Aug. 15, 1933. P. W. BRISTOW ET AL 1,922,119

PROCESS AND MACHINE FOR PRODUCING KNITTED FABRICS

Filed April 11, 1931 4 Sheets-Sheet 1

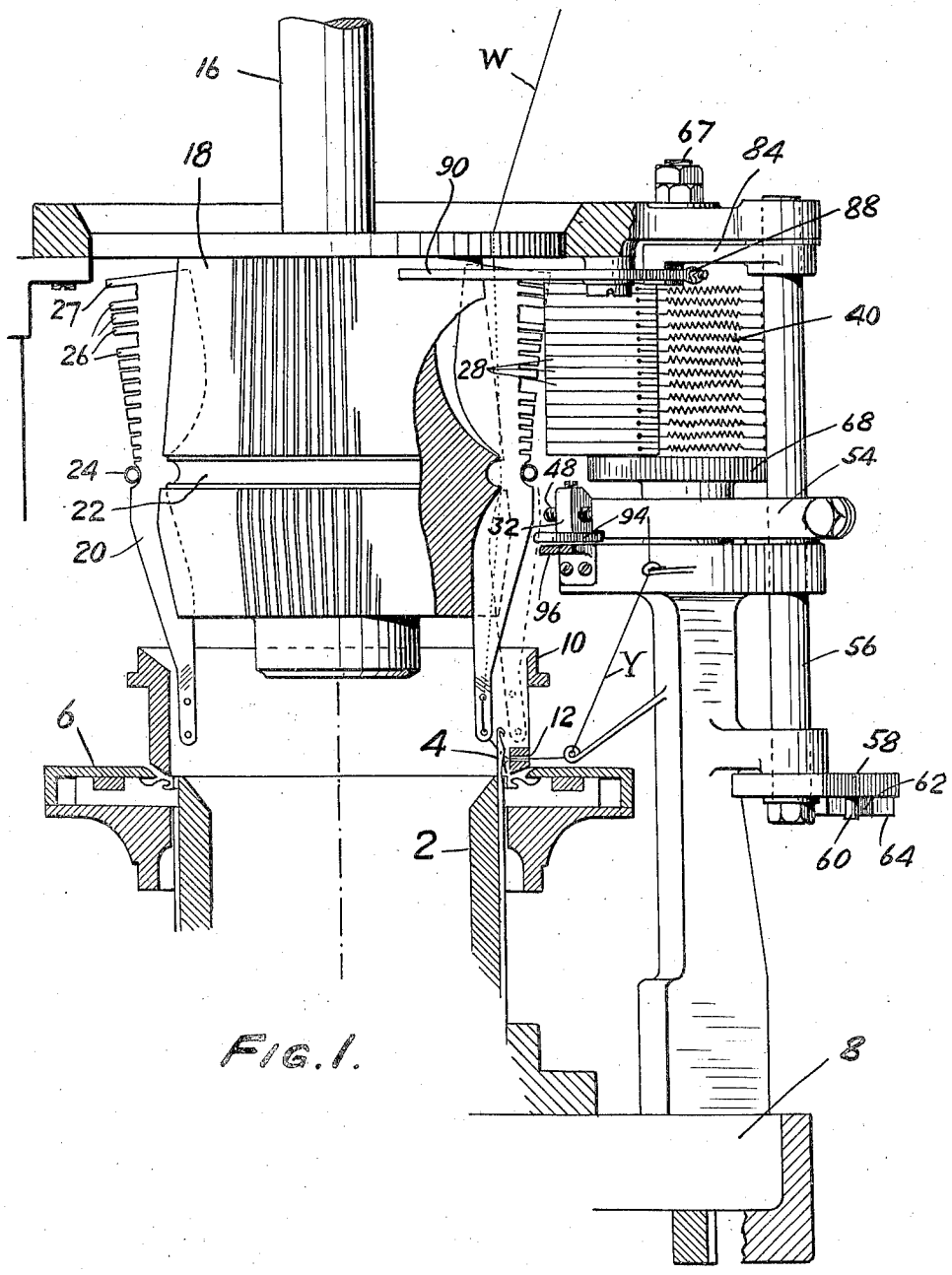


FIG. 1.

WITNESS:

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PROCESS AND MACHINE FOR PRODUCING KNITTED FABRICS

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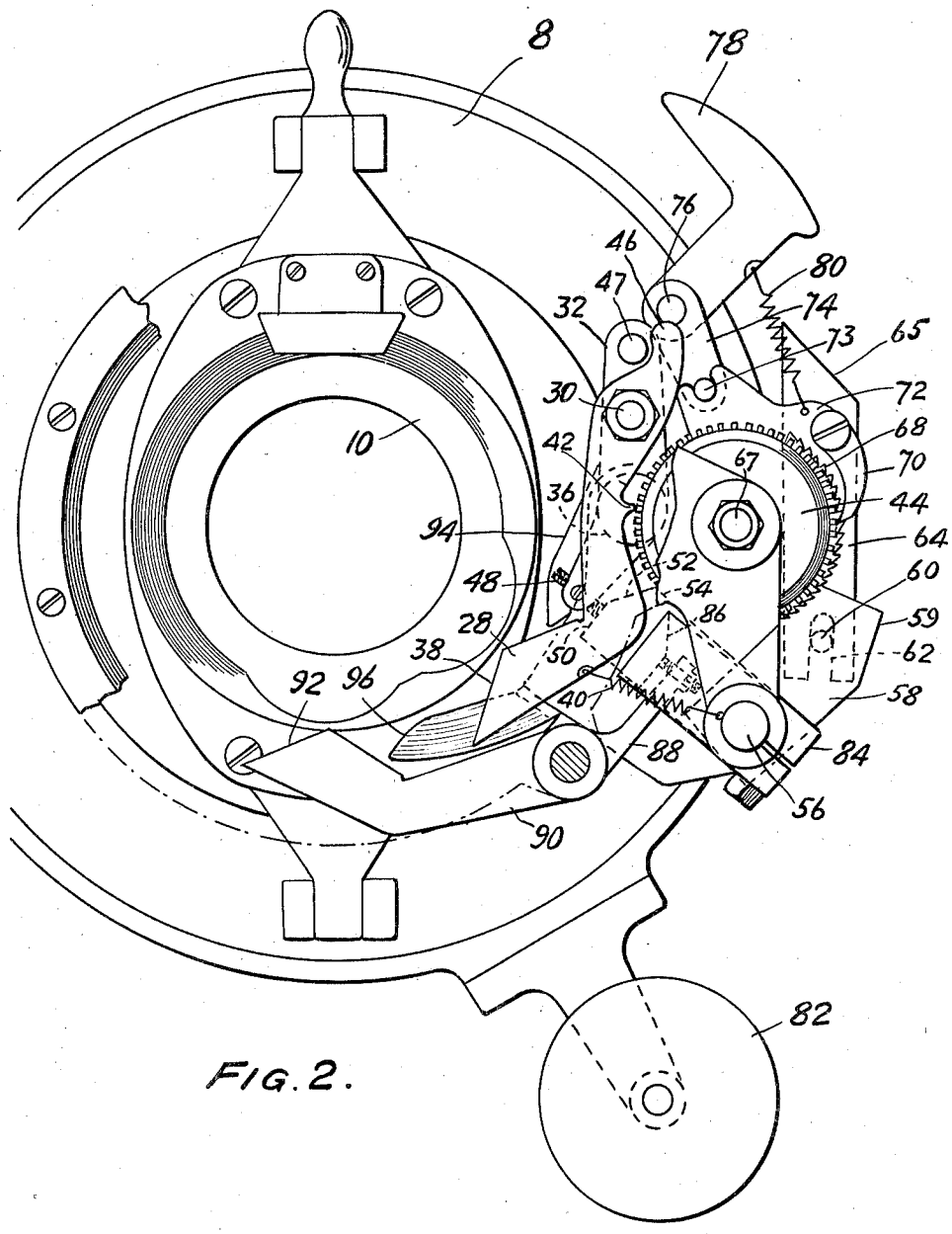


FIG. 2.

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PROCESS AND MACHINE FOR PRODUCING KNITTED FABRICS

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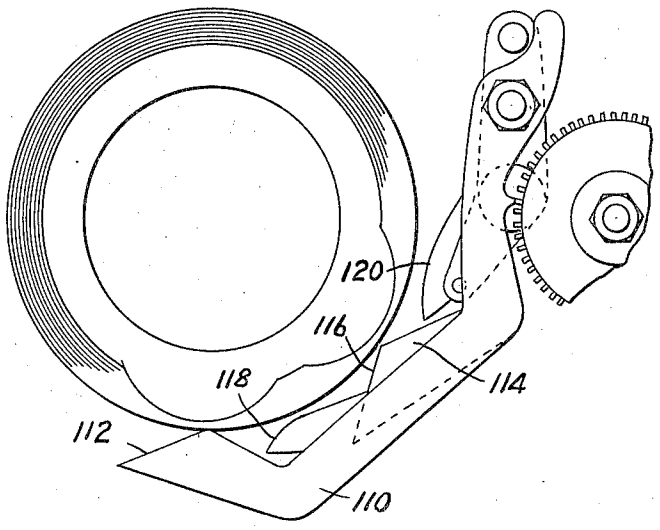


FIG. 4.

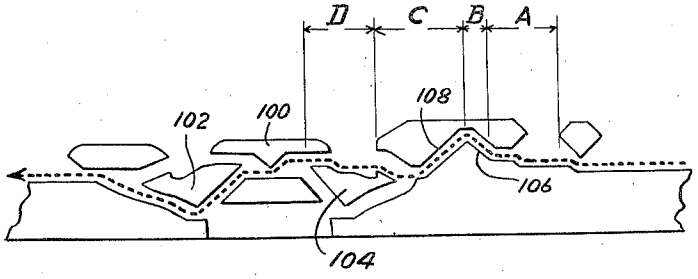


FIG. 3.

INVENTORS

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Aug. 15, 1933. P. W. BRISTOW ET AL 1,922,119

PROCESS AND MACHINE FOR PRODUCING KNITTED FABRICS

Filed April 11, 1931 4 Sheets-Sheet 4

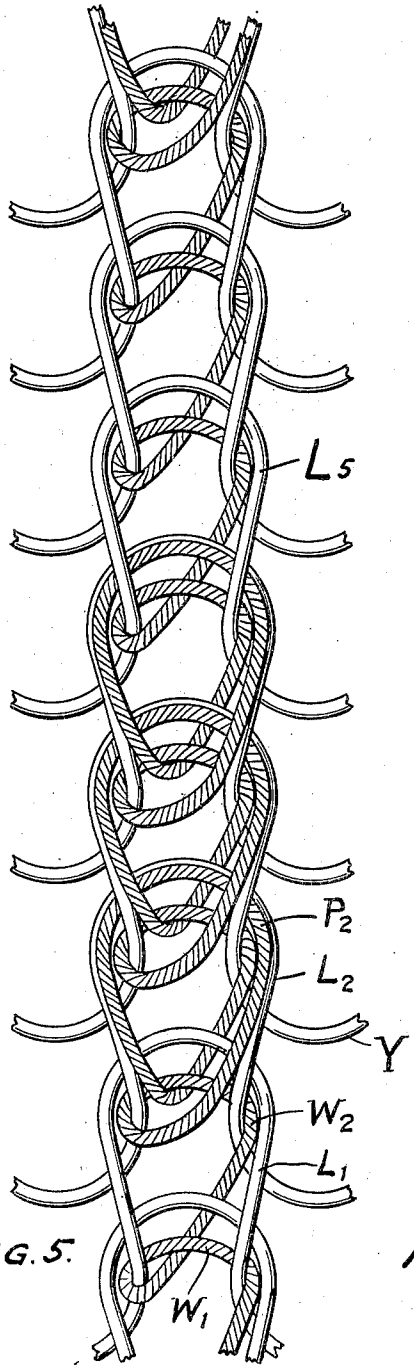


FIG. 5.

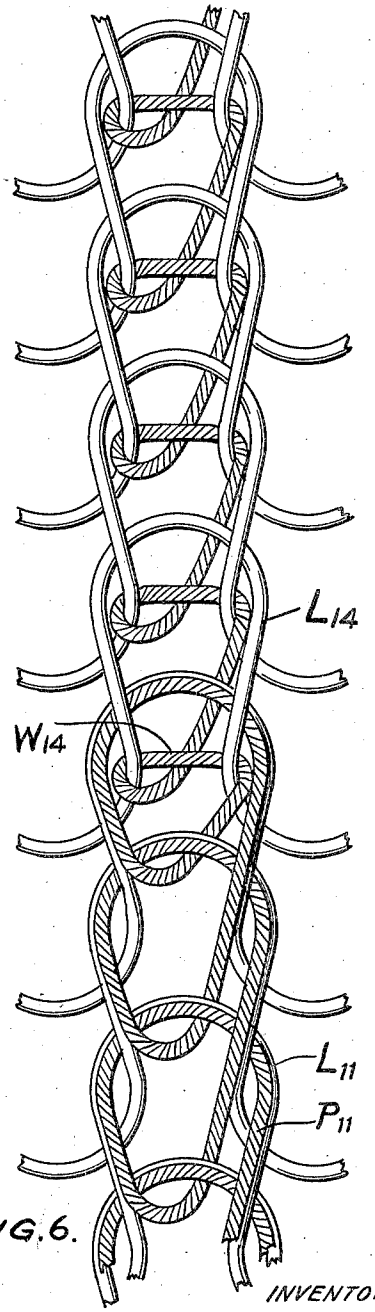


FIG. 6.

WITNESS:
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Patented Aug. 15, 1933 1,922,119

UNITED STATES PATENT OFFICE

1,922,119

PROCESS AND MACHINE FOR PRODUCING KNITTED FABRICS

Paul W. Bristow, Wilmington, and Harold E. Houseman, Edge Moor, Del., assignors to Standard-Trump Bros. Machine Company, Wilmington, Del., a Corporation of Delaware

Application April 11, 1931. Serial No. 529,518

33 Claims. (Cl. 66—135)

This invention relates to a knitted fabric and a method and machine for making the same, the fabric being of the type having designs formed by wrap or embroidery yarns.

The well known process of producing designs by the use of a wrap yarn has heretofore generally included wrapping about needles above the latches thereof yarns differing in appearance from the main yarn or yarns so that the wrapped yarns are knit into the loops with the main yarn and appear on the face of the fabric in plated relationship thereto. When the pattern formed by the wrap yarns is to be interrupted, the wrap yarn is merely not wrapped about the needle. There then result floats of greater or less length between successive zones of plating which are undesirable, particularly in hosiery, and, if the design is elaborate, cannot be readily cut out.

These objectionable floats are avoided by the use of the process disclosed in an application of Stanley R. Shelmire, Serial Number 497,977, filed November 25, 1930. Briefly, it involves wrapping each wrap yarn about a needle (either the same one or adjacent ones) in the formation of every course, the wrapping being carried out so that at the time of drawing the stitch the wrap yarn is either above or below the latch, whereby, in the former case it appears on the face of the fabric, or in the latter case it is linked into the loops, thus avoiding floats, but is substantially invisible from the face of the fabric.

The machine shown in the Shelmire application referred to above has a rotary needle cylinder, which, of course, requires that the supplies of wrap yarns rotate. Obviously, if a large number of wrap yarns are used, this arrangement would require a large yarn support capable of rotating at the speed of the needle cylinder. It follows that the rotary cylinder machine is not very well adapted for the production of complicated wrap designs at high speeds.

In another application of Stanley R. Shelmire, Serial Number 469,056, filed July 19, 1930, there is disclosed a machine more suitable for the high speed production of intricate wrap designs involving a large number of wrap yarns, this machine involving a stationary needle cylinder and consequently yarn fingers which are stationary except for limited shogging movements which, however, do not require movable wrap yarn supplies. In the machine shown in this application, the wrap yarn is floated except where plating occurs.

One object of the invention may be briefly stated to involve the provision of mechanism and a method for effecting the selective production of visible and invisible wrapping by a machine of the stationary needle cylinder type.

It is preferred, however, to produce the visible and invisible wrapping in a different fashion, namely by manipulating wrapping devices at two points rather than one, manipulation at one point resulting in invisible incorporation of wrap yarns into the fabric, and manipulation at the other point, plating. Two variations of such manipulation may occur. In one, in the formation of any course, a wrapping device which is manipulated at the first point is not manipulated at the second while a device which is manipulated at the second point is not manipulated at the first. In this case the results are similar to those disclosed in the first mentioned Shelmire application.

In the second variation, all of the wrapping devices are manipulated at the first point to result in invisible wrapping. Then certain of the same wrapping devices are manipulated at the second point to produce plating. In the resulting fabric, which constitutes a further object of the invention, the visible and invisible wrapping are in a sense superimposed whereby a greater weight of wrap yarn is incorporated into the fabric where plating occurs and a heavy, embossed appearance results. This last procedure is further advantageous since proper plating is insured by the tightness of engagement of the wrap yarn with the needle.

Further objects of the invention relate to the phases of the novel method and machine whereby this improved fabric is produced.

Other objects of the invention relating particularly to details will be apparent from the following description, read in conjunction with the accompanying drawings, in which:

Fig. 1 is an elevation, partly in section, of the parts of the machine adjacent the top of the needle cylinder;

Fig. 2 is a plan view showing particularly the wrap finger controlling mechanism;

Fig. 3 is a developed inside view of the needle cams;

Fig. 4 is a view similar to part of Fig. 2 showing a modified mechanism;

Fig. 5 is a diagrammatic view of the face of a fabric produced by the mechanism of Figs. 1 to 3; and

Fig. 6 is a view similar to Fig. 5 of a modified fabric produced by the mechanism of Fig. 4.

Referring first to Figs. 1 to 3 there is illustrated a modification of the machine of the Shelmire application, Serial Number 469,056, only so much as of this machine being illustrated as is necessary to an understanding of the invention. For details reference may be made to this Shelmire application and the applications of Harold E. Houseman, Ser. Nos. 422,818 and 427,709, filed, respectively, January 23, 1930 and February 12, 1930, the latter showing suitable shogging means for the wrap fingers, which may be used if relatively narrow panels of wrap designs are to be produced as compared with wrapping on substantially all of the needles.

There is illustrated at 2 a stationary needle cylinder of usual construction provided with vertical slots in which latch needles 4 are reciprocated in the conventional knitting wave by suitable rotating cams, other rotating cams serving to operate the cooperating sinkers slidably mounted in the stationary sinker dial 6. A rotating latch ring 10 of the construction illustrated in Shelmire application, Serial Number 469,056, serves to guide main yarn or yarns to the needles, being carried, as are the other rotating parts, by the rotatably and oscillatably mounted cam ring 8 driven in the usual manner to rotate during the formation of the leg and foot of the hosiery and to oscillate during the formation of the heel and toe. The main yarn Y is guided through a suitable opening 12 in the latch ring.

Supported by the spindle 16 which is slidably mounted in the frame and which may also be rotatably mounted for shogging purposes is the wrap finger cylinder 18, in slots in which are located the oscillatable wrap fingers 20 provided with suitable thread eyes at their lower ends for the reception of wrap yarns indicated at W. These yarn fingers are provided with fulcrum portions resting in the trough of an annular ring 22, the fingers being held in position by a retaining spring band 24. To procure very elaborate designs there may be as many threaded fingers 20 as there are needles. In fact, this is the preferred construction. However, if clock designs or bandwrapping is to be performed there may be a smaller number of fingers than needles. In the former case shogging is not feasible since at all times there would be fingers passing between adjacent needles. On the other hand if certain of the fingers are absent shogging may take place during the periods when no fingers are passing through the needle circle.

Each of the wrap fingers 20 is provided with a series of butts 26 used for patterning purposes, and in the present instance with single butts 27 at their uppermost ends for purposes hereafter described. Selected butts 26 may be broken out according to the usual practice for the production of designs.

Adapted to cooperate with the butts 26 are cams 28 in the form of a series of levers, corresponding in number to the number of butts, pivoted on a pin 30 carried by a lever 32 which is pivoted at 36 to a support carried by the rotating cam ring 8. Each of the cams 28 is provided with a face 38 adapted to engage the butts to move the lower ends of the fingers outwardly between the needles, these lower ends being twisted out of radial planes so as to carry the wrap yarns about the needles, during oscillatory movements of the fingers, in a clockwise direction as viewed from above. Each of the cam levers is urged by an individual spring 40 to bring a lug 42 carried thereby and having a sloping cam surface into engagement with tricks carried by the trick wheel 44. As is usual in the production of patterns with trick wheels certain butts on the tricks are missing. If there is at any time no trick butt opposite the lug 42 of the cam lever 28 the cam lever will be moved by the spring until its extension 46 engages the stop pin 47 carried by the lever 32. This stop pin 47 may of course be omitted and the lug permitted to drop against the trick wheel; however in such cases undue wear on the wheel occurs and it is preferable to stop the lugs short of engagement with the wheel by the means just described. The lever 32 is provided with an adjustable follower screw 48 arranged to engage either a flat 50 or a slope 52 formed on the end of a lever 54 carried by a shaft 56 mounted in the frame and carrying at its lower end an arm 58 having an engaging face 59 for a purpose later described. The arm 58 also carries a pin 60 extending downwardly within a slot 62 in a lever 64 pivoted at 66 and having an engaging corner 65.

The trick wheel 44 is pivoted on a stud 67 carried by a bracket secured to cam ring 8 and is provided with ratchet teeth 68 cooperating with a pivoted pawl 70 spring-pressed into engagement with the teeth and carried by an oscillatable bracket also pivoted on stud 67 and having a slot within which engages a pin 73 carried by the arm 74 secured to the shaft 76, which also carries the follower 78 having the shape illustrated, the follower 78 being at a level just above that of the lever 58. A spring 80 reacting between the follower 78 and bracket 72 normally moves the pawl to a retracted position.

Adapted to cooperate with the levers 58 and 64 and with follower 78 is a disc 82 carried by a vertically movable rod slidable in a sleeve carried by a stationary part of the machine frame. The movements of this rod in a vertical direction are controlled by a pattern chain in the manner illustrated in the Shelmire application, Serial Number 469,056. As pointed out in this case, such operation results in stepping of the trick wheel or movement of the wrap fingers into or out of operative positions.

Secured to the upper end of shaft 56 as illustrated in Figs. 1 and 2 is an arm 84 provided with a cam surface 86 arranged to engage an adjustable follower screw carried by one arm 88 of a lever 90 which on the side of its pivot opposite the arm 88 is provided with a cam surface 92. This cam surface 92 is arranged to engage the butts 27 of the wrap fingers in the same manner as the butts 26 are engaged by the cam surfaces 38 of levers 28. While the cam surfaces 92 and 38 act to move the wrap fingers so that their lower threaded ends are carried outwardly of the needle circle return cams 94 and 96 are provided to act upon the wrap fingers below their fulcrums to return them, this return movement carrying the yarns on the opposite sides of the needles with which the fingers cooperate to effect a complete wrapping operation.

Referring now to Fig. 3 in which there is illustrated a developed inside view of the needle cams, it will be noted that the usual upper cam 100 is provided at the feed point, on the sides of

this there being provided the stitch cams 102 and 104. Since the needle cams rotate in a clockwise direction, as viewed in plan, the relative movements of the needles through the stitch cams will be along the path illustrated in dotted lines in Fig. 3 and in the direction of the arrow. While cams 100, 102 and 104 are of substantially conventional form, there are provided two additional cams 106 and 108 engaged by the butts of the needles prior to passing through the usual cams. By cam 106 the needles are raised being later lowered by the cam 108 to a position such that the butts will then ride up over cam 104 and be later depressed by cams 100 and 102 to take yarn and form stitches in the usual fashion. By the letters A, B, C and D in Fig. 3 there are designated various zones of operation corresponding to actuation of the wrap fingers. The zone A represents the point where wrapping initially takes place due to the action of cam surface 92 of lever 90 and return cam 96. At this point the wrap yarns are wrapped above the latch of corresponding needles in the usual fashion. After this takes place the needles are moved upwardly by cam 106 through the zone indicated at B. At this time by reason of the upward movement of the needles the loops of wrap yarn are caused to occupy a position below the latch of the needles. Following this operation the needles are again depressed through zone C at which time the loops of wrap yarn will move relatively to the needles up behind the latches without however closing the latches. Thereafter in zone D wrapping takes place due to the action of cams 38 and 94, selective wrapping of needles taking place either above the latch or not at all. Thereafter the needles take the main yarn and are drawn down by the stitch cam 102 to form stitches.

It will now be evident that if the wrap finger corresponding to any needle has been actuated in both zones A and D a double loop of wrap yarn will be located about the needle, the first loop being below the latch and the second loop being above the latch. When therefore the stitch is formed the wrap yarn will appear in plated relationship to the main yarn.

On the other hand if the wrap finger was actuated only in the zone A and not in the zone D a single loop only of the wrap yarn would be located about the needle below the latch. In this case the resulting stitch would incorporate the wrap yarn in the manner illustrated in Shelmire application 497,977, that is, without this wrap yarn appearing to any substantial degree from the face of the fabric. In the preferable operation of the machine all of the wrap fingers are provided with butts 27 and accordingly wrapping always takes place in the zone A. Floats are thereby avoided. The type of fabric formed by this operation will be hereafter referred to in greater detail.

A modified type of machine is illustrated in Fig. 4, which figure, however, may be read with Fig. 3 inasmuch as the cam arrangement is the same as in the preceding modification. In the arrangement of Fig. 4 there is no single finger such as 90 provided. Instead the stack of fingers illustrated at 28 in Fig. 1 is broken up into two sets having equal numbers of fingers, the upper set illustrated at 110 comprising fingers extending around to the position occupied by the finger 90 of the first modification, these fingers 110 being provided with cam faces 112 arranged to coact with upper butts of wrap fingers. The lower set of fingers illustrated at 114 are the same as fingers 28 being provided with cam faces 116 arranged to cooperate with the lower butts on the wrap fingers. Return cams 118 and 120 similar to cams 96 and 94 are provided.

With this last arrangement it is necessary, in order to totally avoid floats, to set up inversely corresponding patterns on the trick wheel so that if a finger wraps its corresponding needle under the action of cam 112 it will not be acted upon by a cam 116 and vice versa. In other words, while by the use of proper butts on the trick finger floating is always prevented, nevertheless during any rotation any needle is wrapped but once, the location of the wrap loop at the time of stitch drawing being either above or below the latch. In this way the double loops produced by the first modification are avoided. However, it is found that such double loops are generally to be preferred so that accordingly the modification of Figs. 1, 2 and 3 appears to be best. One of the advantages from an operating standpoint consists in the fact that the double wrapping of yarn about a needle causes the wrap yarn to invariably appear on the face in properly plated relationship apparently because of the tight engagement thereof with the needle by reason of the initial wrap below the latch.

In the above operations it has been assumed that the wrapping has taken place so that floats are totally avoided. It will be obvious however that floating may occur, if desired, particularly if an absolutely total disappearance of the wrap yarn is desired at some portions of the fabric. In the modifications of Figs. 1 and 2 this may be readily effected by elimination of butts 27 of certain wrap fingers. In the modification of Fig. 4 the set-up of the trick wheel may provide selective floating.

The products of the two modifications are illustrated respectively in Figs. 5 and 6. In Fig. 5 the loop L_1 has been produced by the wrapping of a needle in zone A only, followed by the formation of the stitch after the needle takes the body yarn Y. In this case the wrap yarn embraces the base of the loop L_1 as indicated at W_1. When this occurs the wrap yarn is substantially invisible from the face of the fabric. In the formation of the next loop L_2 the wrap yarn was not only wrapped about the needle in the zone A but also in zone D. The result of wrapping in zone A followed by movement of the needle so that the latch clears the loop is a production of the loop W_2 about the base of the loop L_2. The wrapping in zone D results in plating as illustrated at P_2. The next two loops in the wale illustrated are formed in the same manner as loop L_2. However in the formation of loop L_5 wrapping in zone A only has again taken place and accordingly loop L_5 is unplated, the wrap yarn being looped about its base. It will thus be obvious that the wrap yarn may be made to selectively appear or be hidden, as desired, without the presence of floats.

In Fig. 6 there is illustrated the product of the modification of Fig. 4. In this case double wrapping of wrap yarn is not presumed to take place although, of course, by a proper set-up on the trick wheel double wrapping may be effected. In the loop L_{11} of Fig. 6 the wrap yarn appears in plated relationship as illustrated at P_{11}. On the other hand in loop L_{14} the wrap yarn does not appear in plated rela-

tionship being wrapped about the base of the loop as indicated at W_{14}.

It will be obvious from the above that by the use of the modification of Fig. 4 which, however, is mechanically more elaborate than the modification of Figs. 1 and 2, a wale of the fabric may comprise plated loops produced by a single wrapping, plated loops produced by double wrapping, unplated loops having the wrap yarn associated therewith in invisible fashion, or even loops behind which the wrap yarn floats all depending on the proper set-up of the trick wheel; that is, to produce a plated single wrapped loop, a cam 114 must be active to cause a finger to wrap a needle while no cam 112 must previously engage that finger in the course considered; to produce double wrapping, once invisibly and once visibly, a finger must be rocked by both a cam 112 and a cam 116; to produce single invisible wrapping, only a cam 112 must rock a finger; and to avoid any wrapping, and hence the production of floats, all of cams 112 and 116 must fail to rock a finger, all of these results being accomplished by a proper arrangement of butts on the wrap fingers and tricks on the trick wheel. The wale particularly illustrated in Fig. 6 is, of course, similar to that produced by the machine of Shelmire application, Serial Number 497,977.

The advantages of the arrangement illustrated in Fig. 5 besides the insurance of plating, as noted above, are the density of wrap yarn where it is desired that the wrap yarn shall appear on the face of the fabric, combined with a sometimes desirable embossed appearance when the wrap yarn is heavy, this appearance resulting from the large amount of wrap yarn incorporated into the loops.

As mentioned previously shogging with the machine illustrated cannot be readily accomplished when all of the needles are being wrapped. However, if certain needles only are being wrapped the wrap fingers may be shogged relatively to the needles when no wrap fingers are passing through the needle circle. If shogging is used in this fashion it will be obvious that elaborate designs involving double or single wrapping may be produced.

The illustrations in Figs. 5 and 6 are diagrammatic since the specific positions occupied by the yarns depends to a great extent upon relative tensions, location on the needle of the wrap yarns, etc. This is brought out in Shelmire application, Serial Number 497,977, in which the radical effect of heavy tension on the wrap yarn is shown. Figs. 5 and 6 are accordingly meant only to illustrate the relative crossings and interlockings of the yarns. It is therefore intended to cover variations produced by different tensioning, or the like, in the following claims even though for clarity such claims are directed to the arrangement particularly illustrated.

What I claim and desire to protect by Letters Patent is:

1. The process of making a knitted fabric on a machine having a series of independently movable latch needles including, in the formation of a course, the steps of effecting the looping of a wrap yarn both about the shank of a needle below the latch thereof and above a loop of a previously formed course held on said shank below the latch, and also above the latch, of feeding a main yarn to the needle above the latch, and of moving the needle to draw a double loop of main and wrap yarns through the double loop of wrap and main yarns below the latch.

2. The process of making a knitted fabric on a machine having a series of independently movable latch needles including, in the formation of a course, the steps of effecting the looping of a wrap yarn both about the shank of a needle below the latch thereof and above a loop of a previously formed course held on said shank below the latch, and also above the latch, of feeding a main yarn to the needle above the latch, and of moving the needle to draw a double loop of main and wrap yarns through the double loop of wrap and main yarns originally below the latch, the main and wrap yarns being so related in the hook of the needle that the latter appears in plating relationship to the former in the drawn loop.

3. The process of making a knitted fabric on a machine having a series of independently movable latch needles including, in the formation of one course, the steps of effecting the looping of a wrap yarn both about the shank of a needle below the latch thereof and above a loop of a previously formed course held on said shank below the latch, and also above the latch, of feeding a main yarn to the needle above the latch, and of moving the needle to draw a double loop of main and wrap yarns through the double loop of wrap and main yarns originally below the latch; and in the formation of another course, the steps of effecting the looping of the wrap yarn about the shank of a needle below the latch thereof and above a loop of a previously formed course held on said shank below the latch, of feeding the main yarn to the needle above the latch, and of moving the needle to draw a loop of the main yarn through the double loop of wrap and main yarns resulting from the first step in the formation of this course.

4. The process of making a knitted fabric on a machine having a series of independently movable latch needles including, in the formation of one course, the steps of effecting the looping of a wrap yarn both about the shank of a needle below the latch thereof and above a loop of a previously formed course held on said shank below the latch, and also above the latch, of feeding a main yarn to the needle above the latch thereof, and of moving the needle to draw a double loop of main and wrap yarns through the double loop of wrap and main yarns originally below the latch; the main and wrap yarns being so related in the hook of the needle that the latter appears in plating relationship to the former in the drawn loop; and in the formation of another course, the steps of effecting the looping of the wrap yarn about the shank of a needle below the latch thereof and above a loop of a previously formed course held on said shank below the latch, of feeding the main yarn to the needle above the latch thereof, and of moving the needle to draw a loop of the main yarn through the double loop of wrap and main yarns resulting from the first step in the formation of this course.

5. The process of making a knitted fabric on a machine having a series of independently movable latch needles including, in the formation of a course, the steps of looping a wrap yarn about a needle above the latch thereof, of moving the needle upwardly to cause the latch to clear the loop of wrap yarn so that it lies about the shank of the needle above a loop of a pre-

viously formed course, of again looping the wrap yarn about the needle above the latch thereof, of feeding a main yarn to the needle above the latch thereof, and of moving the needle to draw a double loop of main and wrap yarns through the double loop of wrap and main yarns resulting from the upward movement of the needle.

6. The process of making a knitted fabric on a machine having a series of independently movable latch needles including, in the formation of a course, the steps of looping a wrap yarn about a needle above the latch thereof, of moving the needle upwardly to cause the latch to clear the loop of wrap yarn so that it lies about the shank of the needle above a loop of a previously formed course, of again looping the wrap yarn about the needle above the latch thereof, of feeding a main yarn to the needle above the latch thereof, and of moving the needle to draw a double loop of main and wrap yarns through the double loop of wrap and main yarns resulting from the upward movement of the needle, the main and wrap yarns being so related in the hook of the needle that the latter appears in plating relationship to the former in the drawn loop.

7. The process of making a knitted fabric on a machine having a series of independently movable latch needles including, in the formation of one course, the steps of looping a wrap yarn about a needle above the latch thereof, of moving the needle upwardly to cause the latch to clear the loop of wrap yarn so that it lies about the shank of the needle above a loop of a previously formed course, of again looping the wrap yarn about the needle above the latch thereof, of feeding a main yarn to the needle above the latch thereof, and of moving the needle to draw a double loop of main and wrap yarns through the double loop of wrap and main yarns resulting from the upward movement of the needle; and in the formation of another course, the steps of looping the wrap yarn about a needle above the latch thereof, of moving the needle upwardly to cause the latch to clear the loop of wrap yarn so that it lies about the shank of the needle above a loop of a previously formed course, of feeding the main yarn to the needle above the latch thereof, and of moving the needle to draw a loop of main yarn through the double loop of wrap and main yarns resulting from the upward movement of the needle.

8. The process of making a knitted fabric on a machine having a series of independently movable latch needles including, in the formation of one course, the steps of looping a wrap yarn about a needle above the latch thereof, of moving the needle upwardly to cause the latch to clear the loop of wrap yarn so that it lies about the shank of the needle above a loop of a previously formed course, of again looping the wrap yarn about the needle above the latch thereof, of feeding a main yarn to the needle above the latch thereof, and of moving the needle to draw a double loop of main and wrap yarns through the double loop of wrap and main yarns resulting from the upward movement of the needle, the main and wrap yarns being so related in the hook of the needle that the latter appears in plating relationship to the former in the drawn loop; and in the formation of another course, the steps of looping the wrap yarn about a needle above the latch thereof, of moving the needle upwardly to cause the latch to clear the loop of wrap yarn so that it lies about the shank of the needle above a loop of a previously formed course, of feeding the main yarn to the needle above the latch thereof, and of moving the needle to draw a loop of main yarn through the double loop of wrap and main yarns resulting from the upward movement of the needle.

9. The process of making a knitted fabric including in the formation of a course, looping a wrap yarn twice about a needle, one loop below and the other above the latch, subsequently feeding a main yarn to the needle, and drawing a loop including both the main and wrap yarns.

10. The process of making a knitted fabric on a machine having a circular series of independently movable latch needles, wrap fingers, devices having rotary movement relative to the needles to move them for the production of stitches, and angularly spaced elements also having rotary movement relative to the needles and capable of effecting the wrapping of wrap yarns about needles above the latches thereof as the needles and elements come into opposition, including raising the needles between the spaced elements so that the latches thereof may clear any wrap yarns located thereabove, feeding main yarn to the needles through means trailing the spaced elements in the relative movement of the needles and devices, and manipulating needles to draw loops including the main yarn.

11. The process of making a knitted fabric on a machine having a circular series of independently movable latch needles, wrap fingers, devices having rotary movement relative to the needles to move them for the production of stitches, and angularly spaced elements also having rotary movement relative to the needles and capable of effecting the wrapping of wrap yarns about needles above the latches thereof as the needles and elements come into opposition, including raising the needles between the spaced elements so that the latches thereof may clear any wrap yarns located thereabove, selectively manipulating the trailing elements to effect selective wrapping of needles thereat, feeding main yarn to the needles through means trailing the spaced elements in the relative movement of the needles and devices, and manipulating needles to draw loops including the main yarn.

12. The process of making a knitted fabric on a machine having a circular series of independently movable latch needles, wrap fingers, devices having rotary movement relative to the needles to move them for the production of stitches, and angularly spaced elements also having rotary movement relative to the needles and capable of effecting the wrapping of wrap yarns about needles above the latches thereof as the needles and elements come into opposition, including raising the needles between the spaced elements so that the latches thereof may clear any wrap yarns located thereabove, selectively manipulating said elements to effect selective wrapping of needles thereat, feeding main yarn to the needles through means trailing the spaced elements in the relative movement of the needles and devices, and manipulating needles to draw loops including the main yarn.

13. The process of making a knitted fabric on a machine having a circular series of independently movable latch needles, devices having rotary movement relative to the needles to move them for the production of stitches, and angularly spaced elements also having rotary move-

ment relative to the needles and capable of effecting the wrapping of wrap yarns about needles above the latches thereof as the needles and elements come into opposition, including continuously effecting wrapping of needles by the leading element, raising the needles between the spaced elements so that the latches thereof may clear any wrap yarns located thereabove, selectively manipulating the trailing element to effect selective wrapping of needles thereat, feeding main yarn to the needles through means trailing the spaced elements in the relative movement of the needles and devices, and manipulating needles to draw loops including the main yarn.

14. The process of making a knitted fabric on a machine having a series of independently movable latch needles including, in the formation of one course, the steps of effecting the looping of a wrap yarn about a needle first below the needle latch and then above the needle latch prior to engagement with the main yarn.

15. The process of making a knitted fabric on a machine having a series of independently movable latch needles including, in the formation of one course, the steps of effecting the looping of a wrap yarn about a needle first below the needle latch and then above the needle latch prior to engagement with the main yarn, and casting over the needle hook the first mentioned loop of wrap yarn along with the loop or loops in the previously knit course.

16. The process of making a knitted fabric on a machine having a series of independently movable latch needles including, in the formation of a course, the steps of effecting the looping of wrap yarns about all of the needles below their latches and then selectively above the latches of certain needles prior to engagement with the main yarn.

17. The process of making a knitted fabric on a machine having a series of independently movable latch needles and elements moving relatively to the needles to actuate them including, in the formation of a course, the steps of effecting the looping of wrap yarns selectively below the latches of certain needles at the location of certain elements and selectively looping the wrap yarns above latches of other needles at the location of other elements prior to engagement of any of the needles with the main yarn, all of the needles moving in the same wave during knitting as aforesaid.

18. A knitting machine including a series of independently movable latch needles and devices cooperating therewith to form stitches, said devices including means whereby a wrap yarn is looped about the shank of a needle below the latch thereof and also above the latch thereof, means for feeding a main yarn to the needle, and means for moving the needle to draw a loop of main and wrap yarns through the double loop formed by the wrap yarn and a previous loop located about the shank of the needle.

19. A knitting machine including a series of independently movable latch needles and devices cooperating therewith to form stitches, said devices including means whereby a wrap yarn is looped selectively either only about the shank of a needle below the latch thereof, or both about the shank of a needle below the latch thereof and also above the latch thereof, means for feeding a main yarn to the needle, and means for moving the needle to draw a loop of main and wrap yarns through the double loop formed by the wrap yarn and a previous loop located about the shank of the needle.

20. A knitting machine including a series of independently movable latch needles and devices cooperating therewith to form stitches, said devices including means whereby a wrap yarn is looped selectively either only about the shank of a needle below the latch thereof, only above the latch thereof, or both about the shank of a needle below the latch thereof and also within the hook of the needle, means for feeding a main yarn to the needle, and means for moving the needle to draw a loop of main yarn only or main and wrap yarns through a previously formed loop.

21. A knitting machine including a series of independently movable latch needles and devices cooperating therewith to form stitches, said devices including means operable to loop wrap yarns about needles above the latches thereof, means for causing relative movements between the loops of wrap yarns and needles whereby the loops rest below the latches thereof, means operable to loop the wrap yarns about the needles following operation of the last named means, means for feeding a main yarn to the needles, and means for moving the needle to draw stitches.

22. A knitting machine including a series of independently movable latch needles and devices cooperating therewith to form stitches, said devices including means continuously operable to loop wrap yarns about needles above the latches thereof, means for causing relative movements between the loops of wrap yarns and needles whereby the loops rest below the latches thereof, means operable to loop the wrap yarns about the needles following operation of the last named means, means for feeding a main yarn to the needles, and means for moving the needle to draw stitches.

23. A knitting machine including a series of independently movable latch needles and devices cooperating therewith to form stitches, said devices including means selectively operable to loop wrap yarns about needles above the latches thereof, means for causing relative movements between the loops of wrap yarns and needles whereby the loops rest below the latches thereof, means operable to loop the wrap yarns about the needles following operation of the last named means, means for feeding a main yarn to the needles, and means for moving the needle to draw stitches.

24. A knitting machine including a series of independently movable latch needles and devices cooperating therewith to form stitches, said devices including means operable to loop wrap yarns about needles within the hooks thereof, means for causing relative movements between the loops of wrap yarns and needles whereby the loops rest below the latches thereof, means selectively operable to loop the wrap yarns about the needles following operation of the last named means, means for feeding a main yarn to the needles, and means for moving the needles to draw stitches.

25. A knitting machine including a series of independently movable latch needles and devices cooperating therewith to form stitches, said devices including means continuously operable to loop wrap yarns about needles within the hooks thereof, means for causing relative movements between the loops of wrap yarns and needles whereby the loops rest below the

latches thereof, means selectively operable to loop the wrap yarns about the needles following operation of the last named means, means for feeding a main yarn to the needles, and means for moving the needles to draw stitches.

26. A knitting machine including a series of independently movable latch needles and devices cooperating therewith to form stitches, said devices including means selectively operable to loop wrap yarns about needles within the hooks thereof, means for causing relative movements between the loops of wrap yarns and needles whereby the loops rest below the latches thereof, means selectively operable to loop the wrap yarns about the needles following operation of the last named means, means for feeding a main yarn to the needles, and means for moving the needles to draw stitches.

27. The process of making a knitted fabric on a machine having a series of independently movable latch needles and elements moving relatively to the needles to actuate them including, in the formation of a course, the steps of effecting the looping of wrap yarns below the latches of needles at the location of certain elements, and selectively looping wrap yarns above the latches of certain needles at the location of other elements prior to engagement of any of the needles with the main yarn, all of the needles moving in the same wave during knitting as aforesaid.

28. The process of making a knitted fabric on a machine having a series of independently movable latch needles including, in the formation of a course the steps of laying wrap yarns above the latches of needles at two wrap points in advance of the engagement of a main yarn by said needles, and effecting the elevation of the needles after the first wrap point and before the second wrap point to clear their latches of any loops of wrap yarns they may carry.

29. A knitting machine including a series of independently movable latch needles and devices cooperating therewith to form stitches, said devices including means for selectively laying wrap yarns above the latches of needles at two spaced wrap points prior to the engagement of a main yarn by said needles, and needle elevating means between the two wrap points for causing the needle latches to clear loops of wrap yarns.

30. The process of making a knitted fabric including, in the formation of a course, looping a wrap yarn twice about a needle, subsequently feeding a main yarn to the needle, and drawing a loop including the main yarn, said wrapping being so performed that at least one of the wrap loops is drawn with the main yarn in said drawn loop.

31. The process of making a knitted fabric including, in the formation of a course, looping a wrap yarn twice about a needle, subsequently feeding a main yarn to the needle, and drawing a loop including the main yarn, said wrapping being so performed that at least one of the wrap loops is cast off during the drawing of said loop including the main yarn.

32. The process of making a knitted fabric including, in the formation of a course, looping a wrap yarn twice about a latch needle so that at least one of the loops lies above the latch, subsequently feeding a main yarn to the needle, and drawing a loop including the main yarn and at least one loop of wrap yarn.

33. The process of making a knitted fabric including, in the formation of a course, looping a wrap yarn twice about a latch needle so that at least one of the loops lies below the latch, subsequently feeding a main yarn to the needle, and drawing a loop including the main yarn, said wrapping being so performed that the loop of wrap yarn above mentioned is cast off during the drawing of said loop including the main yarn.

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