

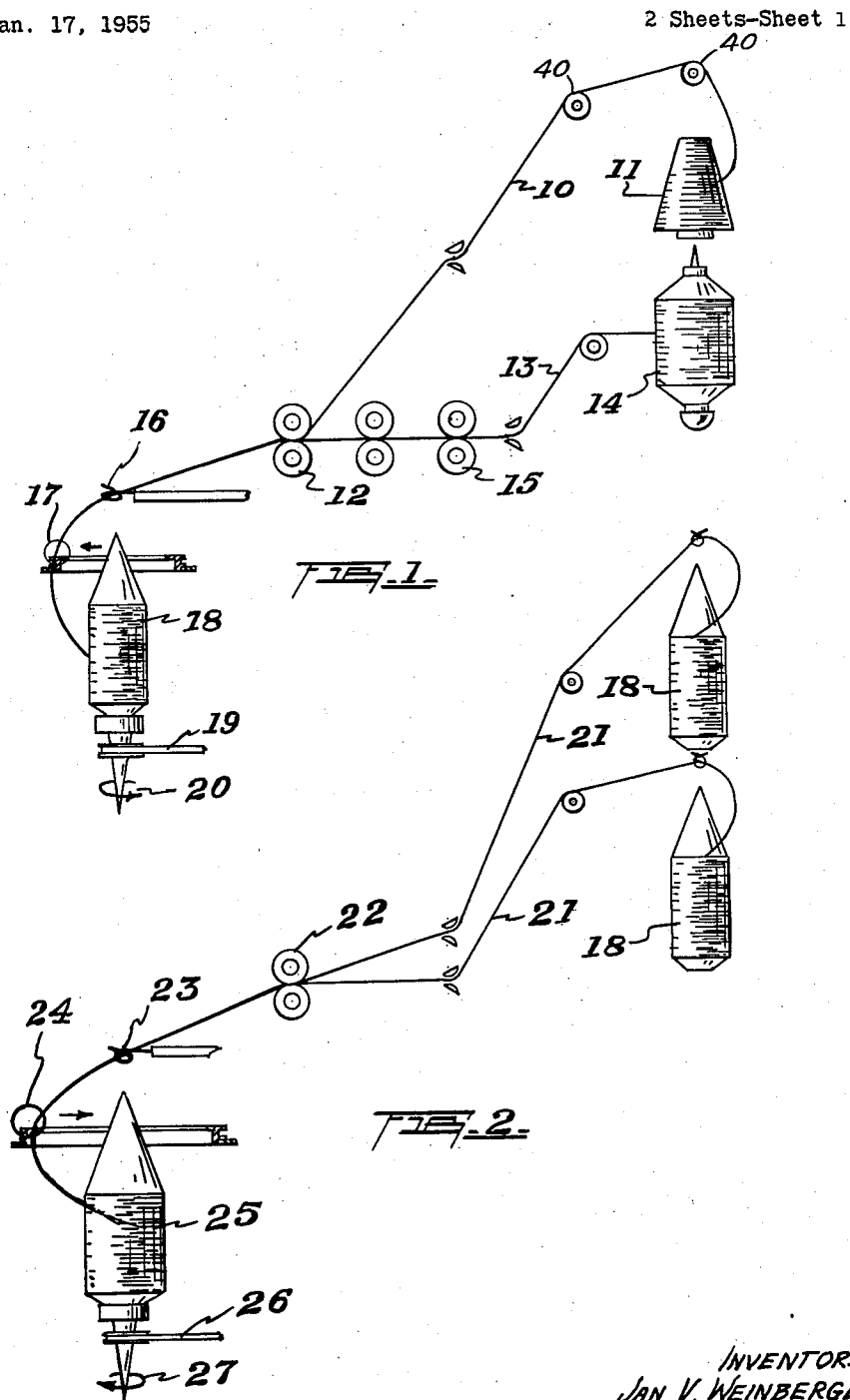
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J. V. WEINBERGER ET AL

2,901,884

MULTIPLE CORE YARN

Filed Jan. 17, 1955



INVENTORS
JAN V. WEINBERGER
HENRI A. DELCELLIER
By *Smart & Biggar*
ATTORNEYS

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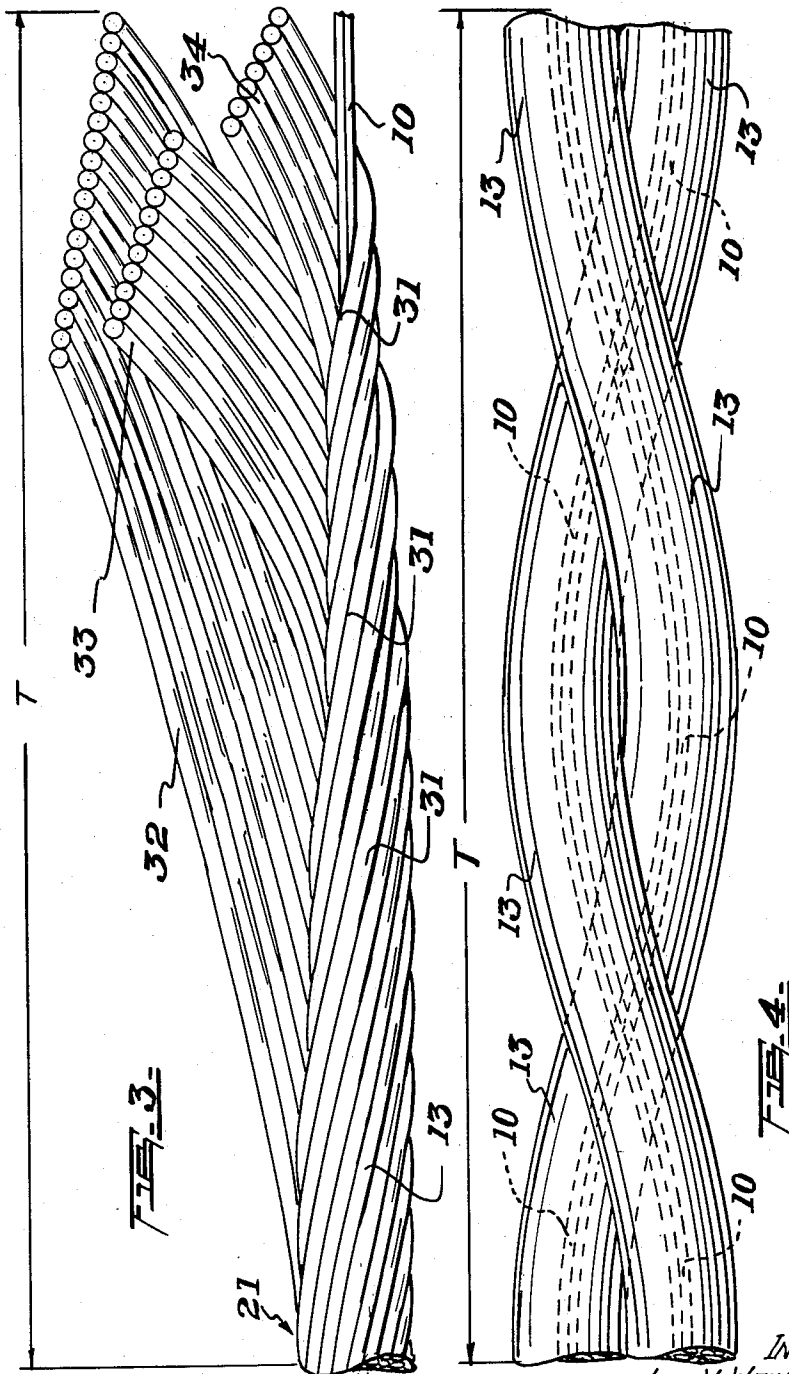
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BY *Smart & Biggar*
ATTORNEYS

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MULTIPLE CORE YARN

Jan V. Weinberger and Henri Aime Delcellier, Ottawa, Ontario, Canada, assignors to Her Majesty The Queen in the right of Canada as represented by The Minister of National Defence, Ottawa, Canada

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4 Claims. (Cl. 57—144)

The present invention relates to a multiple core yarn of high tensile strength and a method of making it.

Prior to the present invention it has been customary to make yarn by a spinning process in which the group of fibres or filaments is twisted to create sufficient internal friction to prevent the fibres or filaments slipping on each other during the spinning process and under the stress which may later be applied to the yarn. This twisting of the yarn has caused each individual fibre or filament to be twisted about its own axis and to be spirally wound about the yarn axis. The result is a certain amount of torsional stress in the fibres or filaments and a variation in the length of fibres in a given length of yarn because the outer fibres are left in spiral paths while the inner fibres are nearly straight.

From the above description of a yarn twisted according to the general practice prior to the present invention it can be seen that there are two potential sources of weakness: one is the torsional stress left in each fibre due to it being twisted about the yarn axis during the spinning process, and the other the variation in length of individual fibres in a given length of the yarn. As is well known, the tensile strength of any structural member is reduced by it being put under stress due to torque and, therefore, each fibre is unable to contribute to the strength of the yarn to as great a degree as would be expected from an evaluation of the tensile strength of the untwisted fibres or filaments contained in it. The second characteristic mentioned results in stress applied along the length of the yarn not being evenly distributed among the fibres which form the yarn. The shortest fibre in any given length of the yarn, for example a fibre nearest to the centre of the yarn, will come under stress first and will have to bear the load without the support from the adjacent fibres which might be expected from an evaluation of their individual tensile strengths. When the shortest fibre breaks the load is transferred to adjacent fibres and in this way the fibres break successively so that at no given instance does the yarn have the full combined strength of all the fibres included in it.

The present invention avoids these disadvantages by providing a multiple core yarn in which the individual fibres and filaments have substantially no twist about their own axis and in which the fibres and filaments in a given length of yarn have substantially equal length. In this specification the term "filament" or "filament yarn" means a continuous fibre commonly referred to as endless fibre, which expression includes a mono-filament or a number of filaments, or yarn made of relatively long staple like flax, or yarn spun of substantially longer staple than used in a roving. The term "roving" as used in this specification means a gathering of substantially parallel fibres which is substantially without twist, that is, twist free. A yarn according to the present invention is produced by bringing together a roving of fibres and a filament yarn and wrapping the roving around the filament yarn by twisting the roving and the filament yarn in one rotational direction while the filament yarn is under higher

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tension than the roving thereby forming a first core yarn. A second core yarn is formed in the same manner as the first, and the first and second core yarns are then twisted together in the reverse rotational direction to the direction of twist used for the first and second yarns. In making a multiple core yarn by this method each of the first and second core yarns is twisted in a conventional manner and each contains at least one filament twisted about its own axis so that it is subject to torsional stress. By twisting together the first and second core yarns in an opposite rotational direction to the twist applied to each individual core yarn, the twist, and therefore the torsional stress in each individual filament yarn and each individual fibre of each roving, is substantially dissolved. Further, in making a multiple core yarn by the method according to the invention the twisting together of the first and second core yarns results in interlacing of the filaments of the fibres along the length of the yarn so that the filaments and substantially all of the fibres have substantially equal lengths for a given length of the yarn.

When a multiple core yarn in accordance with the present invention is subject to longitudinal stress, each fibre and filament in the yarn bears its share of the stress in view of the filaments and the fibres having substantially equal lengths for a given length of yarn. The fibres and filaments in the finished yarn are not individually under torsional stress and therefore each is able to contribute to the tensile strength of the yarn an amount which would be expected from the tensile strength of an individual fibre or filament. Accordingly, a yarn in accordance with the present invention has greater tensile strength than a yarn produced in the conventional manner from a fibre blend in the same qualitative and quantitative ratio as used in the multiple core yarn and, because of the nearly parallel arrangement of the fibres, the yarn has a softer texture. A fabric woven from a yarn in accordance with the present invention also has a softer texture and, in an area where the weave in itself does not provide for a division of the individual yarns, the actual dividing lines between yarn bodies become marked to a lesser extent than in the case with prior art yarns containing a considerable amount of twist. The nearly parallel arrangement of the fibres in a fabric woven from a yarn in accordance with the present invention allows for bunching up of the yarns and fibres by fibre slippage under stress within the limits established by the weave. The parallel position of the fibres is favorable to such fibre slippage and slippage occurs to a greater extent than it would in the case of twisted yarns spun in accordance with the prior art. The bunching up of the fibres and yarns greatly increases the tear resistance especially when a weave is chosen which favors such fibre slippage as is the case in a basket or similar loose weave.

Multiple core yarn in accordance with the present invention makes it possible to weave a cloth of greater density and lesser air permeability without substantially interfering with the vapor permeability of the cloth. This was heretofore not possible with the use of materials of the same general composition but spun in the customary manner, since the tension which is necessary on the loom to produce such high density fabrics could not be obtained due to excessive yarn breakage in the warp. High density fabrics produced from multiple core yarns in accordance with the present invention offer a large degree of protection against wind and the penetration of dust particles. This is of paramount importance for safety clothing to be worn in areas which are contaminated by radioactive dust or other toxic chemicals or bacteriologically contaminated particles.

The invention will be further described with reference to the accompanying drawings, in which:

Figure 1 is a schematic diagram showing the wrapping

of a roving of fibres about a filament yarn to form a core yarn;

Figure 2 is a schematic diagram showing the twisting together of two core yarns each of which has been formed in the manner indicated in Figure 1;

Figure 3 is a representation (greatly enlarged) of a roving wrapped about a filament in the manner indicated in Figure 1, part of the roving being removed; and

Figure 4 is a representation (greatly enlarged) of the finished yarn as produced in the manner indicated in Figure 2.

A finished multiple core yarn in accordance with the present invention is made by making a first and a second core yarn which are then twisted together. The first and second core yarns are made in the same manner and a process of making either the first or the second core yarn is illustrated by Figure 1 of the drawings. As shown in Figure 1 a filament yarn (endless fiber) 10, for example a nylon filament yarn, is taken from a cone 11 in the conventional manner and is fed into the front rolls 12 of a conventional spinning frame. A roving 13 of fibres, for example nylon, wool or cotton fibres, is taken in a conventional manner from a roving bobbin 14 and is fed into the back rolls 15 of the spinning frame. The front rolls 12 and the back rolls 15 are driven at different speeds so that the roving 13 is drawn in the usual manner. The filament yarn 10 and the roving 13 are fed together through the usual guide 16 and traveller 17 to a spinning bobbin 18 which is driven in a conventional manner, for instance by a belt 19. As indicated by the arrow 20, in this instance, the spinning bobbin 18 is driven in an anticlockwise direction. As the spinning bobbin 18 is driven the drawn roving 13 is wrapped around filament yarn 10 between the traveller 17 and the front rolls 12 of the spinning frame so that actual twist is applied only to the filament. If the size of the filament yarn 10 and of the roving 13 is properly chosen the filament yarn 10 becomes a core which is completely covered by the roving 13 to form a single core yarn 21. Preferably the filament yarn 10 while being covered by the roving 13 is under higher tension than the roving 13. The higher tension of the filament yarn 10 can be obtained in a number of well known ways, for example, by giving the filament yarn 10 one or more wraps around the guide rods 40 in Figure 1.

Figure 3 shows the structure of the core yarn 21 which is wound on the bobbin 18 in Figure 1. This core yarn 21 comprises the filament yarn 10 which is in the form of a central twisted core, and the roving 13 wound about the filament yarn 10 as indicated by the spiralling lines 31. Various groups 32, 33, and 34 of fibres in the roving 13 are shown wound away from the yarn to indicate that these fibres lie closely parallel to each other as they spiral about the filament yarn 10. The length of one complete revolution of twist in the yarn is indicated as T and the arrowed lines used show that this length of twist T is uniform throughout the yarn and along its length.

As shown in Figure 2, two full bobbins 18 of the core yarn 21 as produced by the method described in connection with Figure 1 are fed together through the rolls 22 of a twisting frame and a guide 23 to a twister bobbin 25. The twister bobbin 25 is driven by a belt 26 in the usual manner and as indicated by the arrow 27 the twister bobbin 25 is driven, in this instance, in a clockwise direction, that is, in the reverse rotational direction to the rotational direction of the spinning bobbin 18 in Figure 1. The twister bobbin 25 is arranged and driven to impart a similar number of turns per inch as the spinning bobbin 18 in Figure 1. The twist imparted by the spinning bobbin 18 to the filament yarn 10 and to the fibres in the roving 13 (Figure 1) is dissolved at the twister bobbin 25 and the entire core yarns 21 as they appear in the yarn wound on the spinning bobbin 25 are for practical purposes twistless. In twisting the two core yarns 21 together the filament yarns are interlaced along the length of the

yarn wound onto the spinning bobbin 25. The rovings of fibres twisted with and surrounding each of the interlaced filament yarns are interlaced with each other so that the rovings are held in place and no slippage of the relatively loose fibres in the rovings occurs in the multiple core yarn wound on the twister bobbin 25.

Figure 4 shows the general structure of the multiple core yarn wound onto the bobbin 25 in Figure 2. This yarn comprises two filament yarns 10 which are interlaced together along the length of the yarn. Also, the yarn comprises two rovings 13 which are interlaced together along the length of the yarn. Combining the core yarns 21, as described above and winding them onto the bobbin 25 dissolves the twist in each of the filaments 10. The filaments 10 with the rovings 13 laid about them are substantially twist free and the individual core yarns 21 are interlaced as shown in Figure 4 so that slippage of the relatively loose fibres in the rovings is prevented. As indicated in both Figures 3 and 4, the filaments 10 and substantially all the fibres of the rovings 13 have substantially equal lengths for a given length of the yarn. The filaments 10 and substantially all the fibres in the rovings 13 are closely parallel and in juxtaposition along the length of the yarn.

In weaving yarns made in accordance with the invention it is preferable to choose a weave which allows the maximum number of yarns to lie and bind in the identical manner. The number of yarns which should be arranged in this way depends on the desired appearance and performance of the fabric and the desired end use. A suitable type of weave is that known commercially as a basket weave. In a basket weave tear stress on the fabric is exerted perpendicularly to the general direction of one or the other yarn system and actually affects the fibres at substantially right angles. Accordingly a fabric woven with yarn in accordance with the present invention has a very high degree of resistance to tear.

What we claim as our invention is:

1. A multiple core yarn comprising a first filament yarn having a roving of fibers surrounding at least one filament, a second filament yarn having a roving of fibers surrounding at least one filament, the covered first and second filament yarns being interlaced with substantially all the fibers in a roving lying substantially parallel to each other and to the filament about which they are wrapped and being substantially twist-free about the longitudinal axis of the yarn and about their own axes.

2. A multiple core yarn comprising a first filament yarn having a roving of fibers surrounding at least one filament, a second filament yarn having a roving of fibers surrounding at least one filament the covered first and second filament yarns being interlaced, with substantially all the fibers in a roving lying substantially parallel to each other and to the filament they surround, said fibers being of substantially the same length as said filaments for a given length of yarn, and being substantially twist-free about the longitudinal axis of the yarn and about their own axes.

3. A multiple core yarn according to claim 1 wherein the filaments are nylon and the rovings are cotton.

4. A multiple core yarn according to claim 1 wherein the filaments are nylon and the rovings are wool.

References Cited in the file of this patent

UNITED STATES PATENTS

12,467	Haslam	Feb. 27, 1855
206,058	Travers	July 16, 1878
763,377	Drury	June 28, 1904
763,864	Drury	June 28, 1904
1,681,234	Heany	Aug. 21, 1928
2,057,577	Kennedy	Oct. 13, 1936
2,076,272	Harris	Apr. 6, 1937

(Other references on following page)

5

UNITED STATES PATENTS

2,313,058	Francis -----	Mar. 9, 1943
2,314,924	Davis -----	Mar. 30, 1943
2,387,320	Foster -----	Oct. 23, 1945
2,526,523	Weiss -----	Oct. 17, 1950

5

6

FOREIGN PATENTS

314,521	Great Britain -----	Jan.30, 1930
571,566	Great Britain -----	Aug. 30, 1945

OTHER REFERENCES

American Cotton Handbook, first edition, pages 339 and 350, copyright 1941, Barnes Printing Company, New York, N. Y. (Copy available in Division 21.)