

July 19, 1938.

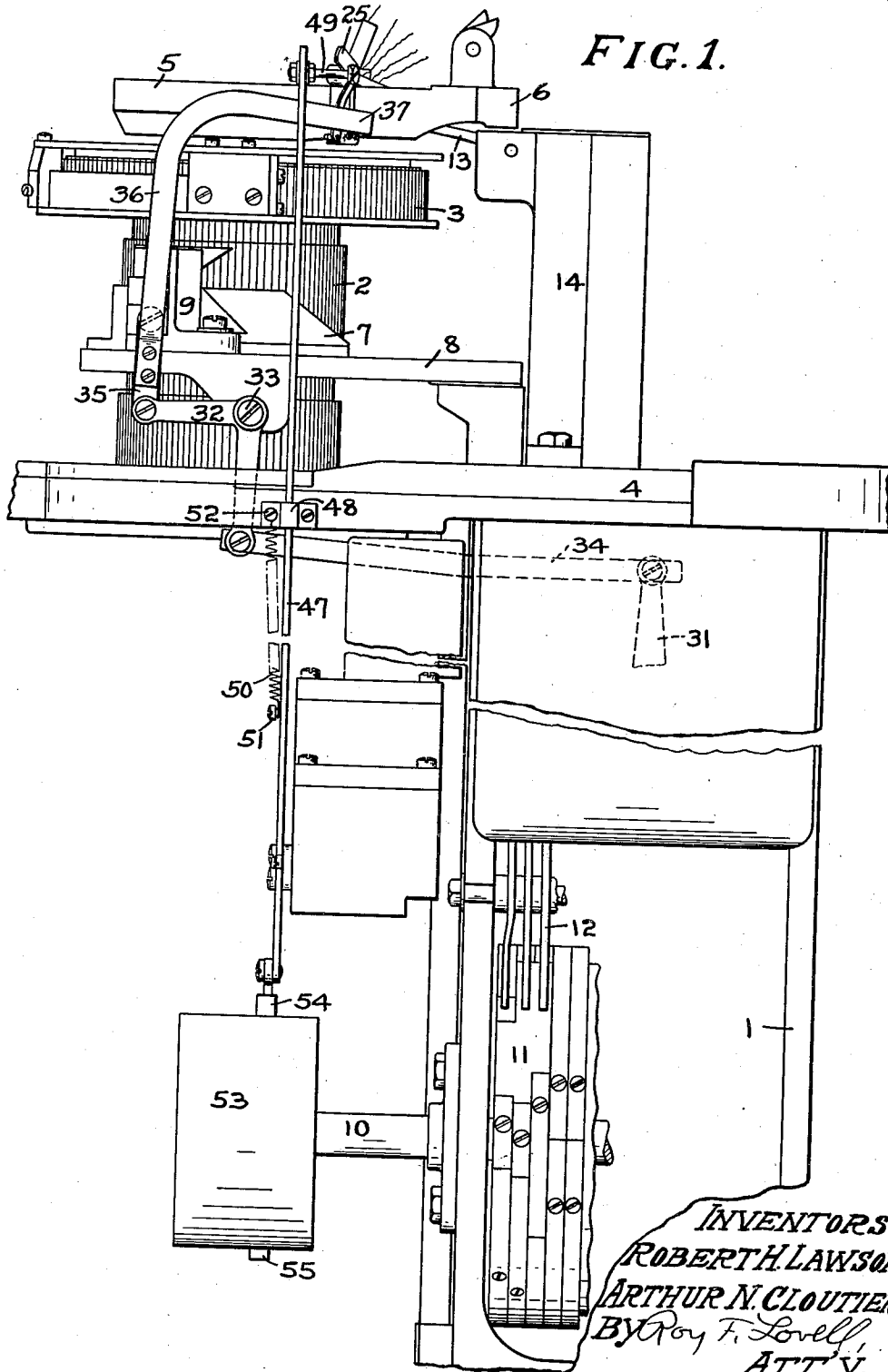
R. H. LAWSON ET AL

2,124,000

KNITTING MACHINE FOR PLAITING AND REVERSE PLAITING

Filed May 14, 1936

4 Sheets-Sheet 1



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FIG. 2.

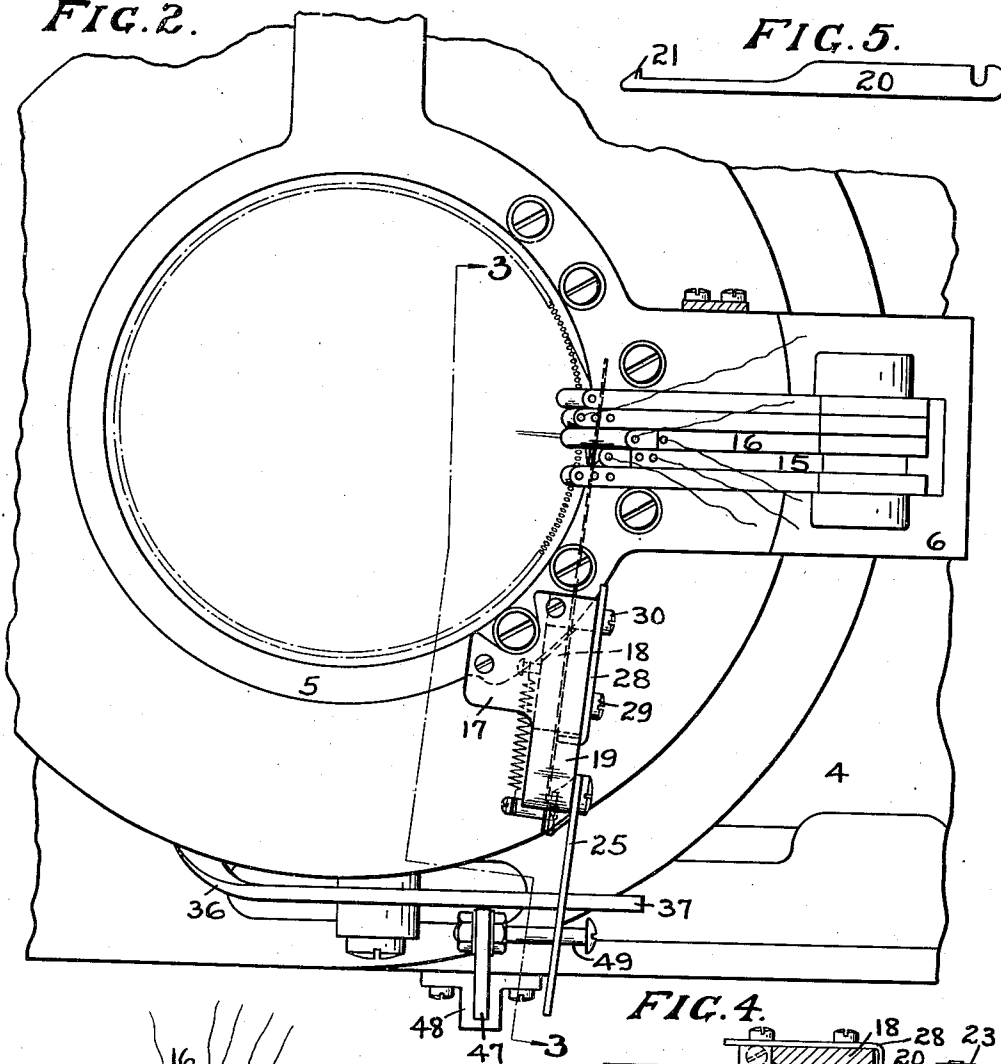


FIG. 5.



FIG. 3.

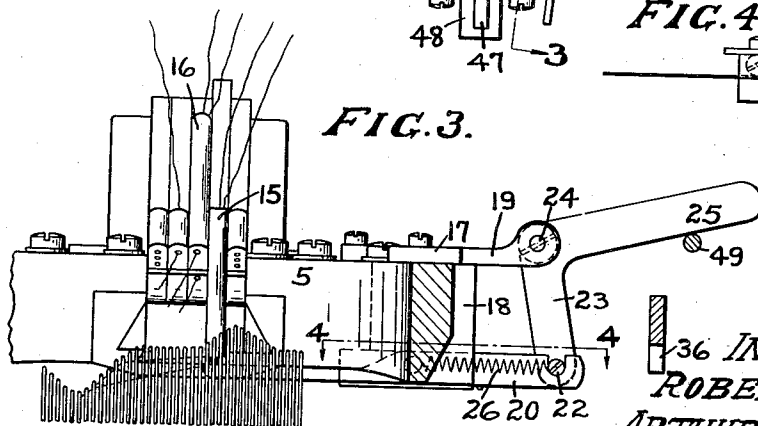
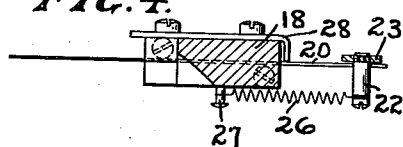


FIG. 4.



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FIG. 7.

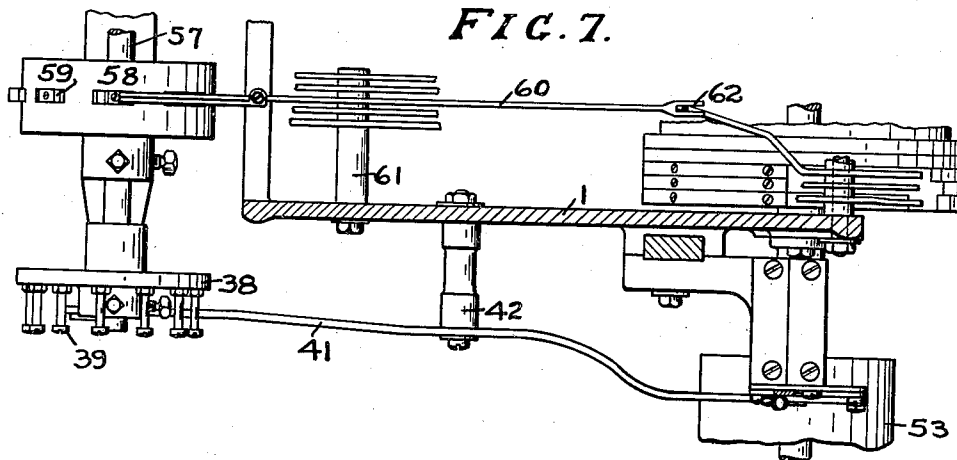
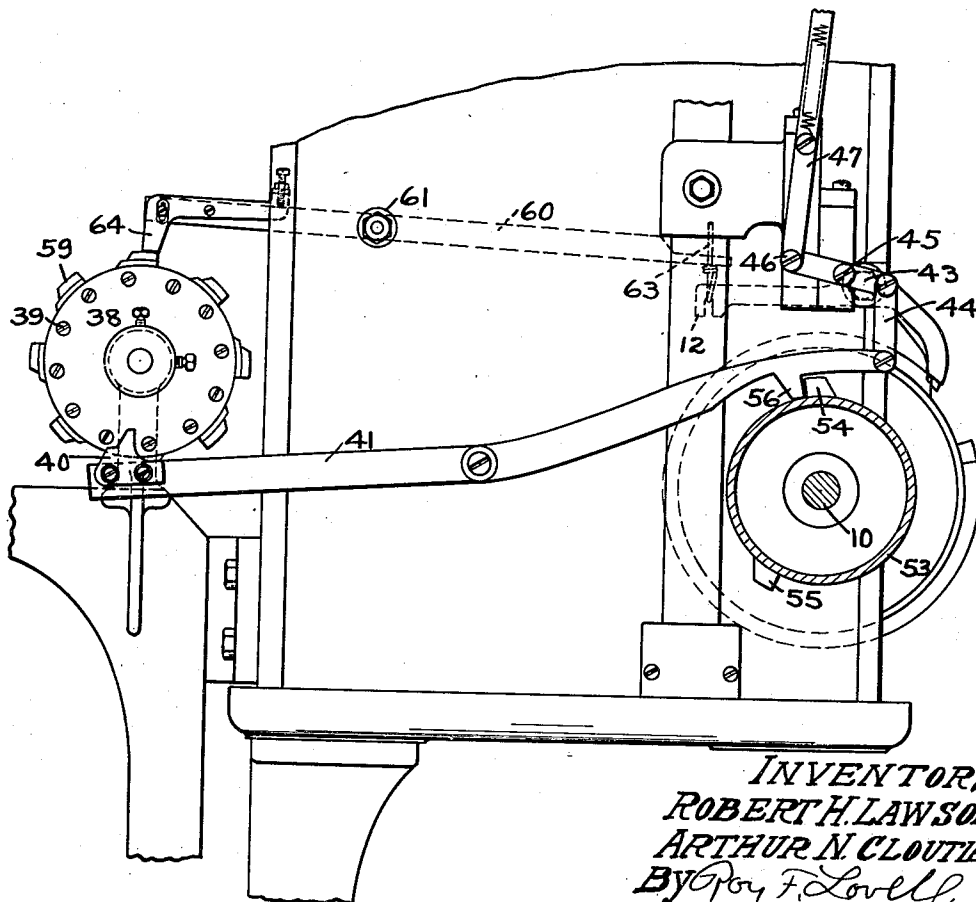


FIG. 6.



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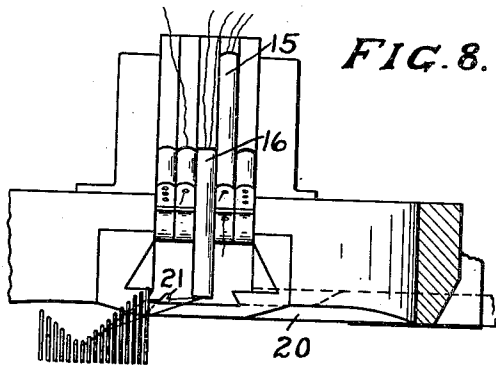


FIG. 8.

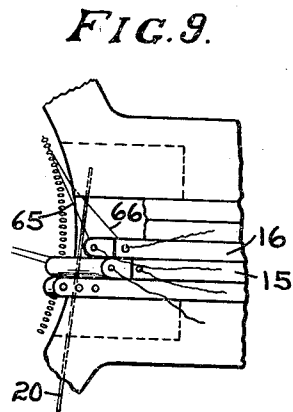


FIG. 9.

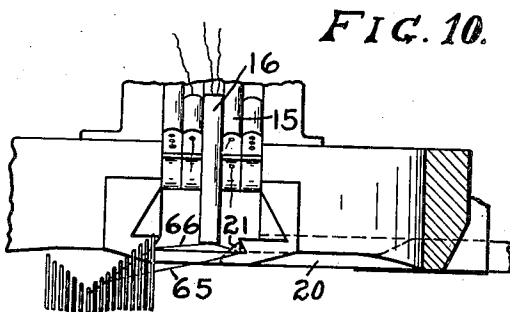


FIG. 10.

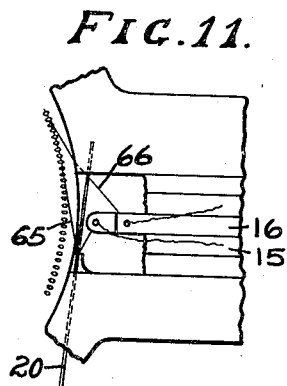


FIG. 11.

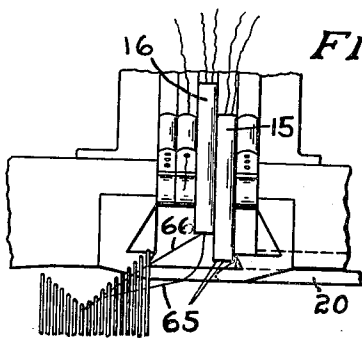


FIG. 12.

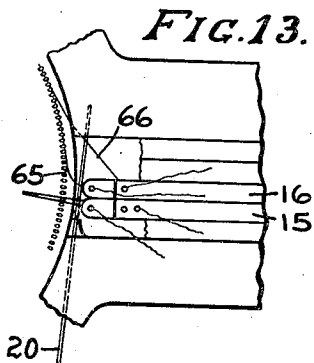


FIG. 13.

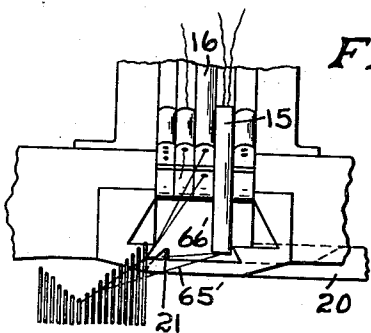


FIG. 14.

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UNITED STATES PATENT OFFICE

2,124,000

KNITTING MACHINE FOR PLAITING AND
REVERSE PLAITING

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Application May 14, 1936, Serial No. 79,742

11 Claims. (Cl. 66—90)

This case concerns an invention in knitting machines of a type adapted to knit ornamental fabric by plaiting and reverse plaiting. The improvement involves mechanism for positively controlling the plaiting and reverse plaiting yarns in such a manner that the relative positions of the two or more yarns as they lie in the fabric will be more precisely determined and that changes from one plaiting yarn to another will be made more positively thus producing fabric with ornamental areas which are sharply defined and in which the plaiting yarn will unfailingly cover the other yarn or yarns over which it lies to produce areas of a definite color as desired.

15 In the drawings:

Fig. 1 is an elevation showing the improved mechanism applied to a conventional hosiery knitting machine;

20 Fig. 2 is a plan showing as much of the machine as is necessary to indicate generally the construction and manner of applying the invention to a hosiery machine;

25 Fig. 3 is a section taken on line 3—3, Fig. 2, showing a fragment of the latch ring, a few needles at the mouthpiece, yarn guides and a part of the device for controlling the position of yarns;

Fig. 4 is a section taken on the line 4—4, Fig. 3;

Fig. 5 is a detail of the yarn engaging hook;

30 Fig. 6 is an elevation of part of the hosiery machine indicating the controlling mechanism for the plaiting and reverse plaiting yarn separating means;

35 Fig. 7 is a section taken through the machine frame and illustrating that mechanism which has been shown in Fig. 6 as it appears from above;

Figs. 8 and 9 are a section and plan, respectively, showing the yarn separating hook about to engage one of a pair of feeding yarns;

40 Figs. 10 and 11 are similar views showing the hook in a position wherein it has engaged and is maintaining one of the yarns in separated position.

45 Figs. 12 and 13 are similar views showing one of the yarns after being released upon a change to separate plaiting yarns.

Fig. 14 is a view showing a fragment of the machine at the mouthpiece, the yarn engaging hook being shown about to engage and separate one of a new set of feeding yarns.

50 The mechanism which forms the subject matter of this case has been employed very effectively to control yarns which are knitted in a fabric by plaiting of any known type and by plaiting and reverse plaiting. The invention is 55 particularly advantageous when employed with

certain yarns such as some of the yarns formed of artificially produced filaments, these yarns being very smooth and being particularly hard to control when plaiting or reverse plaiting, as is well known. The general principle upon which the invention is based is that of maintaining two feeding yarns, one being knitted as a plaiting yarn, in as widely separated relationship as possible. This extreme separation of yarns assures that an extremely strong tendency to come to the front of the fabric will be imparted to one of the yarns, and by means of pattern control, the effect of the yarn engaging and separating means may be shifted from one plaiting yarn to another or other plaiting yarns.

15 It is possible to feed the plaiting yarn with much less tension therein than would be commonly required, it being necessary to impose only a slight tension on either the plaiting or backing yarn, and not being necessary to impose any greater tension on one yarn than the other. With yarns such as acetate or rayon plaiting has been effected with difficulty and then with the employment of such as excessive tension on the plaiting yarn that the filaments have been broken very frequently. The excessive tension on the plaiting yarn has rendered reverse plaiting all the more difficult and uncertain so that this invention assures very satisfactory plaiting, positive and easily acquired reverse plaiting and does not 30 subject the yarns to excessive tension to cause breakage.

Referring to Figs. 1—5, a knitting machine has been illustrated with a frame 1, needle cylinder 2, sinker assembly 3 and a so-called circular base 35 4. A latch ring 5 is pivoted for swinging upwardly at the usual latch ring post (not shown) and this latch ring has the usual extension 6 for pivotally mounting a series of yarn guides herein shown as five in number, although more or less may be employed, these guides to be more specifically referred to as this description progresses. The usual knitting cams would be employed, these not being illustrated although the front needle raise cam 7 is shown mounted on 45 cam plate 8 and the bracket 9 carrying the instep cams is also attached to this cam plate. Part of the main cam shaft 10 is seen in the lower part of Fig. 1, this shaft carrying the usual drum 11 with suitable cams thereon for controlling the 50 yarn guides through a series of fingers generally indicated at 12 and which are connected in the usual way to levers 13 at the upper end of bracket 14, all in a manner known and described with respect to knitting machines of the Banner type.

The invention may be employed with two colors, that is, with one yarn guide such as guide 15, Figs. 2 and 3, having therein two openings through which a plaiting yarn and a backing yarn are to be fed. The invention is not limited to only two yarns, and would be employed with four yarns, thus giving the knitter a choice of four colors for ornamentation of the fabric, and of course, more guides and thus more colors may be added up to a number which may be reasonably handled within the ordinary knitting machine. For purposes of illustration, the guide 15 has been shown feeding two yarns while the adjacent guide 16 is shown feeding two more yarns, and the description of the device will be given with respect to the knitting of these four colors in a fabric, this description being made with a purpose of disclosing one workable form of the invention which will be easily understood by those skilled in the art.

The latch ring 5 has a bracket 17 attached thereto by suitable connecting means, this bracket having a downwardly projecting part 18 and an upwardly projecting portion 19. The part which projects downwardly is slotted as illustrated in Figs. 2 and 4 and guides a hook 20 to be moved transversely of the yarn feeding levers, this hook being shown in detail in Fig. 5. The latch ring is also slotted in continuation of the slot in the part of the bracket 18 so that the hook 20 is guided throughout practically its entire length, the inner end of this hook being reduced in height and terminating in a hooked end 21 capable of pulling a yarn in one direction, but bevelled in the other direction so that it may slide under a yarn to engage it. The outer end of the said hook is notched to be engaged by a pin 22 fixed in one arm 23 of a bell crank lever pivoted at 24 in extension 19. This bell crank lever projects at 25 to be engaged by operating devices which will be described later. The arm 23 is pulled in one direction by means of a spring 26 attached to the pin 22 and also fixed to another pin 27 connected to element 18. This spring tends to move the hook inwardly under the yarns to engage them while the operating devices functioning under pattern control maintain the bell crank lever and hook in the opposite direction except at such times as it is desired to release one yarn and engage another. A stop consisting of an angularly bent piece 28 is adjustably attached by screws 29 and 30 to the side of bracket extension 18 and may be adjustably moved to limit the extent of travel of the hook inward.

Two means for controlling this yarn separating hook are necessary. One means for controlling the hook for removing the same from active engagement with any yarns will be essential when knitting the heel and toe of the stocking, and in fact, for all parts of the stocking which are not to be ornamented. Another control is found necessary for engaging the hook with and releasing yarns during the knitting of patterned fabric, this control being worked from some part of the machine whereby frequent changes may be made so that different colors may be forced to appear at the face of the fabric in rapid succession.

The control during knitting of the heel and toe functions from the clutch actuating lever 31 thus withdrawing the hook at the start of knitting either the toe or the heel, but upon change from reciprocatory to rotary knitting, will free the hook so that it may be controlled by the other means. A bell crank lever 32 is pivoted at 33 to

an extension from the cam plate and one arm of this lever is attached by a link 34 to the upper end of clutch shifter lever 31. The other arm of the bell crank lever functions in the usual way to actuate the instep cams through a short connecting link 35. This short link has attached thereto a curved bar 36 which is bent outwardly to avoid the sinker assembly and has its free end 37 projecting beneath the arm 25 of the lever which directly controls the hook. In Fig. 1 the machine has been illustrated with these parts as they would appear while knitting in rotary work, but upon shifting of the clutch, lever 31 would be moved to the left swinging bell crank lever 32 and raising the bar 36 until it would contact lever 25 and draw the hook outwardly in its slot to avoid interference with any of the yarns or yarn levers.

When knitting a stocking it is common practice to ornament the work throughout the leg and foot, at least through the instep of the foot. At such times the hook 20 would be under the control of a pattern wheel 38 having a series of projecting pins or screws 39 extending therefrom which contact with a follower 40 fixed at one end of a lever 41 which has been pivoted to a stud 42 projecting from the frame of the machine. This lever 41 projects to the outer side of its pivot at 42 and is connected to another short lever 43 by means of a link 44. The short lever 43 is movable about a pivot 45 and connects at 46 to an upwardly extending rod 47. This rod 47 as more clearly shown in Fig. 1, is guided within a restraining element 48 and has a screw 49 fixed at its upper end in a position to contact lever 25. A spring 50 is connected to the rod 47 at 51 and to a fixed part of the machine as shown at 52. This spring is under considerable tension and serves to move the rod in an upward direction except when the same is positively moved downwardly by contact of one of the pins 39 with the follower 40 or by means of cam control on the main cam shaft as will be described presently.

Cam shaft 10 has a drum 53 fixed thereto to which has been attached a cam 54 for actuating the hook at the start of knitting in the leg, that is, right after knitting the ring top; another cam 55 has been fixed to this drum to control the hook at the start in the foot right after knitting the heel. These cams 54 and 55 function upon a follower 56 projecting from the lever 41 and move the hook inwardly to a yarn engaging position at the start of knitting in the leg and in the foot after the heel to assure that the instant a yarn lever is moved to feeding position for feeding a plaiting yarn and a backing yarn, the plaiting yarn will be engaged by the hook and will be drawn to a preferred position at the first course. This avoids special timing of the disc 38 which might involve considerable difficulty with some patterns. In the heel it is not necessary to start and stop the heel at any particular point in the pattern since the cam 55 will assure that the hook controls the yarn after the change from the heel to the foot. The timing of the cam shaft 10 is such that a movement thereof at the start of the leg or at the start of the foot after the heel, imparts a sufficient movement to the drum 53 for either cam 54 or 55 to raise lever 41 and to drop it off its cam at a single motion. The hook will be projected in to catch the plaiting yarn just after its yarn guide has been lowered to feeding position.

The striper drum shaft 57 which is located at the back of the machine also carries a drum 58 having a plurality of double stepped cams 59

thereon. These cams control the yarn guide or guides which feed the threads throughout the knitting of patterned work. The drum is herein shown having only one row of these cams, but a plurality of rows will essentially be used according to the number of colors employed and the number of yarn feeding guides which it is necessary to control. These cams 59 work upon a series of levers 60, one of which is completely shown in Figs. 6 and 7. These levers pivoted on stud 61, are forked as shown at 62 to engage the yarn guide controlling wires 63, and carry adjustable cam followers 64 at their other end by means of which the motion of the double stepped cams is imparted to the yarn guides. The reason for constructing these cams 59 with double steps will be given with respect to the control of the yarn guides themselves.

Of course, each of the wires 63 is controlled by the usual levers 12 which contact cams on drum 11 as previously described. This additional control functions for the changes of color, that is, the changes of yarn incidental to supplying different colors, it being understood that as between colors supplied by any one guide, reverse plaiting will be resorted to for selectively bringing the non-plaiting color to the front of the fabric.

Now with respect to Figs. 8-14 the operation of the device will be described throughout the changes from one yarn guide to another. In the Figs. 8 and 9 the hook 20 has been shown extended inwardly as it would be at the start of the leg or the foot, or as it would be upon change from one yarn feeding guide to another. Such movement would be imparted by cams 54 or 55, or by any one of the pins 39 on disc 38. Yarn guide 16 has just been moved to a feeding position, the other guide 15 being shown in raised or non-feeding position. The two yarns feeding through guide 15 are held in a suitable yarn binder while those yarns fed by guide 16 have already been taken by the needles and are fed through the mouthpiece. The plaiting yarn is indicated by numeral 65 while the backing yarn is indicated at 66. Of course, the relative position of these yarns will be reversed in the fabric upon the action of any reverse plaiting mechanism such as the sinker reverse plaiting characteristic of certain Banner machines. In Fig. 9 the normal separation or divergence of the yarn is shown. With such separation of the yarns it would commonly be necessary to employ considerably more tension on yarn 65, the plaiting yarn, than on yarn 66. As previously stated, failure to use such additional tension with some yarns would result in less perfect plaiting, more unsatisfactory reverse plaiting and poorly defined lines of demarcation between the two. Further, to employ such excessive tension would lead to other difficulties, chiefly that of yarn breakage.

With the construction shown about the same amount of tension would be used upon each of the yarns and that tension would not need to be much more than would ordinarily be applied to any yarn for proper knitting. The hook 20 would only come into the position of Figs. 8 and 9 long enough to catch a yarn after yarn guide 16 had moved down whereupon follower 56 would drop from either cam 54 or 55, or the follower 40 would be released from one of the pins 39 to allow the hook to be drawn to the position of Figs. 10 and 11. This movement is assured by spring 50. When drawn to the position shown

in these figures, the yarns 65 and 66 will be separated to a much greater extent and yarn 65 will be fed very close to the needle circle. This angle of divergence assures that yarn 65 will plait over yarn 66, and that the action of reverse plaiting will be more positive than it would be with only the separation normally provided as in Fig. 9. The yarn guide 15 may feed its yarns 65 and 66 throughout any desired extent of the fabric whereupon another guide such as 15 will be moved to feeding position and the first guide withdrawn.

The withdrawal of yarn guide 16 is accomplished in two steps, this being possible as follower 64 rides upon the lower step and then on to the highest step of one of the cams 59. Figs. 12 and 13 illustrate the guide in its mid-position, that is, when follower 64 would rest upon the first step of a cam. As guide 16 is moved to its intermediate position, the guide 15 may be started on its downward movement, but the purpose of raising the first guide before the second is completely moved to its feeding position is to allow the yarn 65 to be released from the hook so that guide 15 will not come down on top of that yarn to prevent its being released. If such were the case, that yarn could not be freed from the hook until the hook was moved inwardly; this would result in knitting the yarn 65 longer than desired.

In Figs. 12 and 13 yarn 65 has been shown just after it has snapped out of the hook prior to guide 15 being moved to feeding position, the guide being moved to that position in these views. The yarn 65 will be drawn back by the take-up and will go into the binder along with yarn 66 as guide 16 is moved to inactive position as the follower 63 is raised on to the top of one of the cams 59.

In Fig. 14 guide 16 is shown in extreme upper position, the yarn fed thereby being about to be taken into the binder and cut. Guide 15 is in lowermost position and the hook 20 has been projected inwardly to engage yarn 65', the new plaiting yarn, to separate it from yarn 66'. More guides might be employed to feed a greater number of yarns thus increasing the number of colors available. This description is merely given as one example of the invention as it applies to a machine feeding four colors, two at a time, any two of the yarns fed by one guide being subject to reverse plaiting. With the construction shown the guide 16 must be withdrawn in two steps as indicated, however, no such movement would be necessary with respect to the withdrawal of guide 15 which is directly over the point of hook 20 and closer thereto than guide 16. If three or more guides were employed, the two step movement at withdrawal would be imparted to all of those yarn feeding guides except the one nearest the point of the hook.

The invention has been described in more or less specific terms for the purpose of disclosing one preferred embodiment, but this invention is not to be restricted except by the scope of the appended claims.

We claim:

1. In a knitting machine for knitting one yarn in plaiting relation to another yarn, a yarn guide for feeding a plaiting yarn and a backing yarn, said yarn guide being constructed to feed one of the yarns closer to the circle of needles than the other and at a definite angle thereto, and means functioning independently of the guide

for holding one of the yarns in such a position that it will be spaced from the other by an angle greater than that provided by the guide to assure more satisfactory plaiting.

2. In a knitting machine for knitting one yarn in plaiting relation to another, means for feeding a plaiting and backing yarn, said means being constructed to maintain the two yarns spaced throughout a definite angular extent and means functioning independently of said feeding means for holding the plaiting yarn in a position whereby it will feed to the needles at an angle more widely spaced from the backing yarn than that provided by said feeding means alone.
3. In a knitting machine for knitting one yarn in plaiting relation to the other, a yarn guide having spaced guiding apertures through which a plaiting yarn and a backing yarn are threaded, the construction being such that the plaiting yarn and the backing yarn are fed to the needles at an angle to one another and spaced from one another throughout a definite extent, said angle being such that for some yarns the plaiting yarn would not be definitely knitted in plaiting relation to the backing yarn without the use of excessive tension on the plaiting yarn, and means for holding the plaiting yarn away from the backing yarn and closer to the needles than provided for by the feeding means whereby the plaiting yarn will be knitted in plaiting relationship to the backing yarn without imposing any undue tension thereon.
4. In a knitting machine for knitting plaited fabric, a yarn guide for feeding two yarns, one yarn being fed closer to the needles than the other whereby they approach the knitting point at a convergent angle, a hook movable substantially at right angles to the yarn feeding guide for catching one of the yarns and for pulling it closer to the circle of needles whereby it will be fed at an angle more widely spaced from the backing yarn than provided by the yarn feeding guide itself.
5. A knitting machine for knitting one yarn in plaiting relation to another including yarn guides for feeding a plurality of yarns in such a manner that a plaiting yarn is fed to the needles at an angle to the direction in which the other yarn is fed to the needles and closer to the needles than the other yarn, automatically controlled means for withdrawing and projecting said yarn feeding guides to feeding position in accordance with a predetermined pattern, a hook for catching the plaiting yarn and holding it in a position wherein it will feed to the needles at a greater angle with respect to the other yarn than provided by the yarn feeding guide itself and pattern controlled means for moving this hook to and from yarn catching position as the yarn feeding guides are moved to and from their inactive position.
6. In a knitting machine, a yarn feeding guide having two apertures through which yarns are

fed, one of the said apertures feeding its yarn closer to a circle of needles than the other, means automatically actuated for catching one of the yarns and moving it to a position closer to the circle of needles whereby it will be fed to the needles at as great an angle as possible with respect to the other yarn fed by the same feeding means.

7. A yarn feeding and controlling means for knitting machines adapted to knit one yarn in plaiting relation to another, yarn guides constructed to feed two yarns separately and at an angle to one another, said angle being insufficient to cause one yarn to plait over the other without applying excessive tension thereto, a hook movable across the path of the feeding yarns adapted to catch the plaiting yarn and draw it away from the other yarn to increase the angle at which they feed whereby plaiting may be effected without resort to difference in tension.

8. In a knitting machine, a latch ring, a bracket attached to said ring and having a slot therein, a slot in the ring in continuation of that in the bracket, a hook comprising a shank and a yarn engaging point slidable within the slot and means functioning on the bracket for moving the hook in either direction.

9. Mechanism as defined in claim 8, wherein said means for moving the hook in either direction comprises a spring for moving it in one direction and pattern controlled elements functioning from timed parts of the knitting machine substantially as shown and described.

10. In a knitting machine for knitting one yarn in plaiting relation to another, means for feeding a plaiting and backing yarn, said feeding means being constructed to feed said yarns to knitting instrumentalities at a definite angle and other means functioning independently of the feeding means for selectively engaging one of the yarns and moving it to a position so that the said plaiting and backing yarns will then be fed at an angle considerably greater than originally provided by the feeding means itself.

11. A knitting machine for knitting one yarn in plaiting relation to another including knitting instrumentalities and yarn feeding means for feeding a plurality of yarns, one of which may be a backing yarn and others of which may be knitted selectively as plaiting yarns, means for engaging one of the plaiting yarns and for moving it away from the backing yarn thereby to increase the angle at which the plaiting and backing yarn feed to the instrumentalities, and pattern controlled means functioning upon said yarn engaging means and functioning in timed relation to the plaiting yarn feeding means for disengaging the said means from one plaiting yarn and engaging it with another.

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