuft **61** forming the loop.

When the balanced yarn such as described above is one having about 4½ t.p.i. of S twist per end single and two t.p.i. of Z twist in the ply is used in a cut pile fabric, such as shown in Fig. 3, the tufts will remain wide open and therefore permit the objectionable grinning previously described.

In contradistinction, however, Fig. 4 shows the way the two tuft legs behave when they are originally made of the back twisted yarn; it can readily be seen how they sprout wide open and cover up in every direction so as to eliminate all possibility of grinning which is prevalent when balanced pile yarn is used.

In a fabric having a gauge of five needles per inch and between 5 and 8 weft courses per inch it is preferred to use a yarn which in two-ply construction is constituted as follows:

First Single: Approximately 80 to 120 yards per ounce with 5½ t.p.i. of S twist;

Second Single: Approximately 80 to 120 yards per ounce with 5½ t.p.i. of Z twist;

Two-ply Twist: 2 to 4 t.p.i. S or Z twist, respectively.

For knitted pile fabrics that have less than 6 courses per inch a two-ply yarn, being of finer construction than 45 yards per ounce, would probably prove unsatisfactory. As the courses per inch are increased, finer yarns can be used.

It has also been discovered that back twisting has certain advantages when employed in a yarn having more than two plies. For example, since the end of the twist that forms the core becomes the thinner appearing yarn, and since the wrap-around end in the twist becomes the bulkier appearing yarn, a decision has to be made as to which one is to appear as a majority. In order to facilitate the further understanding of this, an example of each is presented as follows:

Example 1 (Two bulky and one hard twisted ends)

First Single: 4 t.p.i. S twist;
Second Single: 4 t.p.i. Z twist;
Third Single: 4 t.p.i. Z twist;
Three-ply of the above: t.p.i. S twist.

Example 2 (A hard core with a single bulky end)

First Single: 5 t.p.i. S twist;
Second Single: 5 t.p.i. S twist;
Third Single: 5 t.p.i. Z twist;
Three-ply of the above: 4 t.p.i. S twist.

Thus it will be understood that these principles are adaptable to a multitude of yarns to be used in knitted pile fabrics and ranging anywhere from a two-ply yarn on to a ten-ply and more, but it is believed that either a two-ply or a three-ply yarn is most satisfactory in a knitted pile fabric of the kind described and especially so when the pile is of cut pile formation rather than of loop pile formation.

It is believed that the plied yarn that has been described functions in a unique manner when applied to knitted fabrics because of being held on the bottom of the tuft and being tied to the backing by warp chain stitches that are given distances apart from each other. By reason of this the back twisted yarns as described have a particularly advantageous function in a knitted fabric that they cannot perform as satisfactorily in any other type fabric.

Having thus disclosed our invention and the preferred manner of practicing the same, what we claim as novel and desire to secure by Letters Patent of the United States is:

A warp knitted pile fabric having spaced parallel chain stitch warps with the stitches thereof aligned transversely in courses, base wefts extending individually back and forth across a plurality of chain stitch warps, raised face pile yarn tufts of U shape individually bound by their bights in one of the chain stitches, at least some of the U-shaped tufts having unequal leg lengths, said pile yarn tufts comprising a plied yarn having a plurality of t.p.i. of S-twist in one single end, a plurality of t.p.i. of Z-twist in another single end and at least one t.p.i. after said ends have been plied.

References Cited in the file of this patent

UNITED STATES PATENTS

2,531,718	Rice	Nov. 28, 1950
2,571,077	Underwood et al.	Oct. 7, 1951
2,639,488	Stanley et al.	May 26, 1953
2,695,441	Runton	Nov. 30, 1954
2,718,132	Herrnstadt	Sept. 20, 1955