

Dec. 15, 1936.

J. McNAMEE

2,064,074

KNITTED FABRIC

Filed Nov. 15, 1935

5 Sheets-Sheet 1

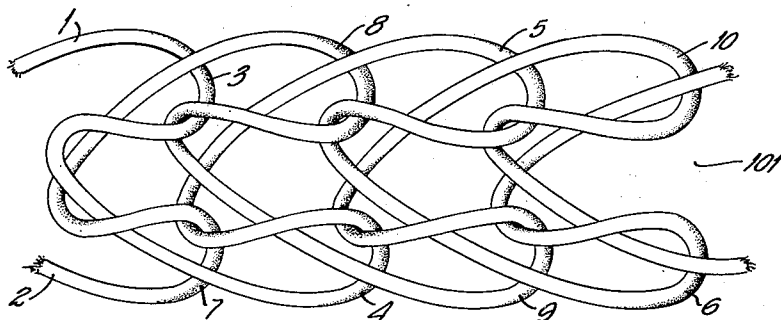


FIG. 1

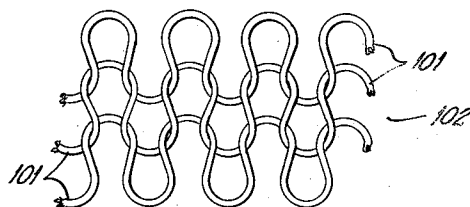


FIG. 2

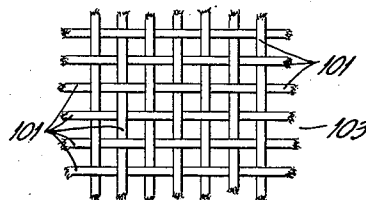


FIG. 2A

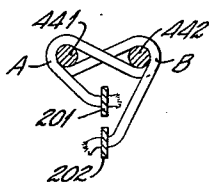


FIG. 18

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5 Sheets-Sheet 2

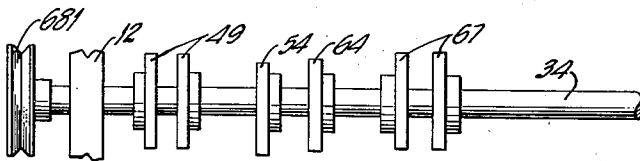
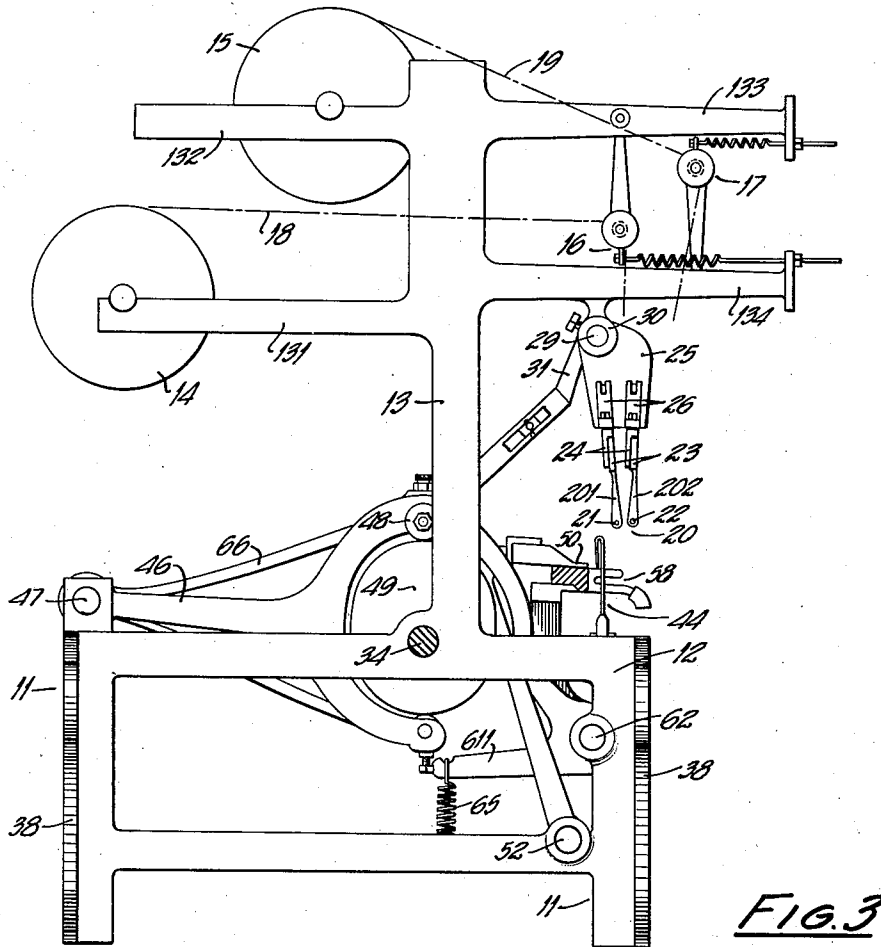


FIG. 6

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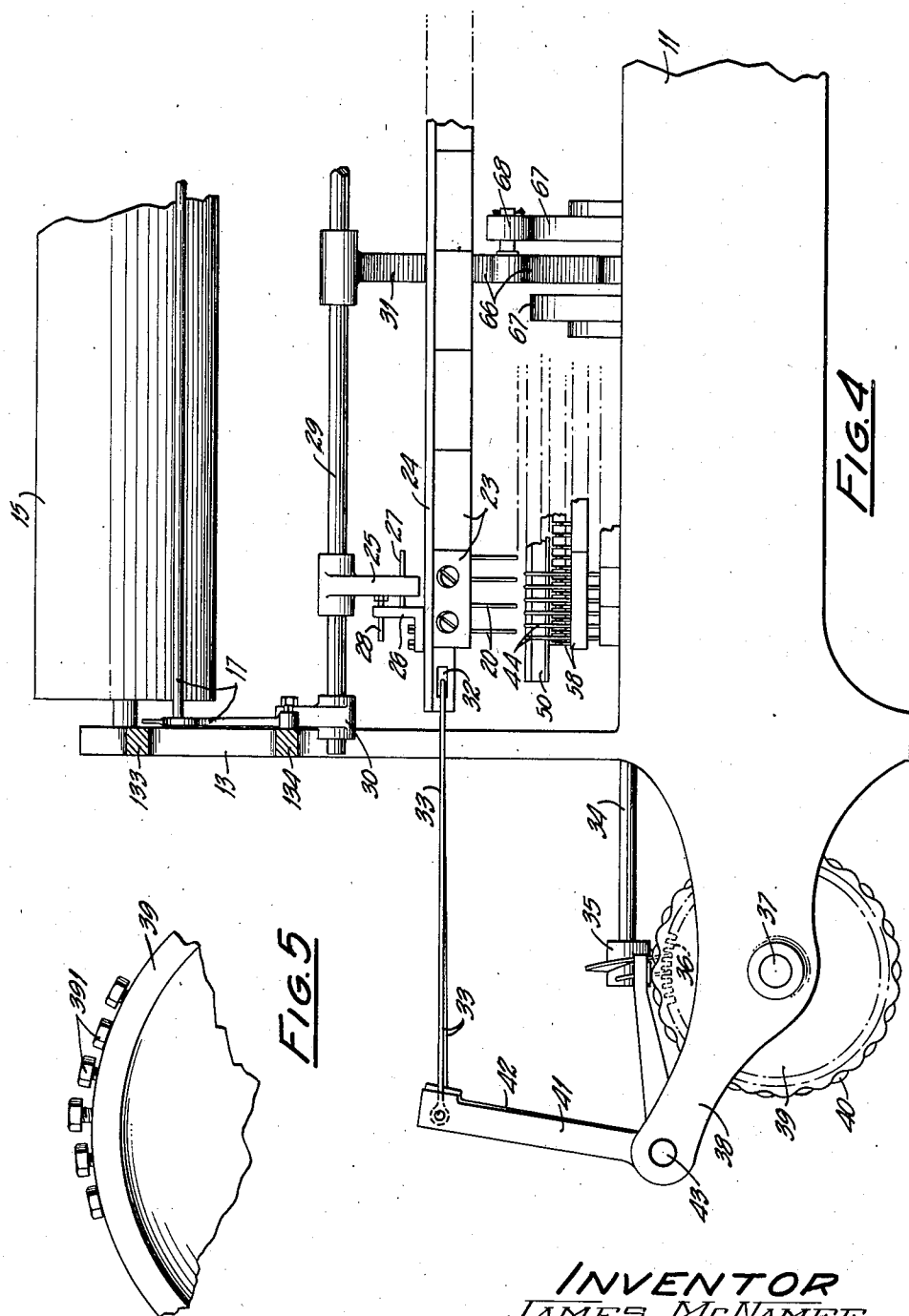
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5 Sheets-Sheet 3



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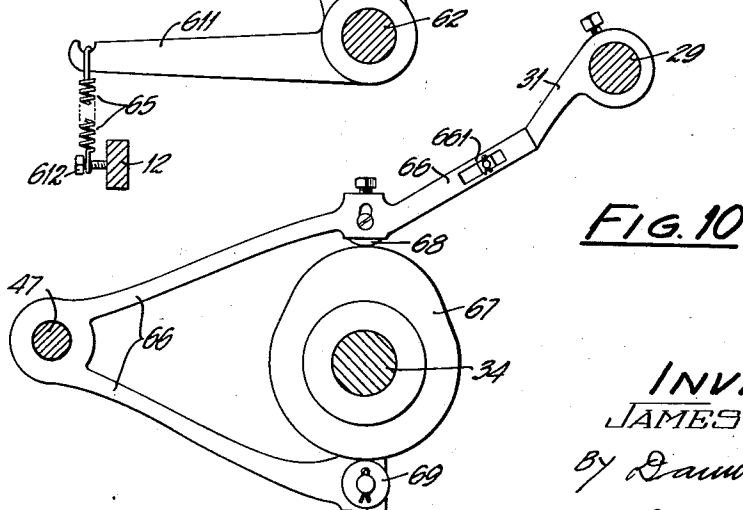
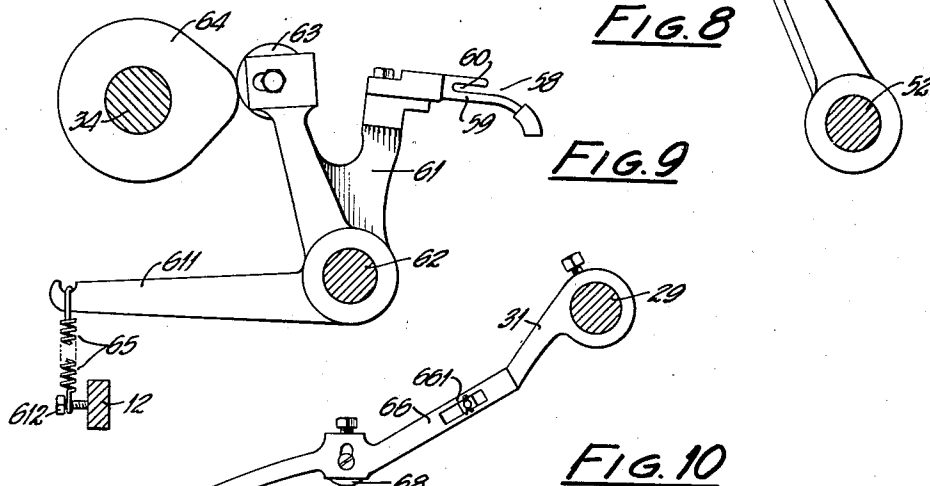
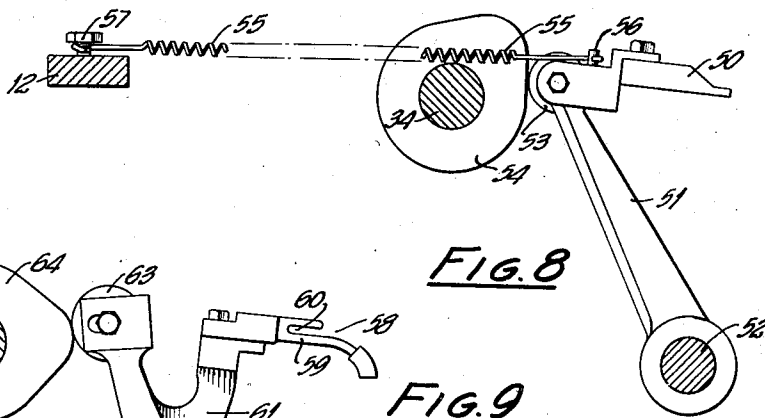
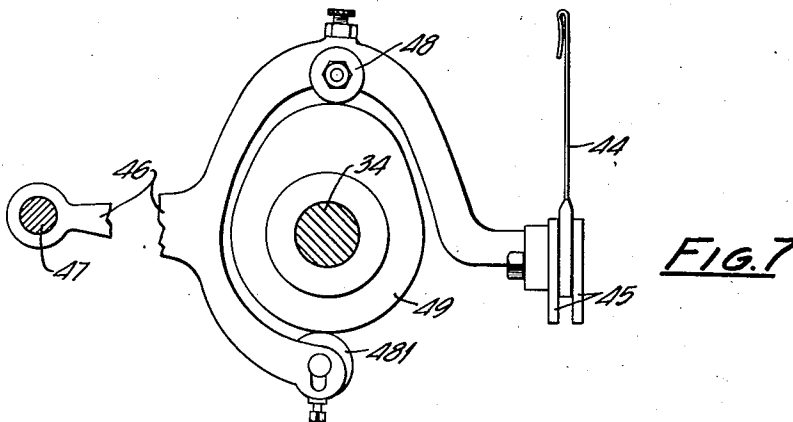
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5 Sheets-Sheet 4



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5 Sheets-Sheet 5

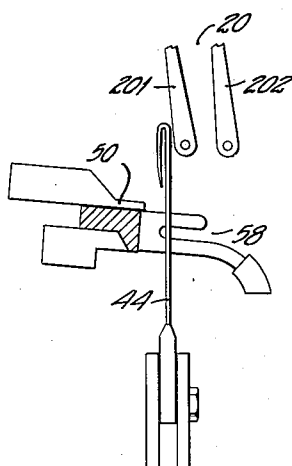


FIG. 11

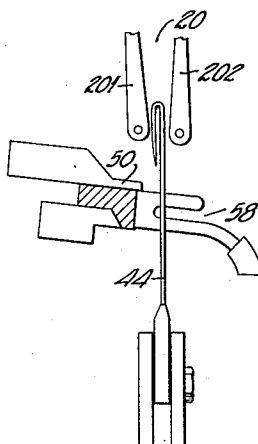


FIG. 12

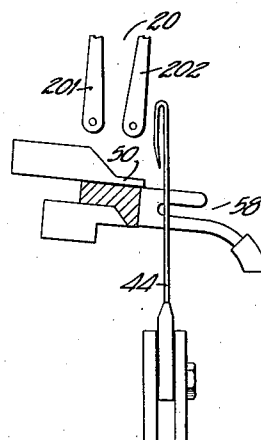


FIG. 13

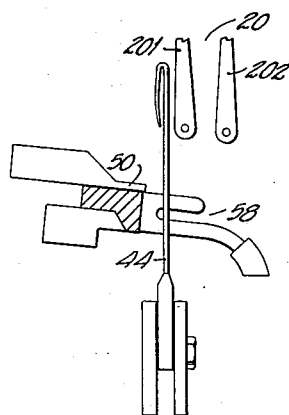


FIG. 14

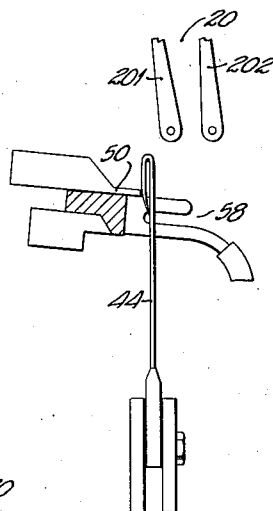


FIG. 15

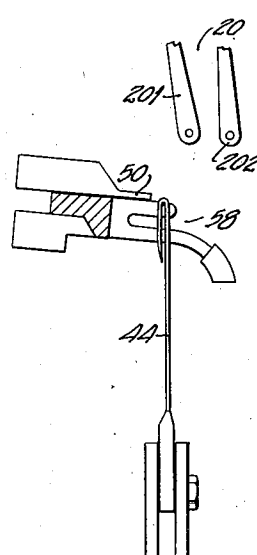


FIG. 16

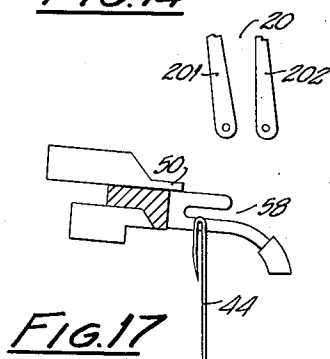


FIG. 17

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UNITED STATES PATENT OFFICE

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Application November 15, 1935, Serial No. 49,948

4 Claims. (Cl. 66—169)

My invention more particularly relates to a yarn composed of a multiplicity of threads, preferably two in number, which are interconnected in such a manner as to provide a yarn which is characterized by its durability, flexibility, resiliency and adaptability for use with weaving or knitting machines.

My invention has for a further object the provision of a yarn of the foregoing character formed of two yarns, which is comparatively simple to fabricate and is relatively much stronger than two yarns, taken together, having an equivalent weight per unit of length. My yarn is also distinguished by the fact that a breakage of one of the individual threads of which it is composed, due to the novel structural arrangement thereof, is localized and the effect upon the appearance of the yarn does not extend an appreciable extent along the same. Furthermore, the tendency to "run" or become discomposed, which is prevalent in ordinary fabrics, is absent in a fabric made from a yarn embodying my invention.

A further object of my invention resides in providing a yarn in which the individual threads forming the same may be of different colors and wherein, due to the construction involved, these colors are intimately associated and blended to produce a resultant yarn coloration which is substantially uniform to all outward appearances.

A still further object of my invention resides in the provision of a fabric which is formed with a yarn of the foregoing character which fabric simulates the appearance of a hand-made article and which is unbiased. In other words, the fabric inherently lacks any tendency to curl or warp, a reason for which being attributable to the character of the yarn employed in fabricating the same.

With these and other objects in view, my invention includes the novel arrangement of two or more threads to form a composite yarn and the fabric which is made therefrom together with their equivalent structures, described below and illustrated in the accompanying drawings in which—

Fig. 1 is a highly magnified and somewhat distorted view of my yarn;

Fig. 2 is a fragmentary, schematic view of a knitted fabric formed from the yarn illustrated in Fig. 1;

Fig. 2a is a fragmentary, schematic view of a woven fabric formed from the yarn illustrated in Fig. 1;

Fig. 3 is a side elevation of a machine with some of the operating mechanisms removed,

which machine is designed to fabricate the yarn of Fig. 1;

Fig. 4 is a fragmentary, front elevation view of the machine shown in Fig. 3;

Fig. 5 is a fragmentary, detail view of an adjustable form of a cam for controlling the movement of the thread guide bars;

Fig. 6 is a fragmentary view of the main cam shaft, illustrating some of the cams mounted thereon;

Fig. 7 is a detail view of the needles and an associated cam control;

Fig. 8 illustrates the presser bar and one of its associated controls;

Fig. 9 illustrates the cast-off mechanism and one of its cam controls;

Fig. 10 illustrates the control mechanism for the shaft which carries the thread guide bars;

Figs. 11, 12, 13, 14, 15, 16 and 17 represent diagrammatically successive, relative positions of the various cooperating elements for one cycle of operation thereof in fabricating the yarn; and

Fig. 18 is a schematic representation of the manner in which the threads are placed around the needles in the formation of the yarn.

It will be noted from an inspection of Fig. 1 that my yarn, in its preferred form, comprises a double series of interconnected loops or stitches. This structure may be readily created by a machine employing the principles of knitting and, for this purpose, I have illustrated a machine which is adapted and designed to knit and interconnect two threads in the manner hereinafter described.

The yarn, indicated generally at 101, in Fig. 1 is composed of two threads, indicated at 1 and 2. Thread 1, for purposes of describing the structural formation of the yarn, is formed into a first loop 3, which may be designated as lying on one side of the yarn, a second loop 4, which may be said to be on the other side, and then the further loops 5 and 6, said loops lying respectively on alternate sides of the yarn. Likewise, thread 2 is formed into a first loop 7, a second loop 8, a third loop 9 and a fourth loop 10, loops 7 and 9 lying on a side opposite to that of the loops 8 and 10. It will be seen that the second loop 8 of thread 2 is looped through the first loop 3 of thread 1 and that the second loop 4 of thread 1 is looped through the first loop 7 of thread 2. This process is continued in forming my yarn as, for example, the third loop 9 of thread 2 is looped through the second loop 4 of thread 1 and the third loop 5 of thread 1 is looped through the second loop 8 of thread 2. In

the practical method of fabricating a yarn of this character, the successive loops of each thread are formed on alternate knitting needles as hereinafter specifically described.

5 From the foregoing, it will be seen that the yarn is composed of a series of loops formed from two separate threads, successive loops of one thread being passed through successive loops of the other and forming two, closely associated
10 rows or series of knitted or substantially chain-like stitches. Hence, it will be evident that in the event of the rupture of one thread, the other thread will serve to bind the ends of the broken thread in place and prevent a progressive collapse
15 of the yarn structure. This feature is very desirable in yarns and particularly in yarns of the general construction herein disclosed.

In the finished product, the yarn, of course, does not appear the same as that illustrated in
20 the drawings as the yarn in the drawings is somewhat distorted for the sake of clearness. Actually, the yarn is substantially of uniform size throughout and in cross-section may be said to be polygonal or approximately rectangular.

25 Due to the successively inter-looped, structural arrangement of my yarn, it is characterized by its durability, as above indicated in reference to rupture, flexibility and resiliency. In flexing the yarn, each loop is moved relative to the adjacent
30 loops as in the manner of hinges. Hence, in many cases, a much smaller loop may be formed by my yarn than may be formed by a single thread of which it is composed. This, of course, is dependent upon the character of the thread
35 used; but, the character of the threads of which my yarn is primarily intended to be fabricated, such, for example, as silk, rayon and the like, has been determined to be less flexible than the yarn made therefrom in conformity with my inven-
40 tion. Obviously, in comparing the yarn with a thread of equivalent weight per unit of length, the difference therebetween in flexibility is very marked.

The resiliency of the yarn is also attributable to
45 the interlooped construction and, furthermore, this construction renders the yarn inherently unbiased so that, when made into a fabric, the fabric does not curl or warp but is comparatively soft and pliable.

50 I have for convenience referred in the claims to wales. It is to be understood that such wales refer to the chain-like stitches of the character above referred to and which are displaced from each other laterally of the yarn.

55 In Fig. 2 I have illustrated, by way of example, a knitted fabric in which my yarn is used. The fabric is indicated generally at 102 and is formed in the well known manner by interlooping the yarn 101 to form successive stitches. And in Fig.
60 2a I have illustrated a woven fabric, indicated generally at 103 which also is made in the usual manner.

The machine which I have illustrated as one means of fabricating my yarn may be best under-
65 stood by reference to Figs. 3 and 4 wherein the general disposition of the cooperating elements employed in knitting the yarn is illustrated. Referring first to Fig. 3, 11 indicates generally the frame of the machine which comprises a bed portion 12 and standards 13 extending upwardly at
70 each end thereof. Each standard 13 is formed with laterally extending arms 131, 132, 133 and 134 adapted to support the spools of thread 14 and 15 and the thread tensioning devices 16 and
75 17. The thread extending from the spools 14 and

15 is represented by the dot-dash lines 18 and 19 and is illustrated as passing over the tensioning devices 16 and 17, respectively, which, in the embodiment illustrated, comprises shafts extend-
5 ing transversely of the machine and helical springs are employed for the purpose of imposing the desired tension on the threads. From the tensioning devices, the threads are brought down-
wardly and threaded through holes or eyes provided in the guide bars indicated generally at 20.
10 For example, thread 18 is passed through the eye 21 provided in the rear guide bar 201 and thread 19 is passed through the eye 22 of the front bar 202. Obviously, the threads extend from the
15 guide bars to the work or yarn contained on the needles.

The guide bars 20 are disposed in a double row transversely of the machine, the disposition thereof being shown in Figs. 3 and 4 which are
20 views taken at right angles. A suitable number of guide bars are secured in proper spaced relationship in each of the blocks 23 which in turn are secured along two similar frames 24, one of which is disposed behind and substantially parallel with
25 the other. The frames are designed to be supported on, movable by and movable relative to rocker arms 25. This construction is afforded by means of angle plates 26, secured to frames 24,
30 which are provided with pins 27 adapted to extend through openings in the rocker arm 25. The rocker arm 25 is likewise provided with pins
35 28 which extend through openings in the angle plate 26.

It would be well to note at this point that my machine is symmetrically arranged as regards the
40 supporting and operating elements of the stitch forming mechanisms. For example, the frames 24 are provided with similar angle plates on their ends opposite to those illustrated which co-
operate with and are supported on a rocker arm 40 similar to arm 25. Because of similarity, therefore, approximately a half only of the machine has been illustrated and, it is believed, a descrip-
45 tion of this portion will suffice when read with the understanding that it is applicable to both halves of the machine. It should also be noted that only a few of the needles, guide bars and associated mechanisms are illustrated because, in
50 each case, they are duplicates and a description of one is sufficient for all. Obviously, the number employed depends upon the number of yarns that are being made at one time on the machine.

The rocker arms 25 are secured to a shaft 29
55 extending transversely of the machine and journaled in bearings 30 depending from the arms 134. A cam controlled arm 31 (see Fig. 4) hereinafter specifically described, is secured to shaft 29 and serves to effect an oscillatory rotation thereof to move the guide bars back and forth
60 relative to the needles.

The frames 24 are provided at one end with slotted openings 32 within which are secured links 33 which serve to connect frames 24 to the oper-
65 ating means for effecting a predetermined movement thereof transversely of the machine. The main cam shaft 34 which extends transversely of and is journaled in the bed of the machine is provided at one end with a worm 35 which
70 meshes with a worm wheel 36, indicated in dotted lines in Fig. 4. Worm wheel 36 is secured on a shaft 37 which is journaled in the brackets 38 which may be cast integrally with the frame 12. Shaft 37 has secured thereon two cams 39 and 40 which are engaged by the arms of bell
75 cranks 41 and 42, respectively, which are pivoted

on a shaft 43 secured between the brackets 38. To the other arms of the bell cranks are respectively connected the links 33. The worm and wheel transmit motion from the main cam shaft 34 to shaft 37 and the rotation of cams 39 and 40 effect through the bell cranks 41 and 42 and links 33 an independent reciprocating movement of the frames 24 transversely of the machine. This movement is intermittent due to the slotted construction of the frames with which the links cooperate and is, obviously, timed with relation to the other moving parts of the machine. Furthermore, the weight of the arms of cranks 41 and 42 maintain the same in engagement with their operating cams.

The cams 39 and 40 may be constructed in the manner illustrated in Fig. 5 wherein the degree of movement of the guide bars transversely of the machine may be varied and adjusted by the set screws 391 which form the cam surface.

The guide bars, above described, are adapted to cooperate with and guide the passage of the threads about the needles, indicated at 44, which are disposed in a single row transversely of the machine. Fig. 7 illustrates the manner in which the needles are supported and controlled to move, it being understood that the needles are disposed to extend vertically between the bars of the cast-off mechanism, hereinafter described, and are actuated in a substantially vertical direction. By referring to Fig. 7 it will be seen that the needles 44 are suitably secured in frames 45 which are supported on needle arms or cranks 46, pivoted on a shaft 47. Shaft 47 is supported in the frame 11 and extends transversely of the machine to provide a pivot for the needle arms and the operating arm for the shaft 29 which supports the guide bars. There are preferably two needle arms 46 each of which is connected adjacent an end of the needle frames and the description of one is sufficient for both. The needle arm 46 is provided with two diametrically opposed rollers 48 and 481, disposed on opposite sides thereof and adapted to contact identically formed cams 49 whereby a positively controlled movement is transmitted to the needles. Cams 49 are keyed on the cam shaft 34 and effect through the medium of the comparatively long needle arms 46 a predetermined, substantially vertical movement of the needles.

Fig. 8 illustrates the presser bar 50 and one of its two similar supporting and actuating mechanisms. The presser bar extends transversely of the machine adjacent the needles and is actuated to press against the beads thereof during a predetermined portion of the cycle of operation of the stitch forming mechanisms. The presser bar 50 is suitably secured to a rocker arm 51 which is pivotally mounted on a shaft 52 extending transversely of the machine. A roller 53 rotatably mounted on the arm 51 is engaged by a cam 54 mounted on cam shaft 34. The roller is urged in contact with cam 54 by a tension spring 55 which is secured between a pin 56 on arm 51 and a stud 57 secured in a transverse member of the bed 12.

In Fig. 9 is illustrated one of the two similar supporting and actuating devices for the cast-off mechanism indicated generally at 58. The cast-off mechanism comprises a series of bifurcated vanes 59 extending in spaced, parallel relationship transversely of the machine. These vanes are disposed to permit the needles 44 to reciprocate therebetween and, preferably, a needle is accommodated in each space between adjacent

vanes. The reentrant portion 60 in the vanes, formed by the bifurcation, serves to prevent work from being carried upwardly by the needles, the stitches being cast off over the lip of the upper and shorter branch of the vanes and being caught thereunder. The cast-off mechanism 58 is suitably secured to two bell cranks 61, rotatably supported on a shaft 62 which extends transversely of the machine and is suitably supported in the frame 12 thereof. Each bell crank 61 is provided with a roller 63 which engages a cam 64 secured to the cam shaft 34 whereby the desired movement of the cast-off mechanism is effected. A tension spring 65 is connected between one arm 611 of the bell crank 61 and a stud 612 secured in a transverse member of the frame 12 to maintain the roller 63 in engagement with its cooperating cam 64.

The cam drive for effecting an oscillatory movement of the guide bars 20, hereinbefore described, is illustrated in Fig. 10. The arm 31 which is secured to shaft 29 is connected to an arm 66 through a flexible coupling indicated generally at 661 and comprising a pin pivoted to arm 31 and slidably mounted in a slot in arm 66. Cams 67, secured to cam shaft 34, engage rollers 68 and 69, respectively, which are mounted on the arm 66 and are adapted to engage the cams on diametrically opposite sides. Arm 66 is pivoted on shaft 47, hereinbefore referred to in connection with Fig. 7. The movement imparted to arm 66 by cams 67 is transmitted through arm 31 and effects an oscillating, rotary movement of shaft 29 whereby the guides 20 are reciprocated substantially in a plane at right angles to the needles 44.

In the foregoing, I have segregated and described the various stitch forming elements together with the means for supporting and actuating the same. Their dispositions relative to each other and to the frame of the machine may be readily understood from an inspection of Figs. 3 and 4.

Furthermore, in Fig. 6, I have shown a fragmentary portion of the cam shaft 34 with some of the cams mounted thereon, it being understood that, with the exception of the guide bar cams which are mounted substantially in the middle of the shaft, the balance of the cams are duplicates of those illustrated and are disposed in inverse order on the shaft from its middle toward the end. A pulley 681 is illustrated mounted on the end of shaft 34 over which may be reeved a belt for driving the same.

The cooperation of the stitch forming or knitting elements of my machine and their manner of operation in fabricating my yarn will best be understood by reference to Figs. 11 to 17, inclusive, which respectively illustrate the elements in consecutive positions during one cycle of their knitting operation. It should be remembered that the elements are operated from the same cam shaft and that the actuating cams for each element are designed to effect a timed operation thereof relative to the other elements. Furthermore, it is to be understood that in the formation of a single yarn two needles and two guide bars are utilized, the two guide bars being, at the beginning of a cycle, disposed in a plane extending between the two needles with which they cooperate and at right angles to the plane of the needles.

Referring first to Fig. 11, the elements are illustrated in the positions which they assume at the beginning of a stitch forming cycle. It will be understood that the other needle employed in forming the yarn is directly back of the needle

illustrated and therefore does not appear. Assuming that the last loops of the yarn encircle the two needles 44, a first thread thereof extends upwardly through the eye 21 in the guide bar 201 and, as shown in Fig. 3, over the tensioning device 16 to spool 14. The second thread extends through the eye 22 of guide bar 202 and over the tensioning device 17 to spool 15. The guide bars 20 are moved between the two needles toward the left as viewed in Figs. 12 and 13. This movement is produced through an operation of cam 67 which effects a rotation of shaft 29 upon which the guide bars are supported. Cams 39 and 40 then effect a movement of the two bars transversely of the machine in opposite directions and into planes through which they may be moved back on the outside of the needles and to the position illustrated in Fig. 14. When the guide bars have cleared the needles the cams 39 and 40 move them back into the same plane or, in other words, to their starting positions. The result of this operation of the guide bars is disclosed in Fig. 18. For example, guide bar 201 has formed a loop of said first thread A around the needle 441 in one direction and guide bar 202 has formed a loop of said second thread B around the adjacent needle 442 in the opposite direction. The needles 44 are then, at or slightly before the termination of movement of the guide bars, moved upwardly thereby causing the loops to pass downwardly on the needles and below the beards thereof. Thereafter, the needles descend and the loop of thread on each needle passes under the beard thereof. As the needles continue to descend and immediately before the beards engage the last formed loop of the yarn which is around the needles and approximately in the plane of the reentrant portions of the cast-off mechanism, the presser bar 50 is urged against said beards thereby causing said loops of the yarn to pass thereover. As the presser bar is withdrawn from engagement with the needles, the cast-off mechanism 50 is moved to the left, as shown in Fig. 16 so that as the needles pass beneath the upper branch of the bifurcated element 59 the loops of yarn are cast off over the top of the needle and over the lip of the cast-off mechanism. The needles continue to descend and the cast-off mechanism moves toward the right to the position shown in Fig. 17, thereby preventing the work from riding up with the needles. In other words, the threads extending between the loops formed on the two needles are caught in the reentrant portion of the vane disposed intermediate the two needles. The needles 44 then move upwardly to the position shown in Fig. 11 in readiness for substantially a repetition of the foregoing cycle. The above described operation of the stitch forming mechanism discloses the manner in which one of the threads is knitted on one of the needles and the other on the other needle. However, the yarn of my invention comprises two threads which are knitted together to form alternate loops in the double row of stitches of which the yarn is composed. In the stitch forming cycle following the one above described, therefore, the guide bars are again moved between the needles to the position illustrated in Fig. 13 and are again moved transversely of the machine but in a direction opposite to that described above. In other words, the first thread A which in the above described cycle was passed around the needle 441, as shown in Fig. 18 is, in the second cycle, passed around the adjacent needle 442 and the second thread B, which passed around the last mentioned needle in the first

cycle, is passed around the needle 441. The above described cycles of operation are successively repeated and a yarn having the structure hereinbefore described is produced.

When my yarn is, for example, made into a knitted fabric, the result produced simulates a hand made article which is much more attractive than an equivalent machine made article. Furthermore, due to the novel construction of my yarn, a fabric formed therefrom is unbiased; that is, it lacks any tendency to curl or warp, a characteristic which is very desirable in a fabric which is to be used in the manufacture of garments and similar articles.

It should also be noted that a great many colors and shades may be produced in my yarns by selecting the desired combination of colored threads used in fabricating the same. Likewise, this wide range of colors is obtainable in the fabrics made from my yarns. Furthermore, the resultant color of the yarn has a much better aesthetic appearance than, for example, a twisted yarn formed from threads of the same coloration. This result is due to the fact that the two threads are intimately joined together to form minute, successive loops of alternate colors. Obviously, in the fabric formed from a yarn of my construction, the coloration of the individual threads of which the yarn is composed is not readily ascertainable and the fabric appears to be of substantially uniform coloration.

It is to be understood that my yarn may be, if desired, composed of three or more threads joined together in the same manner as the two threads herein disclosed. Furthermore, yarns embodying my present invention may be used in all forms of needlecraft and I have, merely for exemplification, illustrated and described a knitted and a woven fabric.

For example, a very important application of fabrics made from a yarn of the character set forth extends to the tire industry. Because of the great flexibility and strength of the fabric, which characteristics are derived from the yarn of which it is composed, it is admirably adapted for use in the base of a rubber tire. Furthermore, the comparatively pervious character of the fabric and also the yarn itself permits a very intimate bond to be formed between it and the rubber which is applied thereto.

A further important feature resides in the fact that a woven fabric embodying my invention has a resiliency in all directions that has hitherto been enjoyed in part only by knitted fabrics.

While I have described my novel yarn in its preferred embodiment and a representative woven and knitted fabric formed therefrom, it is to be understood that the words are descriptive and the illustrations exemplary and, hence, changes within the purview of the appended claims may be made without departing from the true scope and spirit of my invention in its broader aspects.

What I claim is:

1. A knitted fabric composed of a plurality of interknitted yarn loops the yarn of which consists of two threads forming only two wales, the loops of the two threads alternating in a given wale.

2. A knitted fabric composed of a plurality of interknitted loops the yarn of which consists of two threads forming only two wales, a loop of one thread being disposed in and interconnected with one of said wales and the next succeeding loop of said thread being disposed in and interconnected with the other of said wales.

3. A knitted fabric composed of a plurality of interknitted yarn loops the yarn of which consists of two threads forming only two wales, a loop of one thread being disposed in and interconnected with one of said wales and the next succeeding loop of said thread being disposed in and interconnected with the other of said wales and in a predetermined sequence.

4. A knitted fabric composed of a plurality of interknitted yarn loops the yarn of which consists of two threads forming only two wales, the loops of a given thread being successively disposed in different wales.

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