Oct. 17, 1939. G. L. LOGAN 2,176,533

METHOD OF AND APPARATUS FOR MAKING KNITTED FABRICS

Filed Dec. 24, 1937 3 Sheets-Sheet 1

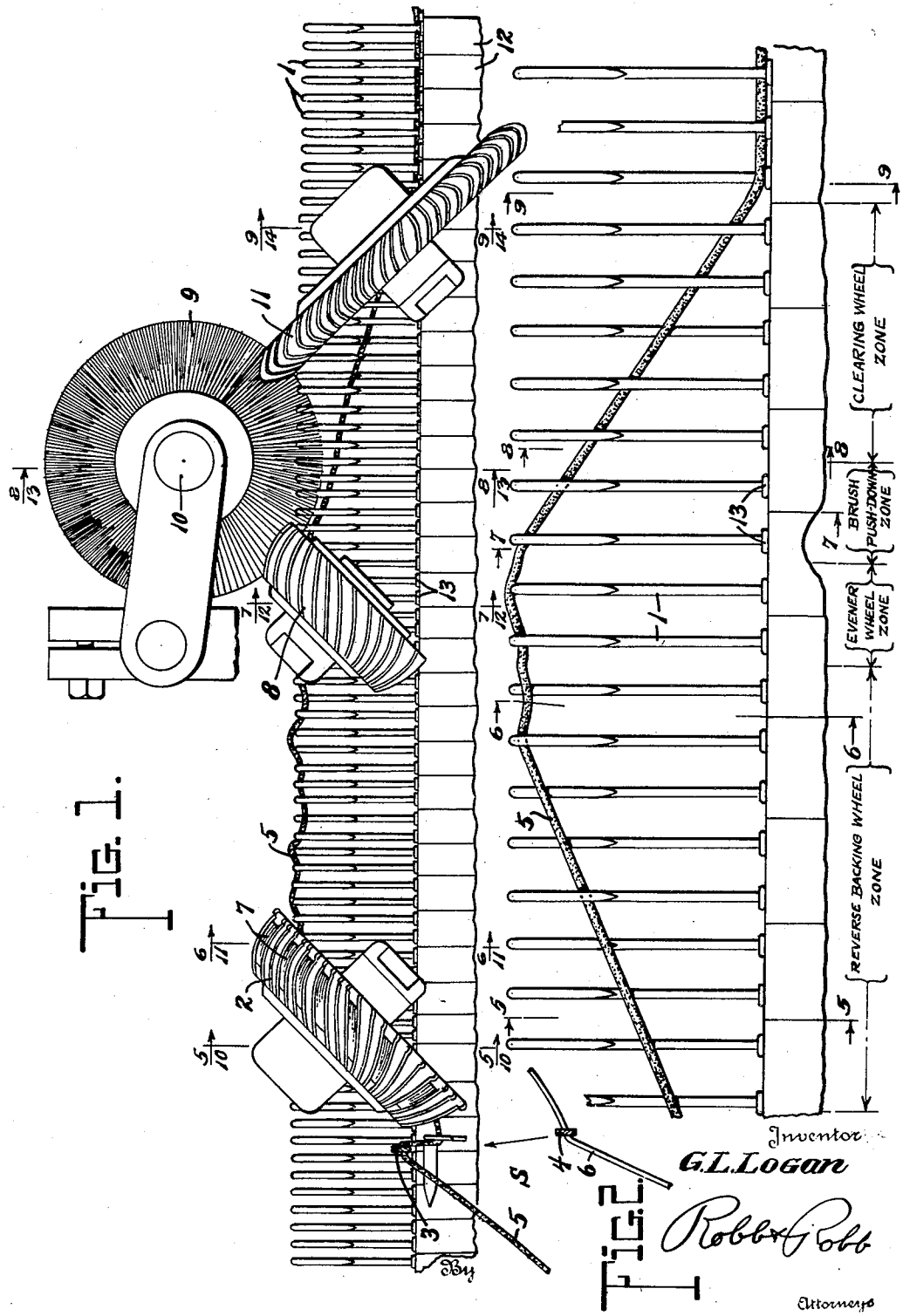


Fig. 1.

Fig. 2.

Inventor
G.L.Logan
Robb & Robb
Attorneys

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Fig. 3.

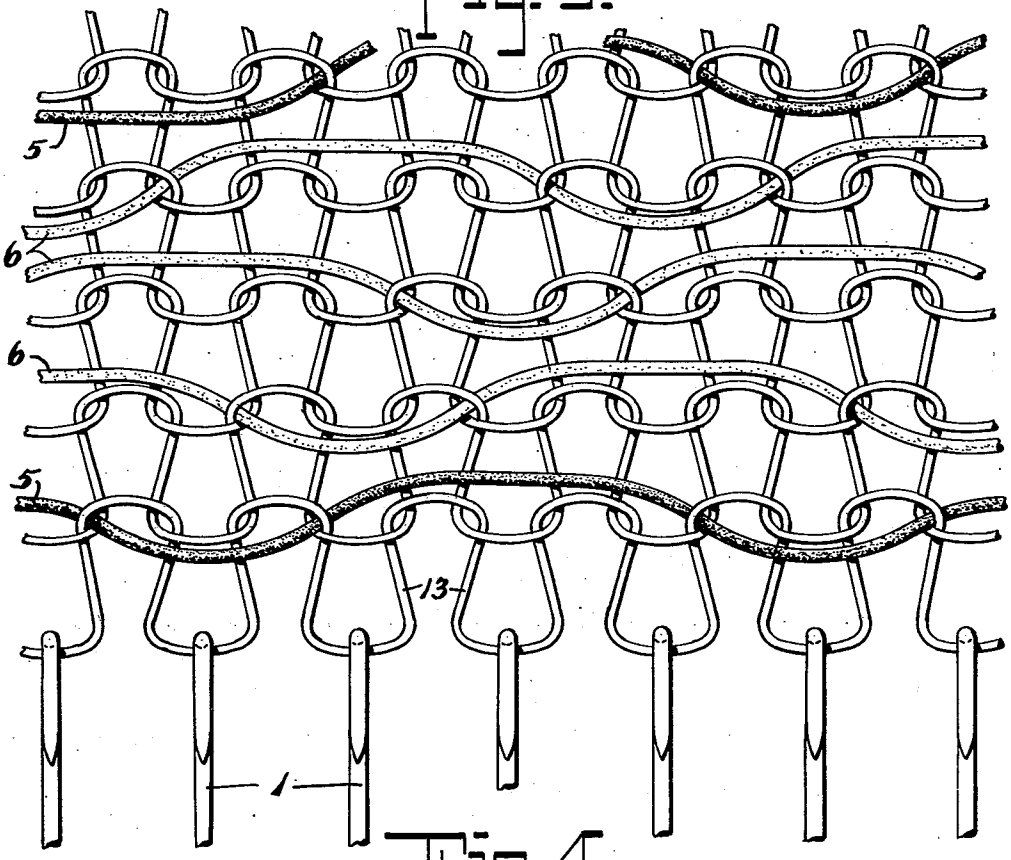
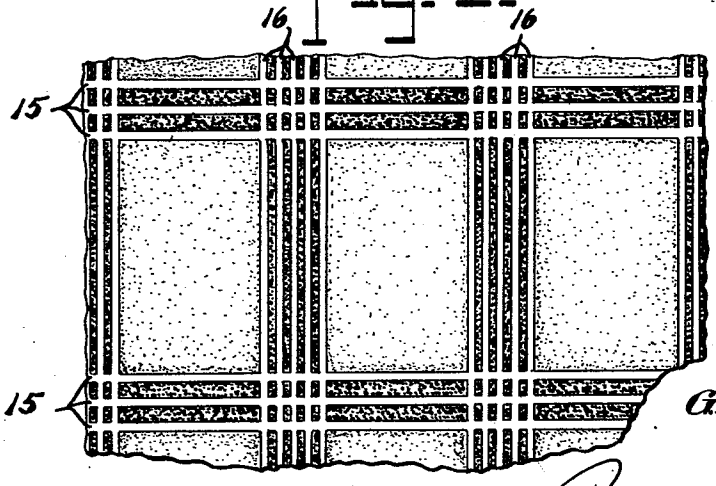


Fig. 4.



Inventor
G.L.Logan

By Robb & Robb
Attorneys

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Fig. 5.

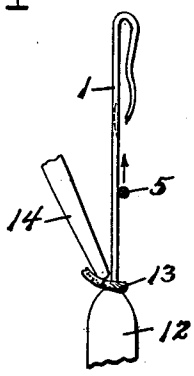


Fig. 6.

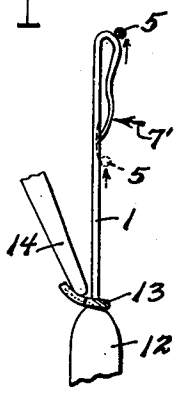


Fig. 7.

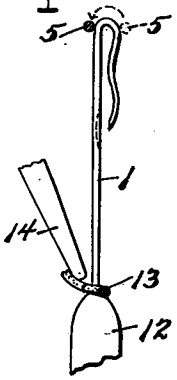


Fig. 8.

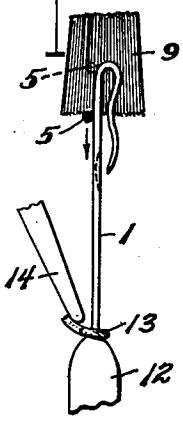


Fig. 9.

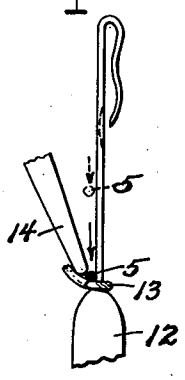


Fig. 10.

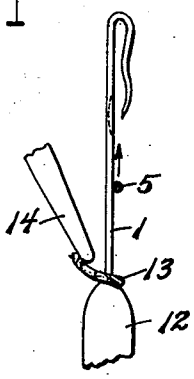


Fig. 11.

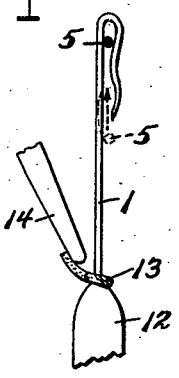


Fig. 12.

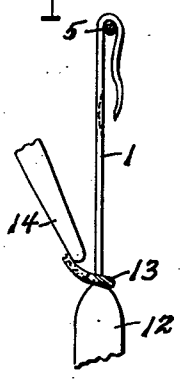


Fig. 13.

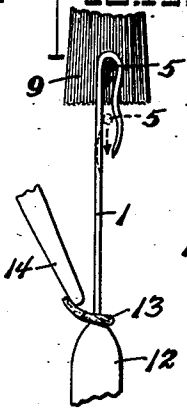
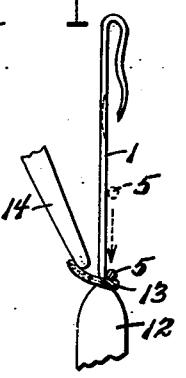


Fig. 14.



Inventor
G. L. Logan

By Robb & Robb
Attorneys

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UNITED STATES PATENT OFFICE

2,176,533

METHOD OF AND APPARATUS FOR MAKING KNITTED FABRICS

George L. Logan, Syracuse, N. Y., assignor to Tompkins Bros. Co., Syracuse, N. Y., a corporation of New York

Application December 24, 1937, Serial No. 181,693

10 Claims. (Cl. 66—80)

This invention appertains to a novel and improved method of and apparatus for making knitted fabrics, and more especially to a new method and means for introducing a yarn which is not normally knitted, known as a backing or lay-in yarn, into fabrics knitted upon circular spring needle knitting machines.

I am aware that it is not new to apply a backing yarn to knitted fabrics, as this has been done for many years to give more body or weight to certain fabrics.. Also, in recent years, there has been developed a new field of knitted fabrics embodying backing yarns wherein the backing yarns form the finished surface of the fabric. Knitted, cotton-backed, overcoating material is one good example of such fabrics which have been developed in this new field.

Heretofore, in knitting cotton-backed overcoating fabrics on a circular spring needle knitting machine, the machine is set up to operate in the usual and well known manner, which is to say, the backing yarn is put into the fabric by means of a backing wheel which is a standard attachment for these machines. In the conventional use of a backing wheel, it is mounted at a suitable point outside of the needle circle in such manner that it runs inwardly towards the needles, thereby carrying the backing yarn into the needles of the needle circle by moving the yarn downwardly about the top of the needles so as to ultimately become laid in the needles alternately in front of and in back of the same in a predetermined order. The backing yarn is not knitted into loops as in the case of the regular yarns which form the cotton backing and which are knitted in the well known manner, but is merely tied in with the regular knitted loops or stitches so as to become united with the same. The fabric is accordingly knitted in tubular form with the cotton face on the inside of the tube and the backing yarns on the outside, and whereas the outside face of the tube is normally known as the back of the fabric, it becomes the front or finished face of the fabric in the case of fabrics of this type. The backing yarn is preferably a heavy fleece or equivalent type of yarn, so that in the finished fabric the backing yarns completely hide the cotton stitches so that they cannot be seen from the side of the fabric on which the backing yarns appear; but, of course, the opposite face of the fabric is formed by the regular cotton stitches.

In the knitting of these fabrics in the old manner just described, only a very limited range of designs and patterns may be attained in the back face of the fabric formed by the backing yarn and which becomes the finished face. My invention largely overcomes these limitations, and is especially adaptable to use with standard and conventional stripers or yarn changers which heretofore could not be used in association with backing yarns without substantial modification and redesigning of the standard knitting machine attachments or without unduly complicating the set-up of the machine. Through my invention, I am able to stripe in a practical and efficient manner the back of the fabric formed by the backing yarn, thereby opening up a new field of patterns, designs, stripes, checks and plaids, which heretofore could not be attained in a practical manner through following the old practices.

In carrying out my invention, I largely employ standard parts heretofore employed in knitting machines, with the exception of one or two elements which may be said to be of new but very simple design.

In practicing my new method, the backing or lay-in yarn is introduced into the needle circle by moving the yarn upwardly into the needles instead of downwardly as hereinbefore mentioned. This is preferably attained by employing what I call a "reverse backing wheel." This wheel is generally similar to a regular backing wheel, excepting that it is positioned substantially reversely to its customary position, thereby causing the backing wheel to run outwardly away from the needles in the same manner as a regular stitch wheel. By reason of the use of a reverse backing wheel, I am able to employ conventional yarn changing instrumentalities in association therewith whereby to change the color or type of backing yarn being introduced into the needle circle, at will. Upon introducing the backing yarn upwardly into the needles so as to initially lay the yarn in front of all the needles, the backing yarn is further manipulated by suitable instrumentalities to carry the yarn over the top of and down behind certain of the needles so as to ultimately cause the backing yarn to assume a conventional position in the needles, that is, alternately in front of and behind the needles in a predetermined order.

Other and further objects and advantages of the invention will be hereinafter described, and the novel features thereof defined by the appended claims.

In the drawings:

Figure 1 is a fragmentary detail view in side elevation, showing a portion of a needle circle of

a leaded or trick spring needle circular knitting machine, together with suitable backing yarn manipulating instrumentalities having an arrangement as in practicing my invention;

Figure 2 is a view in side elevation, on a somewhat enlarged scale, illustrating the manner in which the backing yarn is laid in the needles of the needle circle;

Figure 3 is an enlarged view of a fragmentary section of fabric knitted according to my invention, and particularly showing the stitch structure and the relationship of the backing or lay-in yarns thereto, the backing or lay-in yarns being shown somewhat diagrammatically;

Figure 4 is a somewhat diagrammatic view of a fragmentary portion of a knitted fabric, as viewed from the backing yarn side, illustrating the application of my invention to the knitting of the backing yarn to form a design which includes an arrangement of stripes formed by the backing yarns, it being understood that the design is merely illustrative;

Figures 5, 6, 7, 8 and 9 are sectional views taken approximately on the lines 5—5, 6—6, 7—7, 8—8 and 9—9, respectively, of Figures 1 and 2, and illustrating the different stages of manipulation of the backing yarn relative to those needles behind which the backing yarn is ultimately placed;

Figures 10, 11, 12, 13 and 14 are sectional views generally corresponding to Figures 5 to 9 and taken on substantially the same planes as indicated by the lines 10—10, 11—11, 12—12, 13—13 and 14—14, respectively, of Figure 1, but with the needle cylinder slightly displaced from the position represented in Figures 5 to 9, so as to illustrate the different stages of manipulation of the backing yarn at those needles where the backing yarn remains in front of the needles.

Like reference characters designate corresponding parts in the several figures of the drawings.

In Figure 1, there is represented a fragmentary portion of a well known type of circular spring needle knitting machine, which includes the usual rotary needle cylinder (not shown) which carries the spring needles 1. At a suitable point about the needle circle, and positioned outside of the needle circle, I preferably provide a backing wheel 2, which I have termed a "reverse backing wheel" by reason of the fact that its position is substantially the reverse of the usual position of a backing wheel. As shown, the axis of the backing wheel 2 is inclined in such a direction that the wheel runs outwardly away from the needle circle in its coaction with the needles, thereby generally corresponding to the action of a conventional stitch wheel. By reason of the provision of the reverse backing wheel 2, I am able to utilize a conventional striper or yarn changer therewith, the striper being generally designated S and including two or more interchangeable guide fingers 3 and 4 for selectively manipulating the backing yarns 5 and 6 into and out of cooperative relation with the reverse backing wheel 2, as will be readily understood by those familiar with the art. The backing wheel 2 is provided with a plurality of blocks 7 arranged in a predetermined order between the blades thereof in a well known manner, and introduces one or the other of the backing yarns 5 and 6, according to the position of the respective yarn-changing fingers 3 and 4, into the needles 1 in a manner generally similar to a conventional blocked stitch wheel. For the sake of simplicity, the following description will be primarily directed to the manipulation of just one of the backing yarns 5, which, according to Figure 1, is being introduced into the needles. It is to be understood, of course, that the action is identically the same for the other backing yarn 6 when the finger 4, which guides this yarn, is moved upwardly in the direction of the arrow in Figure 1, to bring the yarn 6 into operative relation to the reverse backing wheel 2, and the finger 3 is moved downwardly to carry the yarn 5 out of operative relation respecting the backing wheel, according to the well known action of a yarn changing attachment.

Excepting for the change in the angular position of the reverse backing wheel 2, the construction of this wheel may be the same as in the usual backing wheel, and accordingly need not be further elaborated upon. By reason of its construction, the proper length of the backing yarn 5 is introduced into the needles of the needle circle. This would not be possible with a regular blocked stitch wheel because in the latter it is impossible to feed in a short enough length of yarn at the point of its introduction into the needles, to compare with that required for backing yarns.

It will thus be seen that the reverse backing wheel 2 preferably feeds the backing yarn 5 into the needles 1 from a point outside of the needle circle, the backing yarn being carried upwardly from a point below the needle beards towards the top of the needles, as will be best understood from reference to Figure 2. The blocks 7 in the backing wheel 2 engage the needle beards of certain needles, according to the predetermined arrangement of the blocks in the backing wheel, thereby closing the beards of these needles and causing the backing yarn 5 to be carried upwardly in front of the needle beards of these selected needles. At the other needles where the blocks are left out of the backing wheel, the backing yarn 5 is allowed to freely pass under the beards of these needles. It will be clear then that when the needles have passed the reverse backing wheel 2, assuming the rotation of the needle circle to be from left to right as viewed in Figures 1 and 2, the backing yarn 5 will be positioned adjacent to the tops of the needles, and will lie within the beards of certain of the needles and at the outside or in front of the beards of certain other needles, according to the particular arrangement of the blocks 7 in the reverse backing wheel 2, which, of course, may be varied as desired.

Also positioned outside of the needle circle at a point somewhat beyond the reverse backing wheel 2 in the direction of rotation of the needle cylinder, there is provided an evener wheel 8, which may be of conventional construction, and the position of which generally corresponds to that of the reverse backing wheel 2. The function of this evener wheel 8 is to push the backing yarn upwardly and over the tops of those needle beards in front of which the backing yarn is lying just prior to reaching the evener wheel. Just beyond the evener wheel 8, there is mounted a circular brush 9, preferably composed of relatively fine and stiff wire or other suitable bristles, this brush being positioned directly over the upper ends of the needles and with the bristles of the lower edge of the brush extending downwardly substantially below the tops of the needles and lying partly in front of the needles and partly in back of the needles. The brush is free to rotate on a suitable support, generally designated 10, and the rotation is effected by the rotation of the needle cylinder, and through interengage-

ment of the needles with the brush. The function of the brush is to push the backing yarn downwardly on the needles to a limited extent as the needles advance beyond the evener wheel 8.

Beyond the circular brush 9 in the direction of advancement of the needles, and also preferably mounted outside the needle circle, there is provided a clearing wheel 11. The axis of rotation of the clearing wheel 11 is inclined substantially oppositely to the axes of the reverse backing wheel 2 and the evener wheel 8, and the angle is such that the clearing wheel 11 serves to push the backing yarn all the way down on the needles 1 to substantially the tops of the leads 12 in which the needles 1 are mounted.

It will be understood, of course, that the needles 1 also carry the regular loops or stitches 13, which, in the case of a cotton-backed overcoating fabric, form the inner face of the fabric tube knitted by the machine. These stitches or loops may be formed in the regular and customary manner by suitable instrumentalities not shown, but which will be readily understood by those familiar with the art. The cotton yarn would be fed into the needles at some other point about the needle circle, as will be obvious.

As the courses of stitches 13 are knitted, the backing yarn is introduced into the fabric in the manner just described, and while my invention contemplates a new method and means for introducing the backing yarn into the needles, the position of the backing yarn ultimately becomes the same as heretofore attained through the old practice insofar as its relationship to the needles is concerned and to that part of the fabric which is formed by the stitches or loops 13. That is to say, when the needles and backing yarn have advanced past the clearing wheel 11, the backing yarn then occupies the usual position of a backing yarn which is laid in the needles in the conventional manner, and wherein the backing yarn lies alternately in front of and in back of certain needles so as to ultimately become bound in and united with the finished fabric, but without being knitted into stitches or loops, as will be understood from reference to Figure 3. In this figure, the yarns are shown on a somewhat enlarged and exaggerated scale, the stitches or loops 13 being knitted on the needles 1 in the regular and conventional manner and forming the inner surface of the fabric tube as it is knitted on the circular machine, and the yarns 5 and 6 constituting the backing yarns which form the outer surface of the fabric tube, and being interlaced with and bound in with the stitches 13 in the usual manner of backing yarns. In the case of cotton-backed overcoating material, where the backing yarns 5 and 6 are preferably composed of heavy fleece or the like, the surface of the finished fabric as viewed in Figure 3 is primarily composed of the fleece backing yarns, which will completely conceal the cotton stitches 13 and give to this face of the fabric a uniform fleece appearance generally corresponding to that obtained in a woven fleece fabric. After the fabric has been knitted, it may be fulled, brushed, sheared, etc., as desired, according to the customary treatment of such fabrics.

Briefly summarizing the operations of introducing the backing yarn according to the new method herein disclosed, and particularly referring to Figures 5 to 14, inclusive, it is to be understood that the backing yarn, such as the yarn 5 for example, is carried inwardly towards the needles 1 and upwardly thereon by means of the reverse backing wheel 2, the initial introduction of this yarn taking place at a point below the needle beards, and above the regular stiches 13, which latter are held down by the conventional push-down member 14, as indicated in Figure 5. As the needle advances from this point, and assuming that it is one of those needles which is engaged by one of the blocks 7 in the reverse backing wheel 2, the block presses upon the needle beard to close the same, as indicated by the arrow 7' in Figure 6, thereupon causing the backing wheel 2 to carry the yarn upwardly in front of the needle beard to a point near the top of the needle. Continued advancement of this needle brings the needle into cooperation with the evener wheel 8, which acts upon the yarn 5 formerly brought upwardly in front of the needle beard to a point near the top thereof, as indicated by the dotted lines in Figure 7, and turns it over the top of the needle, to the full line position at the back side thereof, as indicated by the broken arrow. As the needle further advances, the circular brush 9 which runs on the tops of the needles and extends substantially below the upper ends of the needles, acts upon the yarn 5 to push it from its former position indicated by the dotted lines, to the full line position represented in Figure 8. Continued advancement of this needle brings the same into cooperation with the clearing wheel 11, which serves to push the backing yarn 5 down to the bottom of the needle, as indicated in Figure 9, to a point just above the regular stitches or loops 13 which are maintained in position at the bottom of the needles next to the leads 12 by means of the push-down 14 throughout the various stages of introduction of the backing yarn as just described.

The action of the backing yarn manipulating instrumentalities relative to those needles which are not engaged by the blocks of the reverse backing wheel 2 should be readily understood and the different stages thereof are represented in Figures 10 to 14 inclusive. Figure 10 corresponds to Figure 5, and illustrates the backing yarn 5 as it is initially fed to the needle by the reverse backing wheel 2. As the needle advances from the position represented in Figure 10, the backing yarn 5 is moved upwardly by the reverse backing wheel 2, but inasmuch as there is no block in the stitch wheel to act upon this needle, the needle beard remains open, and the yarn moves up under the needle beard, as indicated in Figure 11. As those needles having the backing yarn under the beards are advanced to the evener wheel 8, the evener wheel has no effect on the backing yarn on these needles other than to urge the same to the limit of its upward movement under the needle beards, as indicated in Figure 12. Similarly, as these needles pass the brush 9, the backing yarn 5 remains under the needle beards although it is free to move downwardly, as indicated by the arrows in Figure 13. Further advancement of these needles to the clearing wheel 11 brings the backing yarn 5 into engagement with the clearing wheel which causes it to be moved downwardly to the bottom of the needles, as indicated in Figure 14. Thus it will be seen that on those selected needles in front of which the backing yarn is to lie in the conventional manner of a backing yarn relationship, the backing yarn is free to move up and down on those needles at the front side thereof, throughout the manipulation of the backing yarn from the front side to the back side of those

other selected needles in back of which the yarn is to ultimately lie.

It is to be understood that in referring herein to the making of cotton-backed overcoating material, I do not intend to limit my invention to this field, since this is but one of the many practical applications to which my invention can be put to great advantage over former practices. By reason of its especial adaptation to use in conjunction with conventional striping attachments or yarn changers, the invention can be applied in any case where it is desired to produce striping through means of a backing or lay-in yarn. On the other hand, the striping feature is not absolutely essential, and the invention can be employed to advantage for merely introducing a backing yarn into any type of knitted fabric and irrespective of the charatcer of the backing yarn material, or the material of which the regular knitted loops or stitches is composed.

In the case where the invention is employed in conjunction with a striper attachment or yarn changer, as generally represented in Figure 1, the backing yarn may be changed at will to form areas distinguishing from each other in respect to color, quality, or both, and particularly, to form stripes as by employing backing yarns 5 and 6 of different colors. As shown in Figures 3 and 4, the backing yarns 6 may be introduced into the fabric under the control of the striper S to form horizontal stripes, generally designated 15 in Figure 4, which have a distinctive contrast with the other areas formed by the other backing yarns 5 or combination of yarns. By suitably combining the horizontal stripes 15 with vertical stripes 16 formed by tucking or in any other suitable manner, which will be readily understood by those familiar with the art, a wide range of check and plaid designs may be attained with the backing yarns, as will be understood from reference to Figure 4.

While the specific details have been herein shown and described, the invention is not confined thereto as changes and alterations may be made without departing from the spirit thereof as defined in the appended claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is—

1. The method of knitting fabrics on circular spring needle knitting machines, which comprises feeding a yarn into the needles and knitting the same to form a knitted body, feeding a lay-in yarn to the needles in such manner that the latter yarn is received at the same side of each needle, and thereafter moving the second yarn to the opposite side of certain needles only so that the second yarn becomes disposed alternately in front of and in back of the needles in a predetermined order and becomes bound in the knitted body as the first mentioned yarn is knitted.

2. The method of knitting fabrics on circular spring needle knitting machines, which comprises feeding a yarn into the needles and knitting the same to form a knitted body, feeding another yarn to the needles from a point outside of the needle circle in such manner that the another yarn is received at the front of each needle and while the stitches formed on the needles by the first yarn are maintained adjacent to the bottom of the needles, and thereafter turning the second yarn over to the back of certain needles only so that the second yarn will become bound in the knitted body as the first mentioned yarn is knitted and constitutes a lay-in yarn.

3. The method of knitting fabrics on circular spring needle knitting machines, which comprises feeding a yarn into the needles and knitting the same to form a knitted body, pressing the stitches formed on the needles by this yarn downwardly towards the bottom of the needles, presenting a backing or lay-in yarn to the outside of the needle circle in such manner that the backing yarn is received at the front of each needle and above the stitches formed by the first yarn, moving said backing yarn upwardly on the needles while pressing the beards of certain of the needles closed, whereby to cause the backing yarn to be received under the beards of certain only of the needles and on the beards of the other needles, turning the backing yarn over the top and to the back of those needles which have the backing yarn on their beards, and then moving the backing yarn downwardly on all the needles to a point in close proximity to the stitches formed on the needles by the first yarn, whereby to cause the backing yarn to become bound in the knitted body as the first mentioned yarn is knitted.

4. The method of knitting striped fabrics on circular spring needle knitting machines, which comprises feeding a yarn into the needles and knitting the same to form one face of a knitted body, pressing the stitches formed on the needles by this yarn downwardly to the bottoms of the needles, selectively feeding a plurality of lay-in yarns to the needles in such manner that each lay-in yarn is presented at the same side of each needle, moving the lay-in yarns to the opposite side of certain needles only so that the lay-in yarns become bound in with the stitches of the first yarn and form the opposite face of the fabric, and interchanging the feed of the lay-in yarns in accordance with a predetermined striped pattern.

5. In a circular spring needle knitting machine of the class described, the combination with a rotary needle cylinder carrying a circle of bearded spring needles, and means for feeding a yarn into said needles to form a knitted body and for pressing the stitches on the needles downwardly to approximately the bottom of the needles, of means for presenting a lay-in yarn to the needles at the same side of each needle while the stitches aforesaid are maintained in a depressed position on the needles, and means for moving the lay-in yarn to the opposite side of certain needles only and for pushing the lay-in yarn down on all the needles, whereby to cause the lay-in yarn to become bound in the knitted body as the first yarn is knitted.

6. Apparatus as claimed in claim 5, wherein the lay-in yarn presenting means comprises a backing wheel positioned outside of the needle circle and having its axis disposed in such manner that the lay-in yarn is carried upwardly thereby into the needles responsive to rotation of the needle cylinder.

7. In a circular spring needle knitting machine of the class described, the combination with a rotary needle cylinder carrying a circle of bearded spring needles, and means for feeding a yarn into said needles to form a knitted body and for pressing the stitches on the needles downwardly to approximately the bottom of the needles, of means for presenting a backing or lay-in yarn to the needles at the same side of each needle while the stitches aforesaid are maintained in a depressed position on the needles, and means for moving the backing yarn to the opposite side of certain needles only and for pushing the backing

yarn down on all the needles whereby to cause the backing yarn to become bound in the knitted body as the first yarn is knitted, said last mentioned means including an evener wheel disposed beyond the backing yarn presenting means and operatively coacting with the needles and with the backing yarn to turn the backing yarn over the tops of certain needles responsive to rotation of the needle cylinder.

8. Apparatus as claimed in claim 5, wherein the means for pushing the lay-in yarn down on the needles includes a circular brush rotatably mounted above the needles with the lower edge of the brush disposed below the plane of the upper ends of the needles so that portions of the brush extend downwardly in front of and in back of the needles for a portion of the length of the needles.

9. Apparatus as claimed in claim 5, wherein the means for pushing the lay-in yarn down on the needles includes a circular brush rotatably mounted above the needles with the lower edge of the brush disposed below the plane of the upper ends of the needles so that portions of the brush extend downwardly in front of and in back of the needles for a portion of the length of the needles, and a clearing wheel disposed beyond the brush and coacting with the needles and lay-in yarn to move the lay-in yarn downwardly on the needles below the limit of the brush.

10. In a circular spring needle knitting machine of the class described, the combination with yarn changing instrumentalities adapted to selectively present a plurality of backing or lay-in yarns to be incorporated in a knitted body as it is knitted on the needles of said machine, according to a predetermined striped pattern, of a backing wheel positioned adjacent to the yarn changing instrumentalities and adapted to successively feed the backing yarns into the needles of the machine with an upward movement, said backing wheel having means for pressing the beards of certain of the needles closed during the feed of the backing yarns to the needles whereby to cause the backing yarns to be carried under the beards of certain needles and landed on the beards of those needles only which are closed by the means aforesaid, and means for moving the backing yarns from their position on the beards of the latter needles to a position at the opposite side of the needles, and for pressing the yarns downwardly on all the needles, whereby to cause the backing yarns to become bound in the knitted body in a predetermined relation to each other and to the stitches of the knitted body.

GEORGE L. LOGAN.