R. W. SCOTT.

YARN FEEDING AND CHANGING MECHANISM FOR KNITTING MACHINES.

APPLICATION FILED JULY 20, 1914.

1,159,873.

Patented Nov. 9, 1915.

2 SHEETS—SHEET 1.

Fig. 2

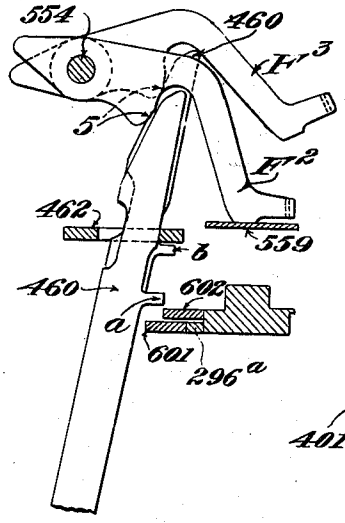



Fig. 1

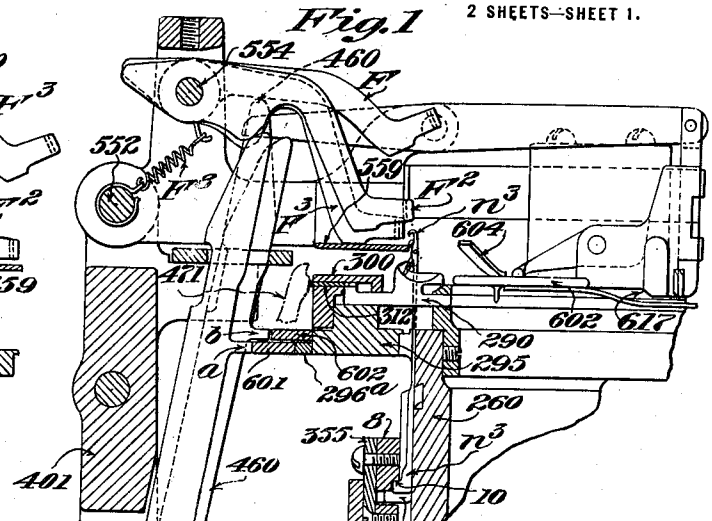



Fig. 11

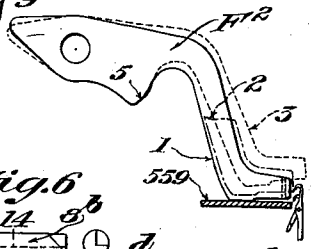



Fig. 3

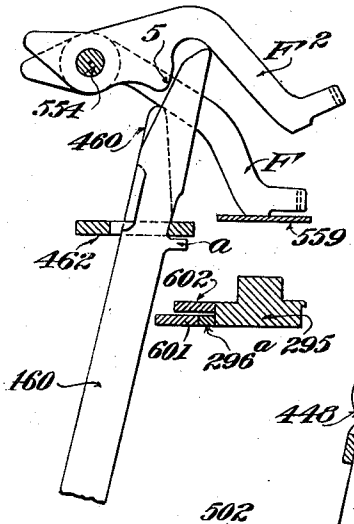
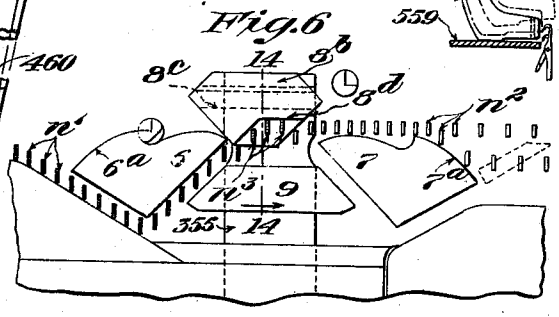



Fig. 6



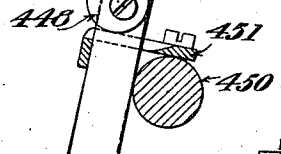
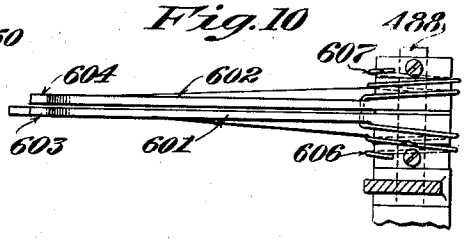
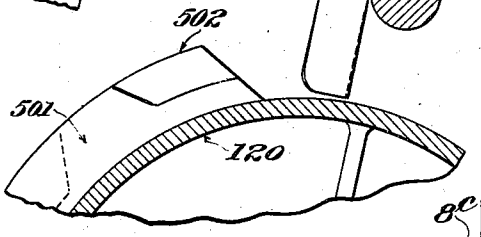




Fig. 10



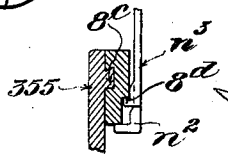




Fig. 14

Witnesses

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Fig. 4

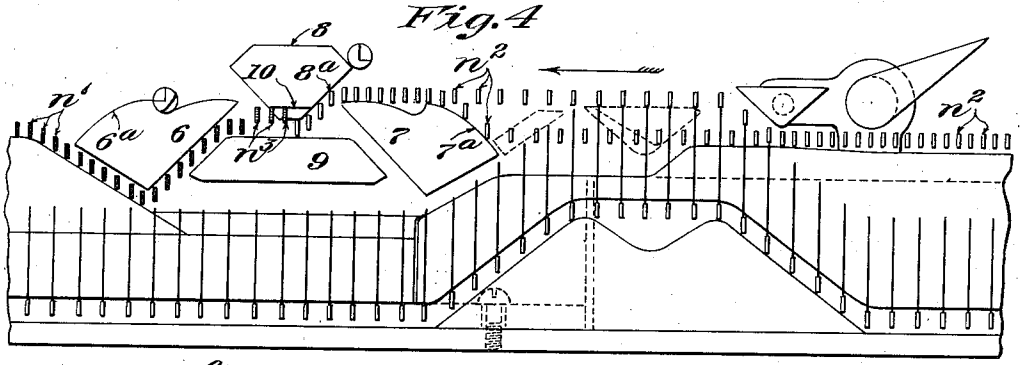



Fig. 5

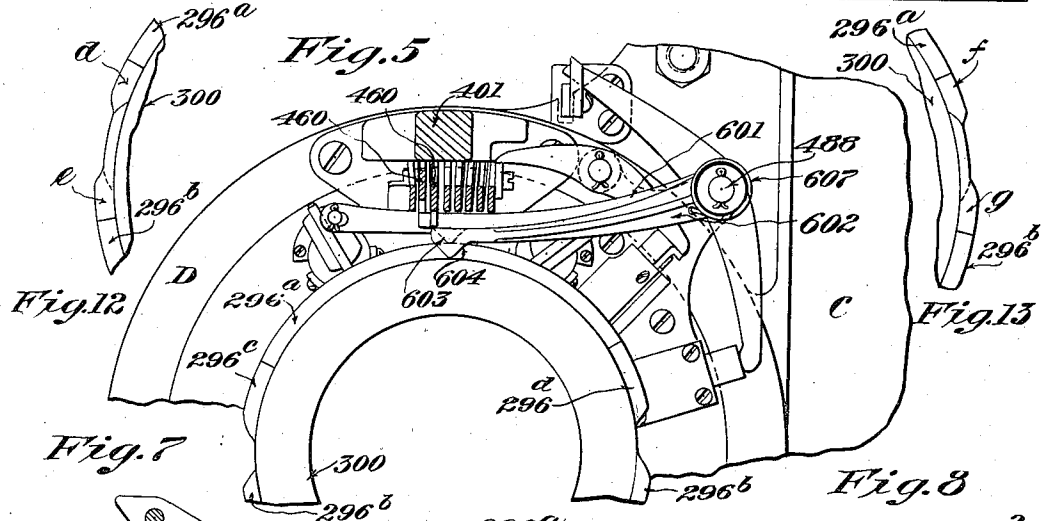



Fig. 12




Fig. 13

Fig. 7




Fig. 8




Fig. 9







Witnesses

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# UNITED STATES PATENT OFFICE.

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## YARN FEEDING AND CHANGING MECHANISM FOR KNITTING-MACHINES.

1,159,873 Specification of Letters Patent. Patented Nov. 9, 1915.

Application filed July 20, 1914. Serial No. 851,931.

*To all whom it may concern:*

Be it known that I, ROBERT W. SCOTT, a citizen of the United States, and resident of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Yarn Feeding and Changing Mechanism for Knitting-Machines, of which the following is a specification.

My invention relates to improvements in yarn feeding and associated mechanism for the improved production of split-foot, sectionally spliced and other forms of fabric.

I have illustrated my device as an improvement upon the mechanism shown, described and claimed in my application No. 845,844, filed June 18, 1914, but it will be evident that the new devices may be applied to other forms of knitting machinery.

In the accompanying drawings, Figure 1 is a vertical section illustrating the pattern mechanism, the yarn guides, the stitch cams, and the needle cylinder of a circular knitting machine as one instance of the application of my devices; Fig. 2 is a detail similar to Fig. 1 illustrating another position of the parts; Fig. 3 is a similar view illustrating a third position of the parts; Fig. 4 is a partial development of the interior of the cam cylinder; Fig. 5 is a section in plan taken above the web-holder bed; Fig. 6 is a detail development showing a modification; Figs. 7 and 8 are illustrations of a modified actuating connection; Fig. 9 is a diagram illustrating the relation of the needles, the yarn, and the yarn guide actuating cams; Fig. 10 is a detail of the yarn guide actuating levers; Fig. 11 is a diagram showing three positions of one of the yarn guides; and Figs. 12 and 13 are details showing modified yarn guide actuating cams. Fig. 14 is a detail section on line 14, 14 of Fig. 6.

In my said application I disclosed a yarn changing and yarn splicing device comprising a series of yarn guide levers pivoted above and outside of the circle of needles in a circular knitting machine, and a device for lifting and lowering said yarn guide levers to change their yarns comprising a series of independent thrust bars, in contact at their lower ends with a pattern cam surface. One of the yarn guide levers was, for sectional splicing, provided on its under side with a lug against which the nose of its thrust bar takes, so that said thrust bar when moved laterally elevates its yarn guide, to sharply remove the yarn thereof from the needles, the yarn being returned whenever the bar is permitted to resume its normal lateral position. A cam carried by the web-holder bed was provided to move the lug on the bar for this purpose, the pattern cam lifting the bar lengthwise to determine whether or not its lug was in range of the said cam, and hence to determine the timely operation of the splicing device.

The present invention provides in addition mechanism for an exchange of yarns occurring during rotary knitting in the same course at a plurality of separated intervals about the knit tube, provision being made to retain the yarn guide about to go out of work in its operative position after the yarn guide put into work shall have begun to feed a new yarn to the needles. My new devices provide for an exchange of this nature occurring persistently at the same needle wales for course after course, to provide a longitudinally split or sutured fabric, such for instance as will be suitable for a substituted fabric above the heel at the back of a stocking, or for a split foot, which may if desired be provided with a sole of a heavier yarn, or a yarn different in color or kind from the fabric of the leg and the top thereof. The said devices provide for the above functions without increase in the necessary number of yarn guides, my invention comprising means for the normal operation of the yarn-guides employed for split foot knitting as yarn-changing yarn-guides.

Referring now to Fig. 1 the machine selected for an illustrative instance comprises a rotary needle cylinder 260 driven by a gear 130 to which cylinder is attached a web-holder bed 295 on which a web-holder cam cap 300 is capable of rotation with respect to the web-holders 290. It will be understood, however, that my invention is not restricted to machines of this type, the devices for performing my new purposes being capable of application without change

in their essentials to knitting machines in which the needle cylinder is stationary and the needle cams movable. The bed-plate D on which said needle cylinder rotates carries a standard 401 upon which is pivoted at 552 a latch guard ring carrying a stud 554 upon which a series of yarn guide levers F are journaled to occupy under the influence of springs $F^8$ a normal operative lower position of rest at which their inner ends stand upon a throat plate 559 bridging a gap in the latch ring through which the yarns are given to the needles. The said devices, as shown in Fig. 1, are at the neighborhood of the plane central of a stitch-cam group, of which one instance is shown in Fig. 6, said cams usually comprising stitch cams 6 and 7, top center cam 8 and bottom center cam 9.

In addition to the above mentioned devices, I provide two or more yarn guides $F^2$, $F^3$, having lugs 5 on their under faces, to coöperate with the upper beveled ends of thrust bars 460 associated with said yarn guide levers, and arched undersides somewhat higher than the remaining guides F, to provide for lost motion between the upper ends of said bars and said yarn guide levers. Each of the thrust bars occupies a slot in a comb 451 attached to a stud 450 fast in the frame of the machine, the upper end of the bar being guided by a comb 462 attached to the standard 401. The said thrust bars 460 have lateral freedom away from the axis of the machine at the comb 462 as illustrated in Figs. 1, 2 and 3. The arrangement is such that a lateral movement away from the axis of the cylinder 260 at the upper ends of the thrust bars will elevate the yarn guide levers by movement against the cam lugs 5.

I may provide upon any member of the organized machine moving in relation to or in unison with the needles means for actuation of connections such as the thrust bars 460 leading to the yarn guides to cause the local movement of said connections in time with the passage of one or more points in the circle of needles, to change the yarn at said points. The ring 130 or its driving gear, for instance, moving in unison with the needles, may be employed for this purpose, but I prefer to employ the following mechanism.

The thrust bars 460 for the guides $F^2$, $F^3$ may be alike with the exception of the provision upon each of them of a lug as at *a*, *b* at respectively different distances from the bottom of the bars, which lugs when the bottoms of the bars are in a certain position are respectively in the planes of two segmental cams $296^a$ and $296^b$ occupying different planes on the periphery of the web-holder bed 295, to which the said cams are attached, as by screws. Said cams may be adjustable circumferentially by any usual means. I prefer to provide sections $296^c$, $296^d$ at their ends which may be moved or replaced by others of different length for effecting adjustment.

On a vertical stud 488 fast on the bed-plate of the machine and also in the planes of the cams $296^a$ and $296^b$ respectively I pivot two levers 601, 602 bearing, substantially in the plane of Fig. 1, lugs 603, 604, respectively. The respective ends of said levers contact with lugs *a* and *b* when said lugs are in their lower adjusted position. Light springs 606, 607 hold said levers against the face of the cams with which they coöperate. Lever 602 is too short to reach the plane of the thrust-bar 460, cooperating with the lever 601.

I prefer to provide each of the thrust bars 460 with a limit stop 448, which may be an eccentric disk, as also shown in my said application, to define with respect to the comb 451 a point upon which the bar may rock when permitted by the cams on the drum 120.

The remaining yarn guides F are provided with thrust bars which need have no adjustment to coact with the cams on the drum 120.

It will be apparent that each of the yarn guides $F^2$, $F^3$, may be elevated by lifting its thrust bar through a distance corresponding to the lost motion between said bar and its yarn guide, and then moving said bar through a further distance, to take its yarn guide to the idle position shown for guide $F^3$, Fig. 2, or to lower it to the operative position shown for guide $F^2$, the movement of the bar 460 to render the guide idle or operative thus taking the lugs *a* and *b* through a space wholly above the cams $296^a$, $296^b$ and levers 601, 602. Comparatively high cams 501, 502 may therefore be provided on the pattern drum for placing one or both the yarn guides $F^2$, $F^3$ in and out of operation by vertical movement of bars 460, without positioning the lugs *a* and *b* to move the bars 460 laterally to enter and remove the yarn guides $F^2$, $F^3$ at the passage of any particular part of the circle of needles. When a series of movements of the guides occurring repeatedly at the same part of the series of needles is to be made the bars 460 are permitted to drop to the position determined by the stops 448 to bring the said lugs in the path of the respective levers 601, 602, as shown in Fig. 1.

Referring now to Fig. 4, the cam $296^b$ may be associated with the long butt needles $n'$ corresponding to the instep and front of the leg of the stocking and the cam $296^a$ may be associated with the short butt needles $n^2$ corresponding to the back of the leg, the sole, the heel and the toe. It will be understood, however, that the segment during which the yarn guide is out of action may be any segment corresponding to the cam for moving the thrust bar for the guide laterally. It will also be evident that the said

cams 296[a] and 296[b] being attached to the needle cylinder and rotating therewith, and being in immediate connection with the yarn guides controlled thereby through the intervening parts of the thrust bar, that a direct and positive association with the needles and therefore of the time of entry and withdrawal of the yarn guide involved is provided for, which is little subject to accidental change.

By the device of the levers 601, 602 interposed between the moving cams and the lugs on the thrust bars, I am enabled to elevate that thrust bar bearing the lug for operation by the lower cam during the passage of the upper cam, under which, if the lugs are in direct contact with the cams on the face of the web-holder bed, the said lug would interlock.

By properly proportioning the cams, the gap between their ends represents the overlap during which both yarn guides are in a position to feed their yarn to the same needles and this gap may be regulated by governing the dimensions of the cams, with exactness. For the product desired to be made mere dependence upon the timing of the entrance and exit of the yarns involved is not sufficient to secure inevitably the entrance and exit of the respective yarns at the same needle when knitting at the high speeds otherwise permitted by the mechanism. In order to secure such accuracy, I may employ mechanism for differentially positioning certain of the needles, hereinafter referred to as suture needles $n^3$, upon which overlap of the yarn occurs, in such a manner as to bring these needles above the neighboring needles at the time they are given the yarn so that an entering yarn positioned in contact with or just above the neighboring needles will be first taken by the leading needle of the suture needles $n^3$ shown as three in number, but which may comprise any desired small number as two or four needles. These needles have shorter butts than the normal short butt needles, as shown in Fig. 1.

Referring now to Figs. 1 and 4 the top center cam 8 fast on the cam ring 271 is preferably cut away as shown at 10, so that the cut portion does not stand far enough inward to contact with the shortest butt needles $n^3$. All of the needles having been advanced by the upper surface 7[a] of the leading stitch cam 7, the needles $n^3$ are not depressed so far by the action of the top center cam 8 as the remaining needles and therefore stand at a higher level at the yarn feeding point which may be anywhere between the down-going face of the center cam 8 and the succeeding down-going face of the following stitch cam 6.

Referring now to Fig. 6 a similar result may be secured by forming top center cam 8 as a slide 8[b] having a cut away part 8[d] moving under impact of the needles on a gib taking into a way 8[c] in the back of the cam 8, (Fig. 14) the lower apex of said cam moving to the left to permit needles $n^3$ to pass the feeding point while at the higher level permitted by the cut 8[d], to which level they have been moved by the highest part of the leading stitch cam 7.

The yarn thrown out of work in the manner described passes above the internal yarn guide plate 602 and into the slot 617, in the same manner as the splicing yarn in the machine improved. The lower position of the yarns carried by the guides $F^2$, $F^3$ may be, as shown in Fig. 1, such as to carry the yarn nearly into contact but not into engagement with the needles preceding the suture needles. For continuous knitting a yarn presented in this position will be taken into the hooks of all of the needles, the preceding needle carrying the yarn down and around the circle into a position to permit all the needles following to take said yarn.

I prefer in some cases to position the yarn guides $F^2$, $F^3$ at their entrance and exits by means of lateral movement of their thrust-bars, in three positions, as shown in Fig. 11, of which the lower position 1 is such as to insure entrance of the yarn to the normally positioned needles; the second position 2 is such as to insure taking of the yarn by the advanced suture needles; and the third position 3 is an idle position above the needles. In this case, feeding both yarns to the suture needles occurs when the yarn guide going out of work dwells at position 2 on its movement from position 1 to position 3, and the other yarn-guide going into work dwells at position 2 on the way from position 3 to position 1. Means to give these movements by the cams 296[a] and 296[b] may comprise segments, Figs. 12 and 13, *d* and *e*, *f* and *g* having respectively opposite active slopes at the same circumferential position, separated by two intermediate portions of the same height, at which the levers 601, 602 are held in a position to hold both bars 460 outwardly far enough to position their guides $F^2$, $F^3$ at position 2, Fig. 11. The effect of this construction is to lower the entering yarn guide after the suture needles $n^3$ have taken the yarn to a normal low position, to prevent accidental failure of the normal needles following the suture needles to take a yarn entered at the suture needles.

When it is not desired to employ either component yarn of the split-foot structure for splicing, I may employ a third guide with a lug 5 and a thrust-bar with a lug similar to the lugs *a* or *b*, as in my said machine, to carry the splicing yarn. It is also within my invention to employ such a third guide, and to make a split tube structure above the heel of the stocking by the

use of said guide and one of the guides $F^2$, $F^3$, the back half of the split thus being of a different yarn from that employed for the sole, but I do not herein claim the combination of the yarn guides for split-foot knitting and the devices for sectional splicing claimed in my application Serial No. 859,894 filed September 2, 1914.

When changing yarns by the action of any of the yarn guides, the presence in the machine of the suture needles $n^3$ or a similar group at another point in the series and means for positioning them at the stitch cams provides a device for localizing the point of change at the wales from these needles, useful in connection with color changes in the fabric.

The suture needles $n^3$ when the split foot structure is being knit will be fed at each course with two yarns with respect to which the knitting of a normal size loop will ordinarily be impracticable, and I may therefore provide in connection with said needles web-holders 290 having butts differentiated from the remainder; said web-holder cam ring 300 may be provided with a special web-holder cam 312 for moving said web-holders with different butts inward at an early time with respect to the stitch-drawing movement at the following stitch cam as described and claimed in my application Serial No. 746,070 filed February 3, 1913. Such a differential movement of the web-holders is effective to alter the length of the loop. The cam 312 may be adjusted automatically by an attachment 471 of a thrust bar similar to the bars 460. When it is intended to splice a segment of fabric such as the back of the stocking, web-holders having high butts may be provided throughout the segment including the group of suture needles at each end thereof.

One of the guides $F^2$, $F^3$ may be employed to carry, by reason of its capacity to be operated like the other guides, the main knitting yarn, such for instance as that employed in the top of the foot in a split foot stocking, the arrangement permitting the orderly exchange of this yarn with the yarn carried by any one or more of the yarn guides F, by suitable conformations of the cams at the height of the cams 501, 502, and of the cams for the guides F. The said arrangement will also permit the use of one of said yarn guide levers for a yarn which may be one component of multiple yarns employed for the heel and toe; and other arrangements permitted by the structure will be obvious to those skilled in the art.

When employing one of the guides $F^2$, $F^3$ for sectional splicing I provide a cam to lower the yarn guide to be so inserted and withdrawn, the thrust bar being dropped far enough to bring its lug $a$ or $b$ into contact with one of the levers 601, 602 to remove the yarn, for instance during the passage of the high butt needles.

When the yarn guides $F^2$, $F^3$ are employed for split tube knitting, it will be understood that the product will be comprised of yarns knit as shown in Fig. 9, which figure shows the split portion in course of formation, the yarns $w$ and $x$ which overlap at opposite points at the needles $n^3$ floating idly across the cylinder between the sutures formed at said needles $n^3$. These floats are cut out when the product is finished.

Instead of employing thrust bars 460 with lugs $a$ and $b$ for the actuation of the exchanging guides $F^2$, $F^3$, I may employ the structure illustrated in Figs. 7 and 8. In this case a thrust bar $460^x$ and a stop 448 is provided for each guide as before, but said bars are without lugs $a$ and $b$. Associated with said thrust bars $460^x$, I provide short thrust bars $460^y$, sliding in the same slots in the comb 451, which are cut off at the top as shown in said figures. Bar $460^x$ is formed with a longitudinal slot $g$ in which plays a shouldered screw $p$ fast in the bar $460^y$. The bar $460^y$ is provided with a lug $a'$ and a similar arrangement for actuating the guide $F^3$ may also comprise another bar $460^y$ attached to a bar $460^x$, said other bar $460^y$ carrying a lug at a different height from the lug $a'$.

The guides $F^2$, and $F^3$ may now be entered and removed from work by the direct thrusting action of the bars $460^x$, under the influence of the cams $502^a$ on the pattern drum 120, independently of the actuation of the thrust bars $460^y$. Separate cams $501^a$ are provided for moving the bars $460^y$. When the split-tube structure is to be made, cams $501^a$ permit bars $460^y$ to bring their lugs in range of the means for moving the thrust-bars laterally, the cams $502^a$ permitting the bars $460^x$ to drop to their lower position at this time.

While I have shown my invention in connection with a circular knitting machine of the specified type, it will be obvious that it is independent of the construction of the knitting devices.

I am aware that it is not broadly new to make split-foot stockings by providing means for feeding during continuous rotary knitting a succession of separate yarns, each being given to one of two segments of needles of the circular knitting machine, and said yarns being overlapped in successive courses at a needle or needles taking both yarns, thereby joining the proximate edges of adjoining areas knit of each yarn and confining the joint or suture to the same needle wales, said yarns being removed from the needles to float within the circle of needles and being again entered at another part of the circle during each revolution of the machine at said sutures. Such a device

is for instance shown and described in the patent Byram & Fox No. 217,581 dated July 15, 1879, and I do not herein claim any and every means for accomplishing the above stated functions.

I claim—

1. A knitting machine having a plurality of yarn guides, and means operating during successive courses for rendering each of a pair of said yarn guides active and inactive in succession during the same course, in combination with means for causing one of said pair of yarn guides to be active and inactive during inactivity and activity respectively of a third yarn guide at intervals of a plurality of successive courses, for yarn changing.

2. A knitting machine having a plurality of yarn guides and means for rendering each of said yarn guides active in turn as desired during inactivity of others, for changing the yarn between sections of the fabric following one after the other, in combination with means coöperating with a pair of said yarn guides for rendering each of said pair active and inactive in turn during each course of a succession of courses for repeated yarn changes between sections of the fabric lying side by side.

3. The combination in a circular knitting machine of needles, a plurality of yarn guides, means for operating each of said yarn guides to render it active at a predetermined segment of said needles, each of said segments comprising one or more suture needles common to an adjacent segment, and means coöperating with said suture needles to cause entrance and exit of yarns taken by them at a predetermined needle during continuous relative rotation between said needles and yarn guides.

4. The combination in a circular knitting machine of needles, a plurality of yarn guides, means for rendering each of said yarn guides operative during continuous rotary knitting at a predetermined segment of said needles, each of said segments comprising one or more suture needles common to an adjacent segment and means coöperating with said suture needles to cause entrance and exit of yarns taken by them at a predetermined needle.

5. The combination in a circular knitting machine of needles, a plurality of yarn guides, and devices comprising means relatively fixed with respect to said needles for rendering each of said yarn guides operative at a predetermined segment of said needles, each of said segments comprising one or more suture needles common to an adjacent segment, and means coöperating with said suture needles to advance them beyond the other needles at the yarn-taking point.

6. In a yarn-changing device for knitting machines, a plurality of yarn guides, instruments movable independently positively to render each of said yarn guides inoperative, in combination with needles, means for moving said needles in a single wave to knit, and means having an element relatively fixed with respect to said needles for moving said instruments alternately to place their yarn guides out of operation with respect to the knitting wave at each course.

7. In a yarn-changing device for knitting machines, a plurality of yarn guides, instruments movable independently positively to render each of said yarn guides inoperative, in combination with needles and means having a cam element relatively fixed with respect to said needles for moving said instruments alternately to move their yarn guides out of operation in two stages and for permitting said yarn guides to return to operation at later times.

8. In a yarn-changing device for knitting machines, a plurality of yarn guides, an instrument movable independently to render each of said yarn guides inoperative, in combination with needles and means comprising cam devices relatively fixed with respect to said needles for moving said yarn guides alternately with respect to the needles into and out of operation in two positions, the intermediate stages of said incoming and outgoing movements being coincident, and operative positions with respect to some of said needles.

9. In a knitting machine for knitting split tubular fabrics, the combination of needles including suture needles, means for positioning said suture needles at their yarn-taking point differently from the remaining needles, and means for feeding yarn to and withdrawing yarn from the series of needles beginning and ending at said suture needles.

10. In a knitting machine for knitting split tubular fabrics, the combination of needles including suture needles, and means for positioning said suture needles above the other needles at their yarn-taking point, in combination with means for entering and withdrawing yarns at said suture needles in two stages, the intermediate stage being such as to cause a normally positioned needle to fail to take yarn.

11. In a knitting machine, yarn-changing, yarn-feeding devices, a needle carrier and independent needles in series having operating butts of three different lengths, in combination with means acting on the needle butts, for positioning one series of said needles at the yarn-feeding devices differently from the other two series, to enable selective entrance and exit of exchanged yarns, at said differently positioned needles.

12. The combination in a circular knitting machine of needles, a plurality of yarn guides, and devices comprising means relatively fixed with respect to said needles for

rendering each of said yarn guides operative at a predetermined segment of said needles, each of said segments comprising one or more suture needles common to an adjacent segment and means coöperating with said suture needles to position them differently from the other needles at the yarn-taking point.

13. In a knitting machine, a plurality of yarn guides, instruments having freedom of movement in two dimensions in contact with each of said yarn guides, means to move said instruments in one dimension to permit said guides to become operative and means to move said instruments in another dimension to alternately render one of said guides inoperative while another is operative.

14. In a knitting machine, a plurality of yarn guides, thrust bars, one in contact with each of said yarn guides, means to move said thrust bars in one dimension to permit said guides to become operative, and means to move said thrust bars in another dimension to alternately render one of said guides inoperative while another is operative, at each course.

15. In a knitting machine a series of needles, a plurality of yarn guides, bars having freedom of movement in two dimensions, in contact with each of said yarn guides, pattern devices to move each of said bars to permit said guides to become operative and cams relatively fixed with respect to said needles to move said instruments in a direction lateral of said first mentioned movement to alternately render one of said guides inoperative while another is operative.

16. In a knitting machine, yarn guides, instruments having freedom of movement in two dimensions in contact with each of said yarn guides, means to move said instruments in one direction to permit said guides to become operative, and means comprising cams relatively fixed with respect to said needles to move said instruments laterally of said direction to alternately render one or more of said guides inoperative while another is operative to exchange yarns at a predetermined needle or needles in successive courses.

17. In a knitting machine a series of needles, a series of movable yarn guides, and instruments in contact therewith for rendering said yarn guides operative or inoperative independently of each other, in combination with means for independently moving each of said instruments in one direction for the actuation of its yarn guide, and means comprising cams relatively fixed with respect to said needles for alternately moving each of said instruments laterally of said direction to determine actuation of its yarn guide with respect to a predetermined part of said series of needles.

18. In a knitting machine a plurality of yarn guides, each having a cam surface thereon, an instrument for each of said yarn guides, and means to move said instruments in the direction of their length to render their respective yarn guides inoperative, in combination with means for selectively moving each of the said instruments laterally against the said cam surface of its yarn guide at predetermined times to remove said guide from an operative position.

19. In a knitting machine, a plurality of yarn guides, each having a cam surface thereon, an instrument for each yarn guide, spaced from contact therewith when in one position, means active when said instruments are in said position only to cause each of said instruments to move into contact with the cam-surface of and to actuate its yarn guide, in combination with devices acting at predetermined times to move one or more of said instruments independently out of said position directly to contact with and actuate its yarn-guide.

20. In a circular knitting machine, a knitting head having a rotating part, a plurality of yarn guides each having a cam surface thereon, a thrust bar for each yarn guide, spaced from contact therewith when in one position, means having a part rotating with said rotating element and a part in contact with one of said thrust bars when said thrust bars are in said position only, to cause lateral movement of said thrust bar into contact with the cam surface of and to actuate its yarn guide, in combination with devices acting at predetermined times to move one or more of said thrust bars out of said position directly into contact with and to actuate its yarn guide.

21. In a circular knitting machine, needles, yarn guides, and means for rendering each of said yarn guides operative at a predetermined segment of said needles only, each of said segments comprising one or more suture needles common to an adjacent segment, in combination with means for locally elongating the stitches at said suture needles.

22. The combination in a circular knitting machine of needles, yarn guides, and means for rendering each of said yarn guides operative at a predetermined segment of said needles only during predetermined times, each of said segments comprising one or more suture needles common to an adjacent segment, in combination with means for locally elongating the stitch at said suture needles, at said times, and for knitting a normal length of stitch thereat at other times.

23. In a knitting machine, a plurality of yarn guides, thrust bars, one for contact with each of said yarn guides, means to move said thrust bars in one direction to permit

said guides to become operative, lugs on said bars at different points for each bar and means in contact with said lugs in one position of said bars independently to move said bars in another direction.

24. In a knitting machine, a plurality of yarn guides, a rotating needle carrier, thrust bars, one for contact with each of said yarn guides, means to move said thrust bars vertically to permit said guides to become operative, lugs on said bars at different heights, levers in different vertical planes, and a cam rotating with the needle carrier to move each lever against one of said lugs to move a thrust bar laterally.

25. In a knitting machine, the combination with needles having butts of different lengths, of means for feeding yarn, stitch cams, and a top center cam having a lower apex and a cut-away portion, with a mounting for said top center cam permitting said cam to move in one direction of relative travel of the needles with respect to the yarn feeding means.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses.

ROBERT W. SCOTT.

Witnesses:
MARY F. GRIFFIN,
MINOT G. CROZIER.