Aug. 26, 1947. E. KILLIAN 2,426,357

KNITTING APPARATUS AND METHOD

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Fig. 1.

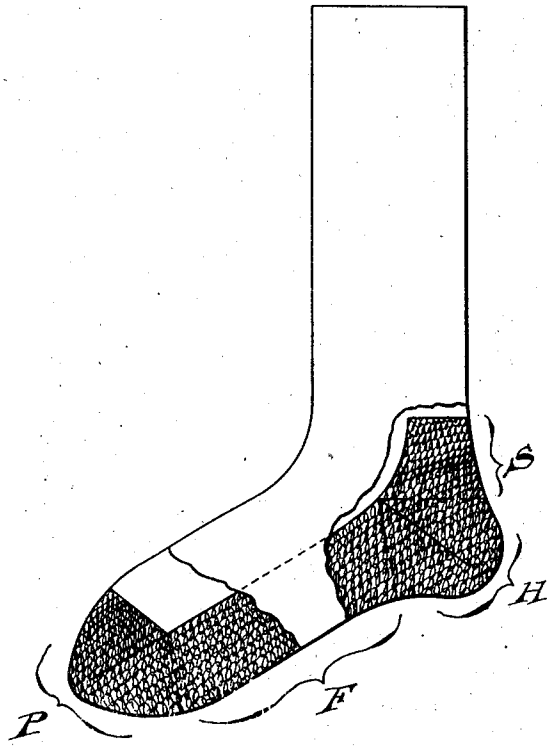
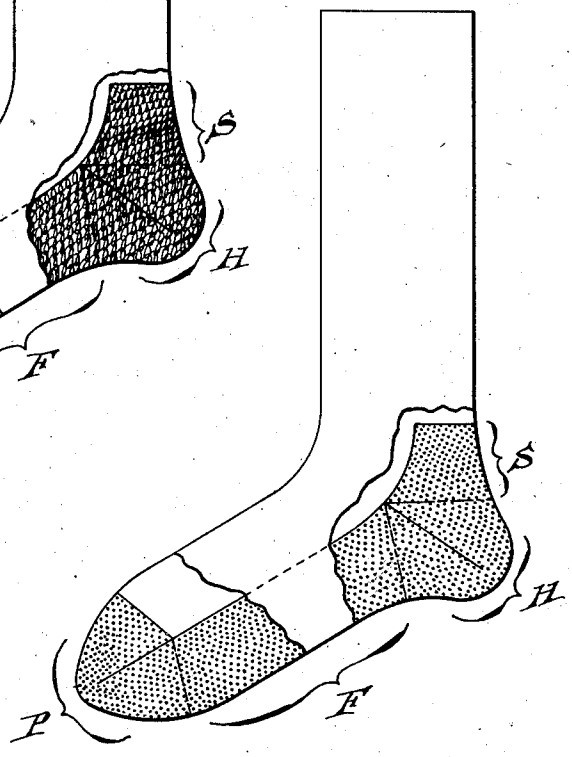


Fig. 2.



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KNITTING APPARATUS AND METHOD

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Fig. 3.

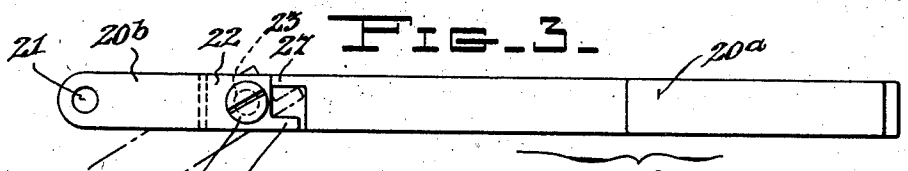


Fig. 4.

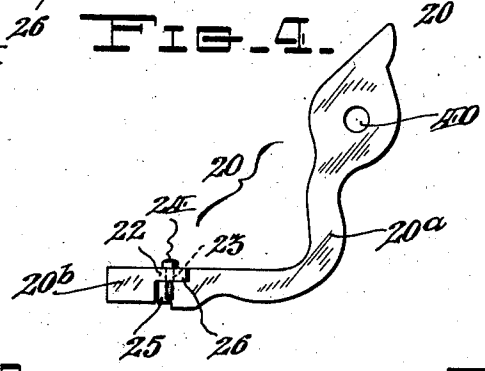


Fig. 5.

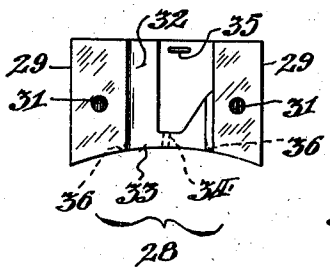


Fig. 6.

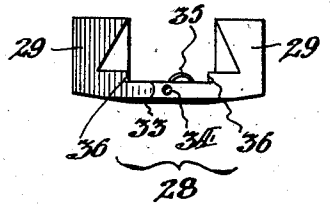


Fig. 7.

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KNITTING APPARATUS AND METHOD

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Fig. 8.

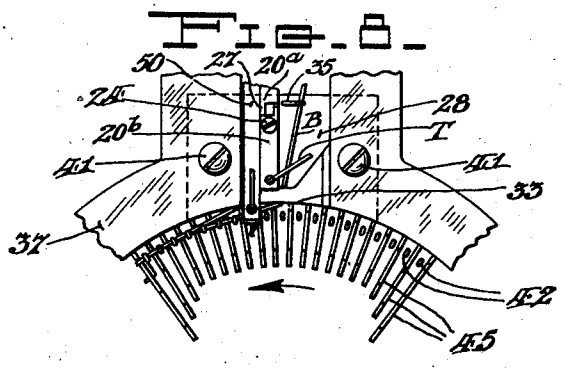


Fig. 9.

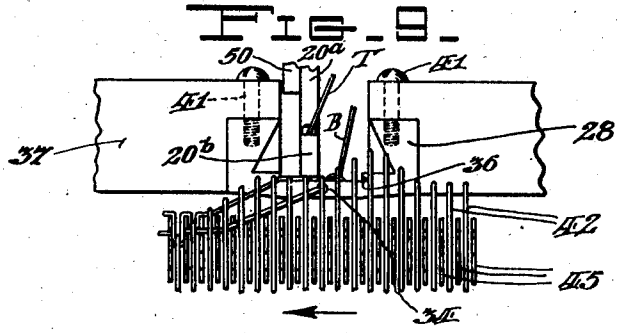


Fig. 10.

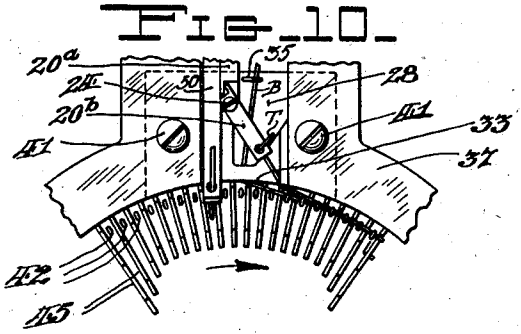
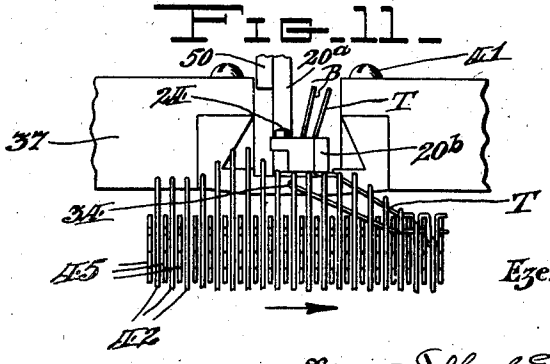


Fig. 11.



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KNITTING APPARATUS AND METHOD

Filed March 25, 1944 4 Sheets-Sheet 4

Fig. 12.

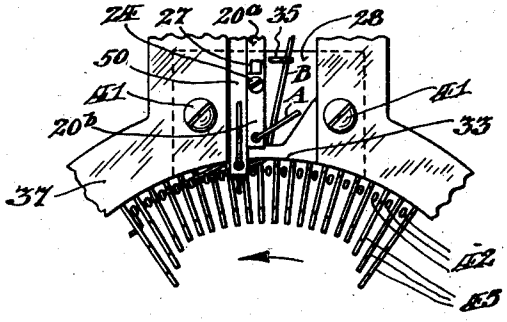


Fig. 13.

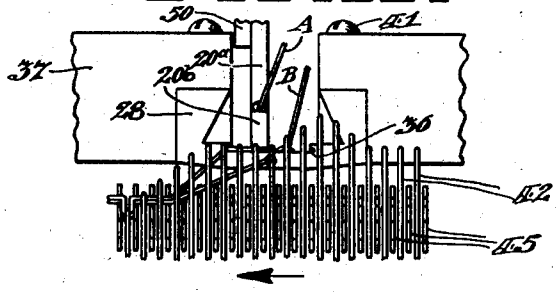


Fig. 14.

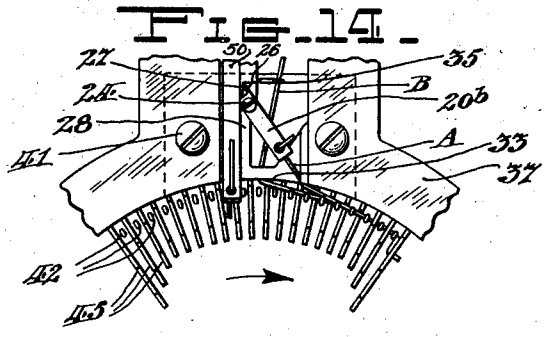
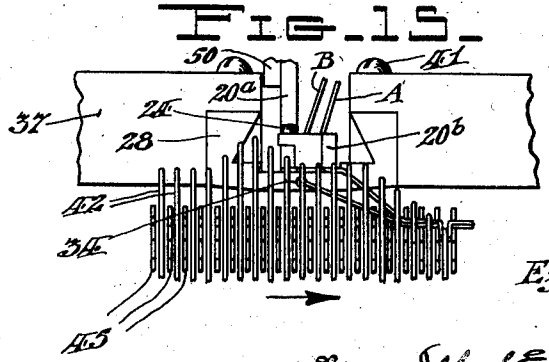


Fig. 15.



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Patented Aug. 26, 1947

2,426,357

UNITED STATES PATENT OFFICE

2,426,357

KNITTING APPARATUS AND METHOD

Ezekiel Killian, Reading, Pa., assignor of one-fourth to E. Louis Kotzen, one-fourth to Samuel R. Kotzen, one-fourth to Myer E. Kotzen, all of Reading, Pa., and one-fourth to Howard C. Mohn Hosiery Co. Inc., a corporation of Pennsylvania

Application March 25, 1944, Serial No. 528,110

17 Claims. (Cl. 66—93)

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This invention generally pertains to knitting machines, such as those utilized for the production of seamless hosiery, and is more particularly concerned with a new means and method of effecting terry loops and plating in the fabrics knitted on such machines.

Modern knitting machines of the "Banner" type utilized for the production of seamless hosiery, such as army socks, are commonly provided with yarn feeding means comprising a plurality of independently operable yarn guides or fingers adapted respectively to feed yarn or different size, quality, material, color, etc., for use either singly, or in desired combination or relation, in knitting different parts of a stocking or sock; the several yarn guides being selectively controlled for individual and combined action as desired, by the standard or conventional patterning means of such machines.

Provision has heretofore been made in such machines to feed the yarn so as to effect terry loops, as well as plating, in certain courses or areas of the hosiery knitted thereby. However, the means provided for this purpose ordinarily involve separate yarn feeding arrangements or devices, one for effecting terry loops and another for effecting plating. Furthermore, the prior art yarn feeding arrangements for effecting terry loops are either incapable of providing such loops in every course of certain areas, such as the heel and toe pockets of the hosiery knitted by the machine, or involve the addition of more or less complicated and expensive installations to the machine.

One object of my invention is to provide a knitting machine of the referred to type having novel means for effecting the production of terry loops in every course of such areas as the heel and toe pockets of hosiery knitted by the machine.

Another object is to provide such a knitting machine having novel means for effecting the production of terry loops in every course of a knitted fabric section resulting from reciprocal knitting action of the machine.

Another object is to provide such a knitting machine having novel means for effecting plating in the fabric knitted by the machine.

A further object is to provide such a knitting machine having novel multiple function means

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which is selectively adjustable so that it will effect the production of either terry loops, or plating in every course of the fabric knitted by the machine, and during circular or reciprocal knitting action of the latter.

An additional object is to provide such a knitting machine having novel means as indicated which is simple in construction and embodies structural and functional features of advantage over similar means of the prior art.

A further object is to provide such a knitting machine having novel yarn feeding means.

It is also an object to provide such a knitting machine having novel yarn feeding means comprising a yarn guide finger embodying new structural and functional features adapted to carry out the purpose of my invention.

Another object is to provide such a knitting machine having novel yarn feeding means comprising a throat plate embodying new structural and functional features adapted to carry out the purpose of my invention.

Still another object is the provision of a novel method of effecting terry loops and plating in the knitted fabrics produced on a knitting machine of the referred to type.

With these and other objects in view, which will become more readily apparent from the following detailed description of certain illustrative embodiments of my novel improvements shown in the accompanying drawings, the invention comprises the novel elements, features of construction and arrangement of parts in cooperative relationship, as well as the new method, hereinafter more particularly defined by the claims.

In the drawings:

Figure 1 is a side elevational view of a foot hose or sock which is partly broken away and diagrammatically illustrates certain internal areas provided with terry loops by the novel means and method of my invention.

Fig. 2 is a side elevational view of a foot hose or sock, similar to Fig. 1, and diagrammatically illustrates certain internal areas provided with plating by the novel means of my invention.

Fig. 3 is a top plan view on an enlarged scale of one form of novel yarn guide finger constituting an element of my invention.

Fig. 4 is a side elevational view of the yarn

guide finger shown in Fig. 3, but substantially actual size.

Fig. 5 is a top plan view of one form of novel throat plate device constituting another element of my invention.

Fig. 6 is a front elevational view of the throat plate device shown in Fig. 5.

Fig. 7 is a partial cross-sectional elevational view through a circular knitting machine of the "Banner" type, having my invention applied thereto.

Fig. 8 is a fragmentary plan view as seen by looking in the direction of the arrows 8—8 on Fig. 7, and shows the relationship of said parts when functioning to effect terry loops during movement of the needle cylinder to the left.

Fig. 9 is a fragmentary elevational view, as seen by looking in the direction indicated by the arrows 9—9 on Fig. 7.

Fig. 10 is a view similar to Fig. 8, but shows certain parts in another position, and illustrates the relationship of said parts when functioning to effect terry loops during movement of the needle cylinder to the right.

Fig. 11 is a fragmentary elevational view similar to Fig. 9, but shows the parts in the positions corresponding with Fig. 10.

Fig. 12 is a top plan view, similar to Fig. 8, and shows the relationship of certain parts when functioning to effect plating during movement of the needle cylinder to the left.

Fig. 13 is a fragmentary elevational view as seen by looking in the direction of the arrows 13—13 on Fig. 12.

Fig. 14 is a view similar to Fig. 12, and shows the relationship of certain parts when functioning to effect plating during movement of the needle cylinder to the right.

Fig. 15 is a fragmentary elevational view, similar to Fig. 13, but illustrates the parts positioned as shown in Fig. 14.

In the referred to "Banner" type and other circular knitting machines, the latch or guard ring of the machine is provided at the yarn feed point with a so-called "throat opening" within which a plurality of yarn guide or feed fingers are located which are selectively operated by a pattern mechanism in well-known manner. Usually, the said throat opening has a floor, or throat plate, which serves as a support upon which the active yarn guide finger, or fingers rest, with their delivery eyes in a predetermined horizontal plane close to the needle row. In passing from the active yarn guide eye to the needle hooks, the yarn slides or reeves over the edge of this floor or throat plate, so that such edge, and the terminal corners thereof, normally define the delivery plane or point for any given yarn.

In accordance with the well-known practice of plating any given yarn upon another, such as a facing yarn on a body yarn, it is important to provide a proper lead angle necessary to cause one yarn to enter the needle hook in accurately spaced relation to the other yarn so as to be plated thereon in uniform relationship. When such plating is to be effected in areas produced by reciprocal action of the needle cylinder, as in knitting the heel or toe pockets of stockings or socks, it is, of course, also important that the mentioned uniform relationship between the yarns be maintained during movement of the needle cylinder in both directions.

As hereinafter more fully explained, the novel plating means of my invention maintains the said uniform relationship between the yarns utilized

to effect plating, by feeding the main or body yarn through a yarn guide eye or aperture which is centrally arranged in the throat plate below and transversely of the previously referred to reeving edge, and by the provision of terminal corners at each end of said edge which are substantially equi-distant from said yarn guide eye. By this arrangement, the yarn fed from the yarn guide eye in the throat plate will invariably have the same angular relationship with respect to the hooks of the needles to which the yarn is fed, and also with respect to the second or plating yarn being fed from a certain selected yarn guide finger, constructed in accordance with my invention and positioned above the throat plate in such manner that the yarn will pass over the reeving edge of the latter at the terminal corners thereof. Accordingly, both the main and auxiliary yarn will be fed to the needles in the same determinedly spaced and angular relationship irrespective whether the needle cylinder is moving in one direction or the other.

With the aid of a certain prior art knitting machine mechanism, it has also heretofore been possible to provide terry loops on the inside of circularly knitted hosiery sections. The referred to mechanism is arranged to feed the terry yarn in such relation with respect to the main or body yarn, that the former will pass over the top edges of the machine sinkers while the main or body yarn enters the throats of the sinkers at the knitting point in conjunction with the movement of the needles through a knitting wave. However, the said prior art mechanism functions to produce terry loops only when the independently operable needle series is moving through its knitting wave in one direction. Consequently, when producing such articles as army socks with terry yarn of 100% wool on the inside of the heel pocket, sole and toe pocket the terry loops can only be provided in every second course with this mechanism during reciprocal action of the needle series, i. e. during the knitting of the heel and toe pockets. The circularly knitted foot section intermediate the heel and toe pockets is, of course, produced by rotation of the needle cylinder in one direction only, and the said mechanism is therefore capable of producing terry loops in each course section constituting the sole area.

When terry loops are formed only in every second course of the heel and toe pockets there are obviously fewer cushioning loops provided where the greatest wear usually comes and where the cushioning is particularly needed.

In accordance with my invention, the previously indicated mechanism for effecting plating on the inside of every course of the heel pocket, the sole area and the toe pocket, can, by a simple adjustment, also be set to provide terry loops in the same courses.

It is to be understood, therefore, that the novel knitting machine mechanism of my invention is arranged so that it can be selectively adjusted to either effect plating or terry loops with a secondary or auxiliary yarn in every course knitted with a main or body yarn during rotary or reciprocal action of the needles, when producing a fabric or article of the type previously indicated, and that the plating or terrying is effected in connection with the movement of the needle series of the machine through a single knitting wave.

The improvements of my invention may be associated with a conventional circular knitting

machine, such for example as a "Banner" machine, adapted to produce a plain or other circular hosiery fabric, and heel and toe pockets in the usual and well-known manner.

In accordance with one mode of operation, my invention functions to produce terry loops on the inside of a foot hose, or sock, as indicated for example in Fig. 1, i. e., in every course of the high splice section S, the heel pocket H, the foot sole section F, and the toe pocket P.

In accordance with another mode of operation, my invention functions to produce plating on the inside of a foot hose, or sock, as indicated for example in Fig. 2, i. e., in every course of the high splice section, the heel pocket, the foot sole section, and the toe pocket; these sections or parts being identified in Fig. 2 by reference characters corresponding with those of Fig. 1.

To effect proper feeding of the yarn when the knitting machine is set to function in accordance with one or the other of said two modes of operation, I provide novel yarn guide or feeding means in the form of a yarn guide finger shown in Figs. 3 and 4, and a throat plate device illustrated by Figs. 5 and 6. In order to facilitate an understanding of the various pases of my invention, the description will be proceeded with by first pointing out the novel structural features of said yarn feeding means, then explaining the cooperative relationship of said means with respect to the standard parts of a conventional knitting machine, and finally setting forth the operation of the invention in carrying out its intended purpose.

The yarn guide finger **20** is of standard or conventional size and shape, and is provided with some or all of the parts and features corresponding with the usual guide fingers associated with the particular knitting machine with which it is adapted to cooperate, depending upon the extent to which such parts and features are required or desirable in conjunction with the improvements of my invention. However, instead of being constructed of a single piece of metal or other material, as usual, it is made in two parts identified as **20a** and **20b**. The part **20b** forms a continuous extension of the part **20a** so that when the said two parts are assembled as shown in Figs. 3 and 4, they form a yarn guide finger which corresponds in size, configuration and other characteristics, substantially with the other standard yarn guide fingers associated with the knitting machine to which it is applied. This feature is of significance in that it permits the ready substitution of my novel two-part yarn guide finger for one of standard construction, without necessitating any alterations insofar as the conventional arrangement and operation of the yarn guide fingers and associated parts is concerned.

The separate front end, or part **20b**, of the finger **20** is provided with a vertically extending yarn guide aperture **21**, an extension **22** having an aperture **23** through which passes the shank of a screw **24** in turn secured in a threaded bore in the lower offset extension **25** of the front end of the finger part **20a**. The upper rear section of the part **20b** is provided with an abutment element **26** designed to cooperate with a complementary abutment element **27** integrally formed on the finger part **20a**. By this arrangement, the part **20b** is limitedly movable or swingable in a lateral direction with respect to the part **20a** i. e., the part **20b** is laterally movable between the position shown in full lines in Fig. 3, and the position indicated in dot-and-dash lines in the same figure. Movement of the part **20b** beyond these positions is prevented by the complementary abutment elements **26** and **27**, as clearly shown.

The throat plate device **28** shown in Figs. 5 and 6, is also generally the same in size and configuration as the similar devices ordinarily associated with the latch ring of conventional circular knitting machines, such as the referred to "Banner" type machines. As usual, the device is of a generally U-shaped configuration and comprises a pair of oppositely arranged side members **29** each of which has a threaded bore **31** in their upper sections arranged to retain the screws which secure the device to the latch ring of the machine. A bottom or floor section **32** extends between the members **29** on which the yarn guide fingers of the machine are adapted to rest when in active position. The front end of the bottom section **32** is provided with an edge **33** over which the yarn from the yarn fingers slides or reeves during its feeding movement to the needles and sinkers of the machine.

In accordance with my invention, the front end of the bottom section **32** is provided with a transversely extending yarn guide aperture **34**, below the yarn reeving edge **33**, as shown in Figs. 5 and 6. At the rear of the bottom section there is also provided a suitable yarn guide element **35**. At each end of the yarn reeving edge **33** the device **28** is provided with a yarn guide notch **36** adapted to limit the lateral movement of the yarn effected by reciprocal movement of the needle series of the machine while traveling over the reeving edge **33** on its way from one or more of the yarn guide fingers of the machine to the knitting elements as aforesaid.

By referring more particularly to Figs. 7, 8 and 9 of the drawings, it will become apparent how the novel yarn feeding means comprising the yarn guide finger **20** and throat plate device **28** of my invention, is associated with a standard latch ring **37** of the knitting machine. The yarn guide finger **20** is mounted in position between the usual pair of vertical bearing lugs **38** united with and extending upwardly from the latch ring **37**. The finger **20** is arranged for vertical movement between active and inactive position as determined by the usual mechanism of the machine, intermediate said lugs **38**, by means of a pin or rod **39** which passes through an aperture **40** in the finger **20** and is fixedly seated in aligned apertures of the said lugs. A second yarn guide finger **50** of standard or conventional construction is shown mounted directly adjacent to the yarn guide finger **20**; the latter being shown in lowered or active position in Figs. 7, 8 and 9, while the former is shown in raised or inactive position.

The throat plate **28** is secured as usual in a cut out section of the forward lower portion of the latch ring **37**, by means of two screws **41** which pass through suitable vertical apertures in the latch ring above the throat plate and are fastened in the threaded bores **31** of the throat plate device **28**, as clearly shown.

As usual, the latch ring is pivotally connected at one side with a stationary part of the knitting machine (connection not shown) so that it may be swung vertically from the position shown in Fig. 7, to a position above and to one side of the needle cylinder in which are mounted the usual series of independently operable needles **42**, which are actuated in well known manner. An adjustment screw **43** is vertically mounted as usual in

a threaded bore in a portion of the latch ring 37 adjacent to one of the bearing lugs 38, and the lower extremity of this screw 43 rests on a stationary member 44 of the knitting machine. The adjustment screw 43 is commonly provided to determine the vertical position of the throat plate 28 and active yarn guide fingers on the latch ring 37 with respect to the needles 42 and sinkers 45, and is fixed in position by means of a set screw 46 threadedly engaged in the side of the latch ring section through which the adjustment screw 43 passes. The end of the set screw 46 is adapted to engage the threads of the adjustment screw 43 and prevent rotation thereof after it has been turned to the right or left to determinedly adjust the height of the said parts on the latch ring relative to the needles and sinkers, as aforesaid.

In order that the latch ring may not be subject to undesirable vibrations during operation of the machine or become accidentally displaced vertically from its adjusted position as determined by the screw 43, there is provided the usual latch or locking member 47 which is pivotally mounted on a screw stud 48 extending into a vertically adjustable plate 49 provided with elongated apertures 51 through which pass the shanks of two screws 52 in turn secured in a stationary machine part 44. The hook-shaped upper end of the latch 47 engages a screw stud 53 secured to the latch ring 37, and this engagement is maintained by means of a spring 54, one end of which is secured to the latch 47 and the other end of which is secured to the stationary machine part 44 by means of a screw 55.

When it is desired to vertically adjust the latch ring 37, so as to slightly lower the throat plate 28 and the active yarn guide fingers such as the finger 20, thereby to vary the relationship of the yarn reeving edge 33, and the lead angle of the yarns passing thereover with respect to the needles 42 and sinkers 45, the set screw 46 is turned to free the adjustment screw 43, and the latter is then rotated to an extent necessary to effect the desired lowering of the latch ring 37. The set screw 46 is then again moved into locking engagement with the threads of the adjustment screw 43.

Since lowering of the latch ring 37, as just described, will cause the screw stud 53 to move downwardly away from the hook of latch 47 so that it will no longer be firmly connected to the latter, it also becomes necessary to lower the latch 47 to re-establish such firm connection. This is accomplished by sufficiently releasing the screws 51, so that the plate 49 on which the latch 47 is mounted, can be lowered to a position re-establishing the desired firm connection between the stud 53 on the latch ring 37, and the hook member on the latch 47. The screws 51 are then tightened to again fix the plate 49 in position against the stationary knitting machine part 44, as before.

When it is desired to adjust the vertical position of the latch ring 37, so as to slightly raise the same, the latch 47 must obviously first be released to permit such upward movement of the ring and stud 53, after which the procedure of effecting the upward adjustment is carried out by substantially reversing the steps previously described.

Moving the hook of the latch 47 to the left in Fig. 7, against the action of tension spring 54, until it is free of the stud 53, will permit the latch ring to be lifted or swung about its usual pivotal connection (not shown) with the knitting machine frame to enable access to the needles and sinkers, as previously indicated.

A vertical bracket 56 is secured to a side member of the latch ring 37 as usual, having a horizontal plate 57 at its upper end in which are provided the porcelain eyelets through which pass the yarns from the cones or bobbins (not shown) of the machine to the yarn guide elements positioned below the plate 57.

Operation of invention to effect terrying

When it is desired to produce a knitted fabric, such as an army sock of the type illustrated in Fig. 1, in which the body yarn consists of about 50% cotton and 50% wool, and the terry loops are produced with yarn consisting of 100% wool, the novel means of my invention are arranged and operated as follows:

The body yarn B from the proper yarn cone or bobbin is passed through a suitable eyelet in the plate 57, through the yarn guide element 35 at the rear of the throat plate 28, and through the yarn guide aperture 34 below the reeving edge 33 at the front end of the throat plate and directed to the needles 42 in usual manner when operation of the machine is about to commence. The terry yarn T is similarly taken from the proper yarn cone or bobbin, is passed through a suitable eyelet in the plate 57 located to the right of the yarn guide finger 20 (Fig. 8), so that it may be extended downwardly from said eyelet to the left and through the yarn guide aperture 21 of the yarn guide finger 20, and then directed to the needles 42, over the reeving edge 33 of the throat plate 28 at the left end yarn guide notch 36, as shown in Fig. 8, to effect the production of terry loops in the manner about to be explained.

Figs. 8, 9, 10 and 11 illustrate the action of the independently operable series of latch needles 42 and cooperating sinkers 45 during feeding thereto of the body and terry yarns by the novel yarn feeding means of my invention to effect knitting of the body yarn into plain loops and the joining therewith of terry loops.

When the independently operated needles 42 move to the left, as indicated by the arrows in Figs. 8 and 9, the body yarn B, after it leaves the aperture 34 at the front end of the throat plate 28, is fed to the needles as shown in said figures, at a lead angle such that it will enter the throats 45^a of the sinkers 45, substantially at the knitting point, or where the needles 42 and sinkers 45 cooperate to form successive plain stitches in connection with the carrying out of a single knitting wave by the latch needles 42 in accordance with the known practice. Simultaneously with the formation of the plain loops by the body yarn, the terry yarn T, after it leaves the aperture 21 of the yarn guide finger 20 and passes over the reeving edge 33 at the left end notch 36 of the throat plate 28 as shown, is fed to the needles 42 and sinkers 45 at a lead angle such that it will pass over the tops 45^b of the sinkers, substantially at the said knitting point, to form successive terry, or lengthened loops, in connection with the carrying out of a single knitting wave by the needles 42.

In this connection it is noted that prior art means have heretofore been employed to feed the yarn to the needles and sinkers as above described to effect the formation of combined plain and terry loops. However, the said prior art means is capable of such operation only when the needles are moving in one direction and it is particularly emphasized, therefore, that the yarn

feeding means of my invention does not merely differ from said prior art means insofar as the structural variations are concerned, but that the means of my invention is additionally designed and arranged to effect this same result when the needles are moving in the opposite direction, or to the right, as will become clear by next referring to Figs. 10 and 11.

As there shown, rotation of the needles to the right will result in correspondingly moving the body yarn B and the terry yarn T to the right side of the throat plate 28. When this takes place, my novel yarn feed means will cause the body and terry yarns to be fed to the needles and sinkers in the same relationship as before, but in order that this be accomplished with the terry yarn T, it will be noted that the part 20b of the yarn guide finger 20 is pulled or moved laterally by the terry yarn T so that the latter occupies the same relative position with respect to the reeving edge 33 and the right end notch 36, as it did with respect to the reeving edge and the left end notch 36 when the needles were moving to the left.

It will be understood, therefore, that the angular relationship of the body and terry yarns relative to the needles and sinkers is the same irrespective whether the needles of the machine are moving to the left or right. Furthermore, that this angular relationship of the two yarns B and T relative to the said knitting elements is maintained by reason of the central location of the yarn guide aperture 34 from which the body yarn B moves to the knitting point, with respect to the two yarn guide elements or notches 36 from which the terry yarn T is fed to the same point as determined by the cooperatively associated yarn operated movable part 20b of the yarn guide finger 20.

Operation of invention to effect plating

When it is desired to produce a knitted fabric, such as a foot hose of the type illustrated in Fig. 2, in which certain parts are plated on the inside as previously pointed out, the novel means of my invention are arranged and operated as follows:

Assuming that the machine is set or adjusted to operate as above described so as to produce a fabric with terry loops, then the terry yarn is replaced by a suitable auxiliary or plating yarn A. Thereafter it is merely necessary to lower the latch ring 37 (in the manner previously described) to the extent necessary to bring the yarn reeving edge 33 into such relationship with the sinkers of the machine, that the angle of the plating yarn is altered or reduced sufficiently so that the same will enter the throats 45a of the sinkers 45 at the knitting point. This will be accomplished by lowering the latch ring 37 approximately $\frac{1}{32}$ inch from the position which it occupies during operation of the machine to produce terry loops, as indicated by the dot-and-dash lines in Fig. 9.

Figs. 12, 13, 14 and 15 illustrate the angular relationship of the body yarn B and a plating yarn A with respect to the needles and sinkers, and the manner in which both yarns enter the throats 45a of the sinkers 45 at the knitting point, after the latch ring has been lowered in the above noted manner. Figs. 12 and 13 show the relationship of the parts previously described when plating takes place during movement of the needles to the left, and Figs. 14 and 15 show the relationship of the same parts when plating takes place during movement of the needles to the right.

When operating the knitting machine to produce either the foot hose of Fig. 1, or that shown in Fig. 2, the various constituent parts thereof are, of course, formed by rotary and reciprocal knitting in accordance with the usual and well-known practice. The leg portion down to the heel pocket H is effected by rotary knitting, the heel pocket by reciprocal knitting, the foot section F between the heel pocket and the toe pocket P by rotary knitting, and the toe pocket by reciprocal knitting.

When it is desired to introduce terry loops or plating on the inside of the hose in conjunction with rotary knitting, as for example in the high splice area S, or the foot sole area F, a usual yarn guide finger 50 (Fig. 7) may be employed instead of the yarn guide finger 20, and the latter raised to inactive position. In accordance with the well-known practice, the yarn guide finger 50, when arranged to feed an auxiliary yarn, may be automatically operated by the standard pattern mechanism of the machine, so as to feed its yarn to the knitting elements only during that portion of rotation of the needle cylinder during which the terry or plating loops are to be combined with the plain loops effected by the body yarn. During the remainder of the course or courses so produced the finger 50 is automatically raised to inactive position by the said patterning mechanism so that the auxiliary yarn is not interknitted with the body yarn, but is merely floated across the course section produced by the latter, as well understood by those skilled in this art.

Of course, the novel improvements and method shown and described, may be changed and modified in various ways without departing from the invention herein disclosed and more particularly defined by the appended claims.

I claim:

1. A knitting machine comprising, a reciprocally movable circular series of independently operable needles, a series of yarn sinkers cooperatively associated with the latter, a latch ring, a throat plate device associated with the latter and provided with a yarn reeving edge, stationary yarn guide means combined with said throat plate device and arranged to direct a yarn to the needles from a position below said reeving edge and at an angle such that it will enter the throats of the successive knitting sinkers thereby to effect the knitting of successive plain loop courses during reciprocal movement of the needle series, and means arranged to feed a yarn to the needles over said reeving edge from a plurality of positions as selectively determined by the yarn and at an angle such that the yarn will pass over the top edges of the successive knitting sinkers thereby to effect the addition of terry loops to each of said successive plain loop courses during said reciprocal movement of the needle series.

2. A knitting machine comprising, a reciprocally movable circular series of independently operable needles, a series of yarn sinkers cooperatively associated with the latter, a latch ring, a throat plate device associated with the latter and provided with a yarn reeving edge, stationary yarn guide means combined with said throat plate device and arranged to direct a yarn to the needles from a position below said reeving edge and at an angle such that it will enter the throats of the successive knitting sinkers thereby to effect the knitting of successive plain loop courses

during reciprocal movement of the needle series, and a yarn guide finger on said latch ring provided with a laterally movable yarn guide element arranged to feed a yarn to the needles over said reeving edge from a plurality of positions as selectively determined by the yarn and at an angle such that the yarn will pass over the top edges of the successive knitting sinkers thereby to effect the addition of terry loops to each of said successive plain loop courses during said reciprocal movement of the needle series.

3. A knitting machine comprising a reciprocally movable circular series of independently operable needles, a series of yarn sinkers cooperatively associated with the latter, a latch ring, a throat plate device associated with the latter and provided with a yarn reeving edge, stationary yarn guide means combined with said throat plate device and arranged to direct a yarn to the needles from a position below said reeving edge and at an angle such that it will enter the throats of the successive knitting sinkers thereby to effect the knitting of successive plain loop courses during reciprocal movement of the needle series, and means arranged to feed a yarn to the needles over said reeving edge from a plurality of positions as selectively determined by the yarn and at an angle such that the yarn will enter the throats of the successive knitting sinkers thereby to effect the addition of plating loops to each of said successive plain loop courses during said reciprocal movement of the needle series.

4. A knitting machine comprising, a reciprocally movable circular series of independently operable needles, a series of yarn sinkers cooperatively associated with the latter, a latch ring, a throat plate device associated with the latter and provided with a yarn reeving edge, stationary yarn guide means combined with said throat plate device and arranged to direct a yarn to the needles from a position below said reeving edge and at an angle such that it will enter the throats of the successive knitting sinkers thereby to effect the knitting of successive plain loop courses during reciprocal movement of the needle series, and a yarn guide finger on said latch ring provided with a laterally movable yarn guide element arranged to feed a yarn to the needles over said reeving edge from a plurality of positions as selectively determined by the yarn and at an angle such that the yarn will enter the throats of the successive knitting sinkers thereby to effect the addition of plating loops to each of said successive plain loop courses during said reciprocal movement of the needle series.

5. A knitting machine comprising, a reciprocally movable circular series of independently operable needles, a series of yarn sinkers cooperatively associated with the latter, a vertically adjustable latch ring, a throat plate device associated with the latter and provided with a yarn reeving edge, stationary yarn guide means combined with said throat plate device and arranged to direct a yarn to the needles from a central position below said reeving edge and at an angle such that it will enter the throats of the successive knitting sinkers thereby to effect the knitting of successive plain loop courses during reciprocal movement of the needle series, means arranged to feed a yarn to the needles over said reeving edge and at an angle such that the yarn will pass over the top edges of the successive knitting sinkers thereby to effect the addition of terry loops to each of said successive plain loop courses during said reciprocal movement of the needle series, and means arranged to vary the feeding angle of the yarn which passes over the reeving edge so that it will enter the throats of the successive knitting sinkers thereby to effect the addition of plating loops to each of said successive plain loop courses during reciprocal movement of the needle series.

6. A knitting machine comprising, a reciprocally movable circular series of independently operable needles, a series of yarn sinkers cooperatively associated with the latter, a latch ring, a throat plate device associated with the latter and provided with a yarn reeving edge, a yarn guide aperture in said throat plate device arranged to direct a body yarn to the needles from a position below said reeving edge and at an angle such that it will enter the throats of the successive knitting sinkers thereby to effect the knitting of successive courses of plain loops during reciprocal movement of the needle series, and a continuous two-part yarn guide finger on said latch ring provided with means arranged to permit a terry yarn guided thereby to freely move one of its parts laterally thereby to effect feeding of the terry yarn to the needles over said reeving edge at an angle such that the terry yarn will pass over the top edges of the successive knitting sinkers so as to combine a terry loop with each plain loop formed by said body yarn during said reciprocal movement of the needle series.

7. A knitting machine comprising, a reciprocally movable circular series of independently operable needles, a series of yarn sinkers cooperatively associated with the latter, a latch ring, a throat plate device associated with the latter and provided with a yarn reeving edge, a yarn guide aperture in said throat plate device arranged to direct a body yarn to the needles from a position below said reeving edge and at an angle such that it will enter the throats of the successive knitting sinkers thereby to effect the knitting of successive courses of plain loops during reciprocal movement of the needle series, and a continuous two-part yarn guide finger on said latch ring provided with means arranged to permit a plating yarn guided thereby to freely move one of its parts laterally thereby to effect feeding of the plating yarn to the needles over said reeving edge at an angle such that the plating yarn will enter the throats of the successive knitting sinkers so as to combine a plating loop with each plain loop formed by said body yarn during reciprocal movement of the needle series.

8. A knitting machine comprising, a reciprocally movable circular series of independently operable needles, a series of yarn sinkers cooperatively associated with the latter, a vertically adjustable latch ring, a throat plate device associated with the latter and provided with a yarn reeving edge, a yarn guide aperture in said throat plate device arranged to direct a body yarn to the needles from a position below said reeving edge and at an angle such that it will enter the throats of the successive knitting sinkers thereby to effect the knitting of successive courses of plain loops during reciprocal movement of the needle series, a continuous two-part yarn guide finger on said latch ring provided with means arranged to permit a secondary yarn guided thereby to freely move one of its parts laterally thereby to effect feeding of the secondary yarn to the needles over said reeving edge at an angle such that the secondary yarn will pass over the top edges of the successive knitting sinkers so as to combine a terry loop with each plain loop formed by

said body yarn during reciprocal movement of the needle series, and means arranged to maintain said latch ring in an adjusted position which will vary the angle of the secondary yarn to such an extent that it will enter the throats of the successive knitting sinkers and thereby combine a plating loop with each plain loop formed by said body yarn during said reciprocal movement of the needle series.

9. Steps in the production of a reciprocally knit fabric provided with terry loops on its inner face, which comprise simultaneously feeding a main knitting yarn from a stationary guide and a terry yarn from a guide which is freely movable by the terry yarn from one predetermined feeding position to another, to the sinkers of a circular knitting machine in such manner that the main yarn enters the throats and the terry yarn passes over the tops of the sinkers at the knitting point during a single knitting wave of the needles and rotary action of the needle cylinder in one direction then moving the terry yarn guide to another of said predetermined feeding positions by exerting thereon a pull with the terry yarn, and then simultaneously feeding the main knitting yarn and the terry yarn to the sinkers in such manner that the main yarn enters the throats and the terry yarn passes over the tops of the sinkers at the knitting point during a single knitting wave of the needles and rotary action of the needle cylinder in the opposite direction.

10. The method of producing on a circular knitting machine a foot hose provided with terry loops in every course on the inner face of the heel pocket, sole section and toe pocket which comprises, knitting the hose to the heel pocket in conventional manner by rotary action of the needle series and feeding to the knitting elements a main knitting yarn, then producing the heel pocket by reciprocal action of the needle series and simultaneously feeding the main yarn from a stationary yarn guide and a terry yarn from a yarn guide which is freely movable by the terry yarn from one predetermined feeding position, to the sinkers of the machine in such manner that the main yarn enters the throats and the terry yarn passes over the tops of the sinkers at the knitting point in the same angular feeding relation during a single knitting wave of the needles in connection with rotary action of the needle series in each direction until the heel pocket is completed, then producing the foot section of the hose by rotary action of the needle series and simultaneously feeding the main and terry yarns to the sinkers as during the production of the heel pocket however only during the knitting of the course portions constituting the lower part of the foot section while feeding only the main yarn to the knitting elements during the knitting of the course portions forming the upper part of the foot section, then producing the toe pocket by reciprocal action of the needle series and simultaneously feeding the main and terry yarns to the sinkers in the manner carried out in connection with the production of the aforesaid heel pocket.

11. A knitting machine comprising, a reciprocally movable circular series of independently operable needles, a throat plate device provided with a yarn reeving edge, yarn guide means associated with said throat plate device and arranged to direct a yarn to the needles from a position centrally of and below said reeving edge, and freely movable yarn guide means arranged to direct a yarn to the needles from a plurality of predetermined positions above said reeving edge as selectively determined by the yarn.

12. A knitting machine comprising, a reciprocally movable circular series of independently operable needles, a throat plate device provided with a yarn reeving edge, yarn guide means associated with said throat plate device and arranged to direct a yarn to the needles from a position centrally of and below said reeving edge, and freely movable yarn guide means arranged to direct a yarn to the needles from a plurality of predetermined positions above said reeving edge as selectively regulated by the action of the yarn.

13. A knitting machine comprising, a reciprocally movable circular series of independently operable needles, a throat plate device provided with a yarn reeving edge, yarn guide means associated with said throat plate device and arranged to direct a yarn to the needles from a position centrally of and below said reeving edge, and freely movable yarn guide means arranged to direct a yarn to the needles from a plurality of predetermined positions above said reeving edge as regulated by the pull exerted on said means by the yarn when the needles move in one direction or another.

14. A knitting machine comprising a reciprocally movable circular series of independently operable needles, a throat plate device provided with a yarn reeving edge, stationary yarn guide means arranged to direct a body yarn to the needles from a position centrally of and below said reeving edge, and freely movable yarn guide means arranged to direct a secondary yarn to the needles from a plurality of predetermined positions above said reeving edge as regulated by the pull exerted on said means by the yarn when the needles move in one direction or another.

15. A knitting machine comprising, a reciprocally movable circular series of independently operable needles, a series of yarn sinkers cooperatively associated with the latter, a throat plate device provided with a yarn reeving edge, yarn guide means associated with said throat plate device and arranged to direct a yarn to the needles and sinkers from a position centrally of and below said reeving edge, freely movable yarn guide means arranged to direct a yarn to the needles and sinkers from a plurality of predetermined positions above said reeving edge as selectively determined by the yarn, and adjustable means arranged to permit simultaneous positioning of both said yarn guide means so as to effect feeding of yarns therefrom to the needles and sinkers in one order or another and the knitting of one fabric structure or another by the machine.

16. A knitting machine comprising, a reciprocally movable circular series of independently operable needles, a series of yarn sinkers cooperatively associated with the latter, a throat plate device provided with a yarn reeving edge, yarn guide means associated with said throat plate device and arranged to direct a yarn to the needles and sinkers from a position centrally of and below said reeving edge, freely movable yarn guide means arranged to direct a yarn to the needles and sinkers from a plurality of predetermined positions above said reeving edge as selectively determined by the yarn, and adjustable means arranged to permit a change in the feeding position of said freely movable yarn guide to effect feeding of its yarn to the needles and sinkers in one order or another and the knitting

of one fabric structure or another by the machine.

17. In a circular knitting machine having a needle cylinder rotatable alternately in opposite directions, and a vertically adjustable latch ring; the combination of a thread guide associated with the latch ring and adapted to direct a yarn to the needles, a second yarn guide pivotally associated with the latch ring above the first mentioned yarn guide and having one feeding position for feeding yarn to the needles during relative rotation of the needle cylinder in one direction and a second feeding position for feeding yarn to needles during rotation of the needle cylinder in the opposite direction, said second yarn guide being swingable from one feeding position to the other by the pull of the yarn fed thereby to present said yarn in proper relation for uniform terrying with the yarn fed by the first mentioned yarn guide in both directions of rotation of the needle cylinder, and means arranged to maintain said latch ring in an adjusted position so that said second yarn guide will present its yarn in proper relation for uniform plating

with the yarn fed by the first mentioned yarn guide in both directions of rotation of the needle cylinder.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,191,740	Scott	July 18, 1916
1,584,099	Kane	May 11, 1926
1,852,607	Gagne	Apr. 5, 1932
1,859,137	Grothey	May 17, 1932
2,087,830	Wrightson	July 20, 1937
2,104,815	Richter et al.	Jan. 11, 1938
2,231,399	Thurston	Feb. 11, 1941
2,143,630	Nebel	Jan. 10, 1939
2,304,916	Hilker et al.	Dec. 15, 1942
2,361,280	Fregeolle	Oct. 24, 1944
2,366,124	Page et al.	Dec. 26, 1944