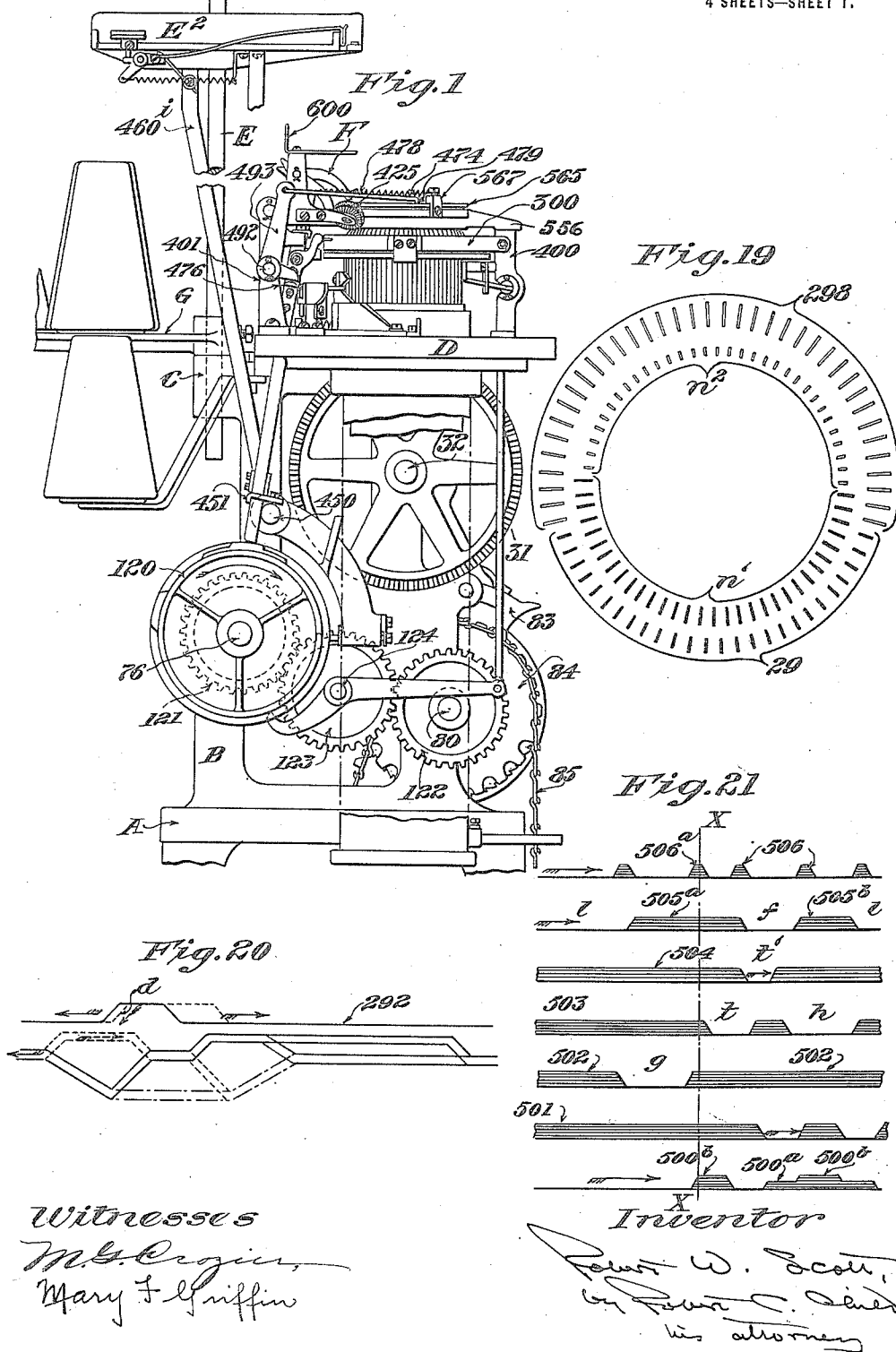


R. W. SCOTT.
YARN FEEDING MECHANISM FOR KNITTING MACHINES.
APPLICATION FILED JUNE 18, 1914.

1,238,052.

Patented Aug. 21, 1917.

4 SHEETS—SHEET 1.

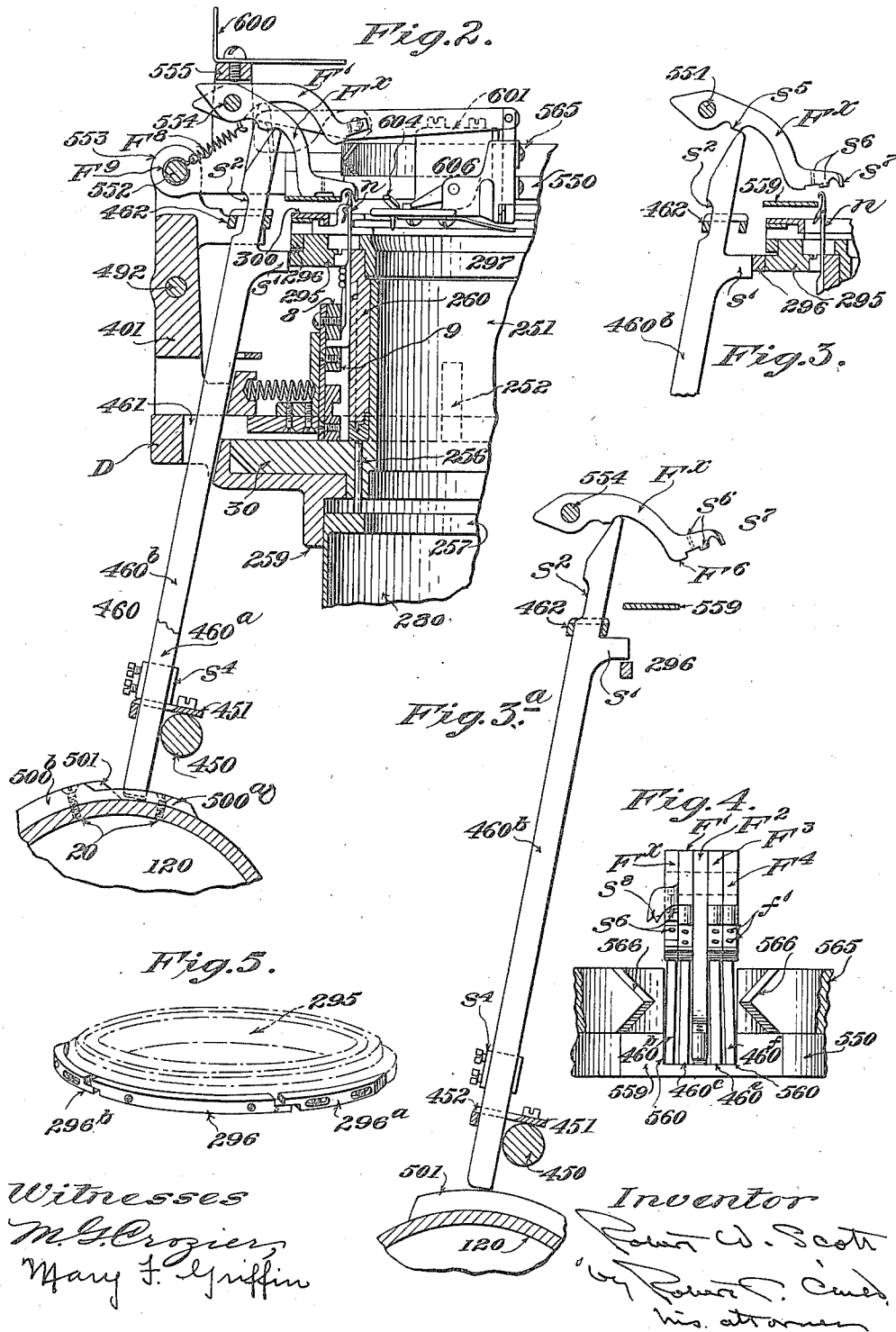


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Witnesses
M. G. Crozier
Mary F. Griffin

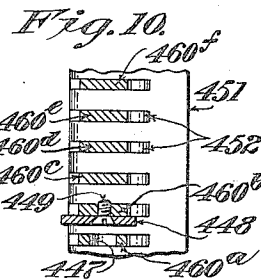
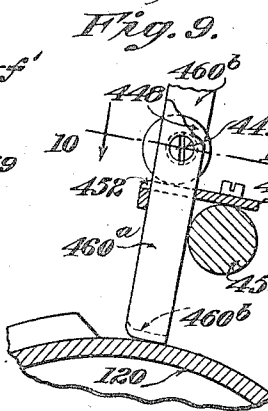
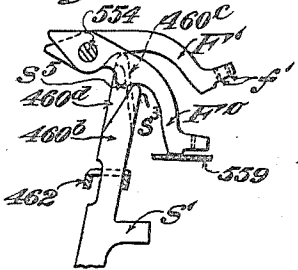
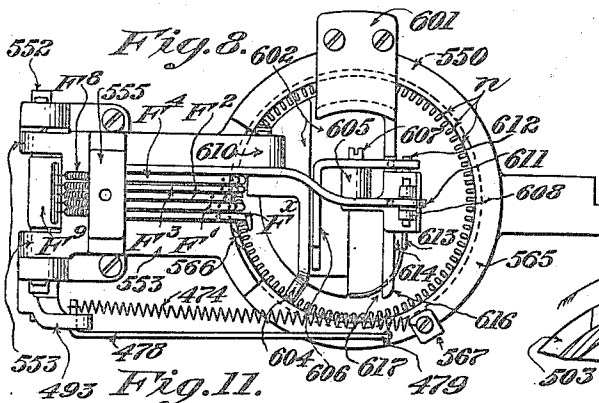
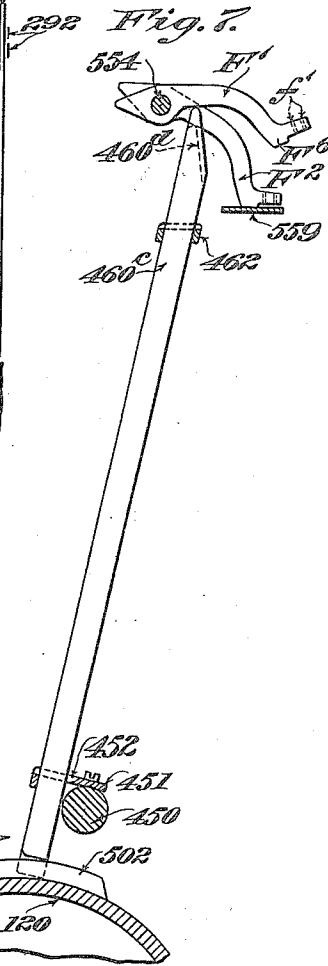
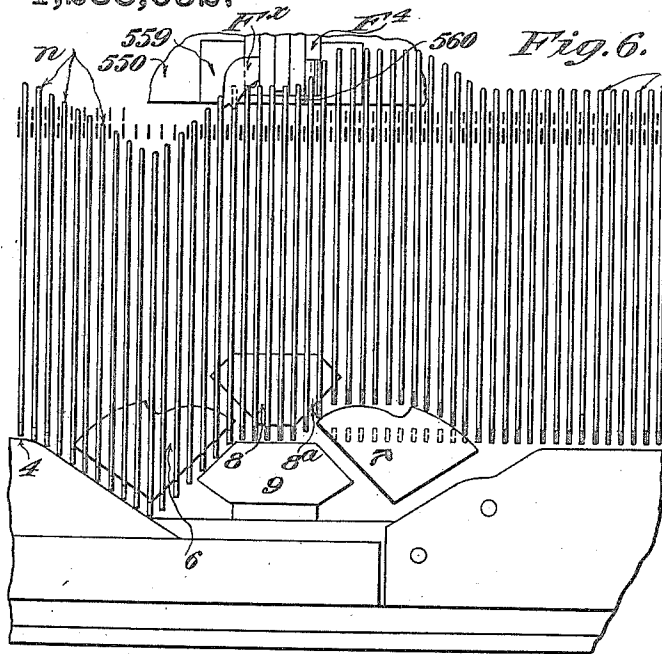
Inventor
Robert W. Scott
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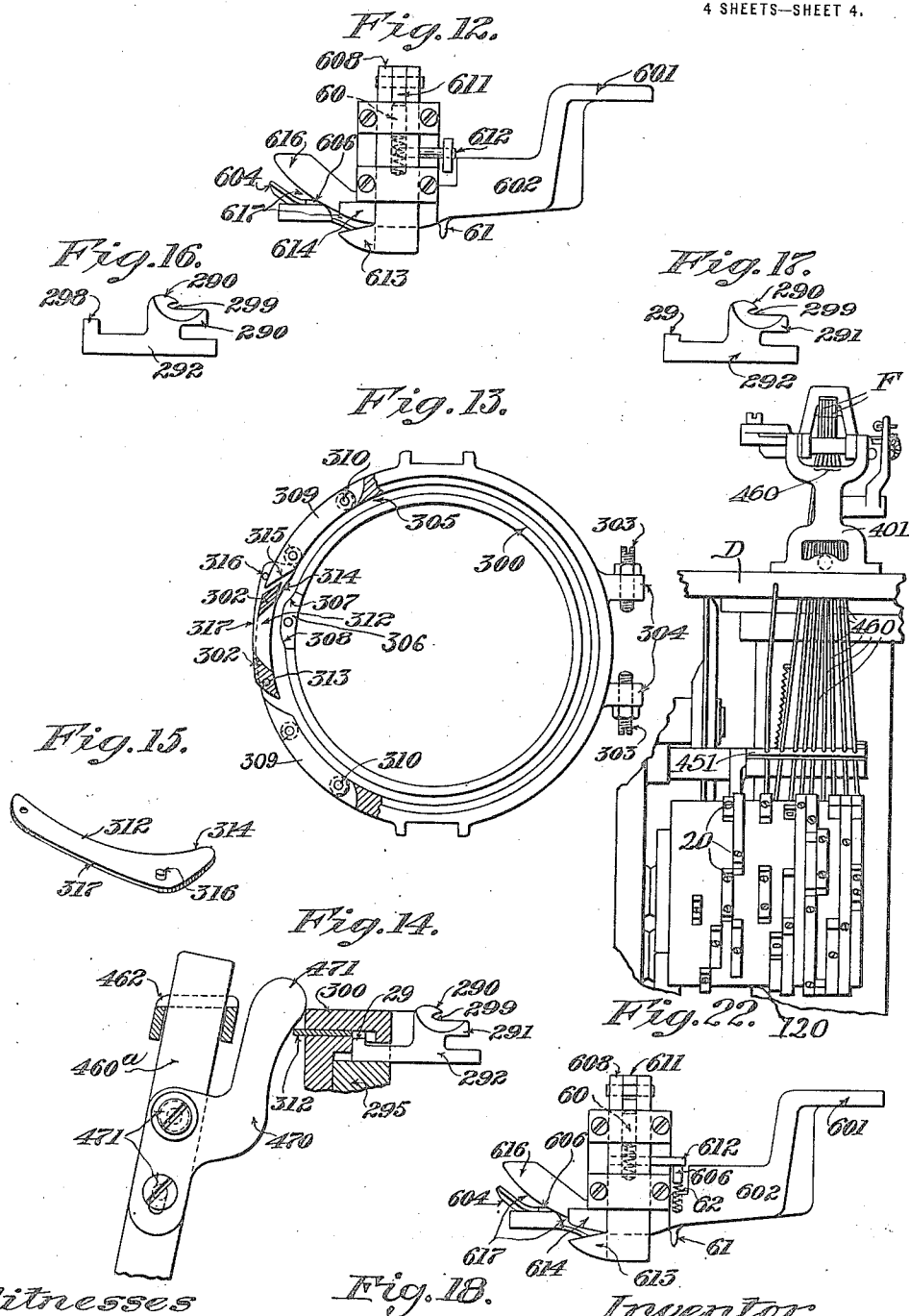


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4 SHEETS—SHEET 4.



Witnesses
M. S. Crozier
Mary F. Griffin

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his attorney

UNITED STATES PATENT OFFICE.

ROBERT W. SCOTT, OF BOSTON, MASSACHUSETTS, ASSIGNOR, BY MESNE ASSIGNMENTS,
TO SCOTT & WILLIAMS, INCORPORATED, A CORPORATION OF MASSACHUSETTS.

YARN-FEEDING MECHANISM FOR KNITTING-MACHINES.

1,238,052.

Specification of Letters Patent.

Patented Aug. 21, 1917.

Continuation in part of application Serial No. 746,070, filed February 3, 1913. This application filed June 18, 1914. Serial No. 845,844.

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 Mechanism for Knitting-Machines, of which the following is a specification.

My invention relates particularly to devices coöperating to feed yarns to the needles of knitting machines, and especially to devices for handling and feeding different yarns in a predetermined order, to a predetermined part or parts of the fabric, in a predetermined relation to each other, which shall be accurate and effective, and operate without damage to the fabric or the machine instruments.

My invention is illustrated in connection with a circular knitting machine intended to produce complete articles of hosiery, and especially articles of hosiery or stockings having a selvage or end-finish formed integrally, as at an end of the article, and having, if desired, heel and toe pockets, sectional reinforcements extending for the whole or a part way around the tubular product of the machine, and comprising connected parts formed of different kinds, colors or arrangements of yarn. Such a machine may correspond to the disclosure of my application Serial No. 746,070, filed February 3, 1913, (Letters Patent No. 1,152,850, September 7, 1915,) of which this application is a continuation in part.

In the accompanying drawings,

Figure 1 is a side elevation of a machine embodying my new devices;

Fig. 2 is a vertical section through the cam ring and needle cylinder of said machine;

Fig. 3 is a detail elevation similar to Fig. 2 showing a yarn guide employed for sectional splicing in one position.

Fig. 3^a is a view similar to Fig. 2 illustrating a yarn guide employed for splicing in an inoperative position;

Fig. 4 is a view from the axis of the machine illustrating the yarn throat;

Fig. 5 is a detail perspective illustrating cams forming a part of the splicing mechanism;

Fig. 6 is a partial development of the needle cam ring, illustrating the relative

positions of the stitch cams and the yarn feeding devices with respect to the position of the needles;

Fig. 7 is a section on a plane perpendicular to that of Fig. 6 illustrating the yarn changing yarn guides, their thrust bars and cam drum;

Fig. 8 is a plan taken above the latch guard ring and internal yarn guide, showing the yarn clamp and cutter, and other attachments of the latch ring;

Fig. 9 is a detail illustrating an adjustment for the splicing yarn guide;

Fig. 10 is a section on the line 10, 10 of Fig. 9;

Fig. 11 is a view similar to Fig. 2 illustrating a modified form of the splicing yarn guide;

Fig. 12 is a front elevation somewhat enlarged of the yarn clamp and cutter;

Fig. 13 is an under plan view of the web-holder cam ring;

Fig. 14 is an enlarged section through the web-holder bed and web-holder cam ring showing the special web-holder cam and part of the connection for adjusting it;

Fig. 15 is a perspective of the special web-holder cam;

Figs. 16 and 17 are detail elevations showing the two different kinds of web-holders;

Fig. 18 is a view similar to Fig. 12 showing a modification;

Fig. 19 is a diagram showing the normal relation of long and short butt needles;

Fig. 20 is a diagram illustrating the movement of the needles in relation to the movement of the web-holders;

Fig. 21 is a diagram development showing one arrangement of some of the cams on the pattern cam drum;

Fig. 22 is a fragmentary rear elevation showing the pattern surface and spaced thrust bars.

The machine in connection with which I have elected to show my new devices may be an automatic circular hosiery machine corresponding to that disclosed in my said application, comprising a bed-plate A, carrying a bed-plate D in which is formed an annular bearing surrounding a central opening in which a bevel gear 30 is held for rotation and against vertical movement.

Said bevel gear carries a longitudinally grooved needle cylinder 260, Fig. 2, having

independently movable needles therein, which may be laterally bent or tensioned latch needles. The heads of the projected knitting needles are surrounded by a latch guard ring shown generally at 550. Mounted upon said latch ring as shown generally at 425, I may provide a brush latch opener to cooperate with the knitting needles.

Two fixed diametrically opposite posts or standards 400, 401 are erected upon the bed-plate D. That standard 401 at the rear of the machine is substantially X-shaped to provide at its bottom the opening 461 and at its top two upstanding lugs bored to carry a horizontal stud 552 upon which and within said lugs are pivoted the rearwardly extending arms 553 of the said latch guard ring 550. This ring is an open drum shaped casting having between said arms 553 a wide parallel walled slot central on a plane radial to the needle cylinder to provide a space for the operation of the yarn levers F, which are journaled on a fixed stud 554 held in lugs bridged by the cap piece 555, all of which may be integral with said latch ring 550. At the front of the machine is provided a lug 556 having a positioning gib taking into a groove in the top of the post 400, upon which it is held in its operative position by a pin and spring latch.

The slot between the arms 553 is closed at the bottom by a channel shaped throat-plate 559 forming at the intersection of the inner face of the arms 553 with the inner surface of the latch ring the bottom of a rectangular throat 560, Figs. 4 and 6, from either corner of which the yarns may pass directly to needles traveling in the grooves between the top center cam 8 and the bottom center cam 9, or down the faces of either stitch cam 6 or stitch cam 7. My machine employs an unusually large number of yarn changing yarn guides of which for a mere example I have shown five, and it will be understood that the gap in the latch guard ring at the throat 560 will be sufficiently large to accommodate the desired number of said yarn guides.

In my Patent No. 1,191,740, July 18, 1916, I have shown and claimed a device comprising an incomplete annulus such as that shown herein at 565 having pointed beveled ends 566 and means to hold said annulus for rotation upon a bearing on the inner face of the latch guard ring to cause one of its ends to close the upper part of the gap formed at the yarn feed point. I employ this structure in my present machine but actuate it by different means, presently to be described.

The machine has the remaining adjuncts of a circular hosiery knitting machine of which the members immediately concerned will be treated more in detail below.

Motion is communicated to the shaft 32, the bevel gear 31, and gear 30 attached to

the knitting head in any suitable manner, such as that disclosed in my said application Serial Number 746,070.

The pattern mechanism.—The machine is provided with a main pattern or cam shaft 80 upon which is loosely mounted a sprocket wheel 84, which may be constantly advanced step by step during the operation of the machine. Said sprocket wheel carries in turn a mutable link pattern chain 85, certain links of which have lugs cooperating with a pawl controller 83 to determine periods of advance and of rest for said shaft 80, by means of a reciprocating pawl, and a rack wheel attached to said shaft. The means for advancing the pattern chain 85 and the shaft 80 may be either pawls carried by an attachment of a mechanism for oscillating or moving back-and-forth the shaft 32, the bevel gears 30 and 31 and the knitting head, as set out in my said application, or suitable means of the prior art.

The sector shaft 76, Fig. 1, extends through its bearing in the end frame B to provide a stud upon which a pattern drum 120 having an integral or attached gear 121 is mounted for rotation. The end of the pattern cam shaft 80 also extends beyond its bearing in the frame and is provided with a similar gear 122. Said gears 121 and 122 mesh with an idler gear 123 mounted on a stud 124, projecting from the end frame at an intermediate point. The motions of the shaft 80 are therefore transmitted without change in direction or extent to the pattern drum 120.

It should be noted that the position of the pattern drum 120 brings it to a point directly behind the cylindrical space defined by verticals from the knitting head and under the bed-plate D, at a point relatively close to the knitting head.

I am thus enabled to provide a comparatively large drum having thereon the desired large number of pattern indications for a relatively complex cycle of operations without taking up lateral or vertical space which can ill be spared.

The drum 120 carries pattern cams or other indications determining the timely operation of certain parts of the machine including the yarn feeding devices. The pattern chain 85 determines when any movement of the main pattern or cam shaft shall take place, said chain also determining by the dimension and extent of the indications carried thereby, the extent of the movement of said shaft 80 in an angular sense. Said shaft 80 is usually operated through one whole revolution during the making of one complete article or stocking and may also be provided with the devices such as those disclosed in my said parent application, or those of the prior art, for initiating changes in the speed of the machine, changes in the

motion from rotary to oscillatory at the knitting head, and other devices coordinated with the machine devices to perform particular operations at certain times during the progress of the article.

The operation of certain special web-holder devices, of the yarn changing and yarn-splicing devices, of the yarn take-up and tension devices and of the yarn cutter and clamp are preferably controlled by the said pattern drum 120.

Referring to Figs. 1, 2, 10 and 22, I provide on the end frame B of the machine a rigid stud 450 extending parallel with the overhanging shaft 76 and in front of the vertical plane of said shaft. A comb or slay 451 is attached to the stud 450, for the reception of a series of rigid flat thrust bars 460, which bars are beveled at their lower ends, and which rest by gravity against the face of the cam drum 120, are spaced apart by the slots in the comb 451, and are prevented from moving forward with the drum by the stud 450.

Said thrust bars 460 extend upward through the opening 461 provided through the shelf or bed D and the standard 401 at the rear of the machine, to a comb 462 mounted on lugs on the standard 401 at the rear of the knitting head. The comb 462 is provided with slots which may be closer together than the comb 451, the dimensions being such as to bring the upper rounded ends of the thrust bars 460 nearly into lateral contact at a point somewhat above the level of the upper edge of the latch guard ring 550. Being flat, the bars 460 are severally adapted to be moved into the space occupied by a yarn-guide to move it without encountering any other of the yarn-guides. The bars 460 may be reduced in thickness at their upper ends to permit them to be brought more closely together. The said combs 451 and 462 together form ways for directing the sliding movement of said bars 460.

Said thrust bars 460^a to 460^b cooperate with cams 500^a, 501, etc., fastened by screws 20 on the surface of the cam drum 120, at positions to cooperate with the spaced lower ends of the bars 460.

The bar 460^a cooperates with the ring of cams 500^a, 500^b to control the devices for closing the gap in the latch ring and for operating the supplemental web-holder cam 312.

Referring now to Figs. 1 and 8 a bell crank lever 493 is mounted on a horizontal stud 492 on the standard 401. Said bar 460^a has screwed on its outer face for vertical adjustment a lug 476 under the horizontal arm of said bell crank lever 493. The vertical arm of said bell crank lever ends above the horizontal plane of the top of the gap-closer ring 565 and is connected with said

ring by a wire link 478 passing through a hole in said lever, and downwardly bent at 479 to enter a hole in said ring. A tension spring 474 is connected to the link 478 on the other side of the lever 493 at one end, and at the other end to a hold down clamp 567 attached to the latch ring 559.

The bell crank lever 493 is thus permitted to swing on the stud 492 when the latch ring is lifted about its pivot 552 without disturbing the open position of gap-closer ring 565 caused by spring 474, but when the latch ring is in its operative position the elevating movement of the bar 460^a is translated into rotation of the ring 465 on the latch ring 550. The extent of this rotation may be adjusted by moving the lug 476.

The bar 460^a may be cut off above the comb 462.

The next bar 460^b is employed for actuating the splicing yarn guide, which will be described below.

The next four bars 460^c, 460^d, 460^e, 460^f, Fig. 10 are employed to operate four yarn changing yarn guides F¹, F², F³, F⁴, pivoted on the latch ring, and presently to be described. Bar 460^e is employed in connection with a yarn cutter 608 and clamp 606 cooperating with the yarn guides, and presently to be described.

Bar 460^f, although guided in the comb 451, is spaced apart from the other bars and extends upward outside of the shelf or table D to the overhead yarn take-up and tension devices E² presently to be described.

As shown and described in my said application (Letters Patent No. 1,152,850) the length of the stitch may be changed at all of the needles by moving cylinder 260 vertically to adjust the knocking-over plane determined by the web-holders 292.

For sharply changing the length of stitch between two or more adjacent segments of the tube of fabric, devices well adapted to cooperate with means to be described below for feeding an additional yarn to the same segment of needles, or in a predetermined relation to the said segment of needles are disclosed in my said parent application and claimed in my Letters Patent No. 1,189,220 granted June 27, 1916, on a divisional application. Said devices include means to change the relation of those needles desired to knit the lengthened wales to their cooperating abutments or knocking-over instruments at the time when the needles are acting to draw their stitches, and devices to adjust said means at the beginning and end only of the part of the tube containing the slackened area, said devices acting on a special part provided throughout one or more segments (which part may be an operating butt of a different length) on one member of each pair of instruments working together to draw the stitch, thus to de-

termine a relation of said instruments to each other in one segment sharply and adjustably different from the relation to each other of instruments of the adjoining segment. One construction for this purpose comprises a segment of web-holders having operating butts longer than the others.

Referring now to Figs. 2, 13, 14, 16, 17 and 19 in order to cooperate with the splicing devices, those web-holders having normal butts as shown at 29, Fig. 17, are distributed in that part of the tube which it is not desired to splice; the remaining web-holders having high butts 298 extend throughout the remainder of the circle, and as shown in Fig. 19 this part of the circle may coincide with that part of the needle cylinder employed for knitting the heel and toe. The extent of the segment of the tube which may be spliced and in which the loops are to be uniformly elongated whenever a splicing yarn is fed at this segment is, however, independent of the needle butts and changeable at will and to illustrate this I have shown in Fig. 19 a segment of high butt web-holders 298 placed to overlap the long butt needles by three at one side and two at the other side.

The construction and operation of the stitch-slackening devices is fully described and shown in my said Patent No. 1,189,220 which may be consulted therefor.

Bar 460^a, Figs. 1 and 14, extends upwardly close to the necessary position of the stitch-slackening cam 312, said bar 460^a bearing for adjustment by means of screws 471 a cam arm 470 which extends to a point near the periphery of the web-holder cam ring 300, and in such a position that a short lifting movement of the thrust bar 460^a will bring the cam portion 471 of the cam arm 470 in contact with the face 317 of the cam 312, to hold said cam in a predetermined and adjustable inward position to determine the extent of slack in the loops drawn at the stitch point by the variation of the time of entry of the web-holders to their inward position. The cam drum 120 is provided with a cam having a surface 500^a to elevate said bar at the desired times to the extent necessary.

It will be seen that the fabric may be locally slackened throughout the segment occupied by the web-holders 298 at any time in the operation, by the provision of a cam 500^a on the surface of the drum 120 for operation at this time. In fabrics, for instance in which it is or is not desired to employ a sectional or segmentally spliced area, I may actuate the long butt web-holders when changing yarns to slacken the fabric in the course, or in the courses preceding and following courses occupied by overlapped yarns at the point of exchange.

The mechanism for changing, cutting

and clamping the yarn.—As above referred to, the independently movable yarn guides F are mounted in a closely adjacent series to swing on the stud 554 in the integral yoke above the slotted latch ring 550, and the present machine is provided with five such yarn guides F. Referring now to Figs. 1, 7 and 8 said yarn guides are metal bars, preferably of hardened steel, and are curved in form as shown in said figures, so that when in a lower position, which is the position in which they are operative to feed yarn to the needles, their feet F⁶ will rest upon the throat-plate 559, which forms the closure at the bottom of the slot between the arms 553 of the latch ring. In this position the heads of the yarn guides are just outside of the periphery of the needles, and yarns carried in bores F⁷ in the noses of the yarn guides may reeve from the corners of the throat 560, to be taken by such needles as are traveling in the groove between the cams 8 and 9. One or more of the yarn guides, F⁴ and F⁵ for instance, may be provided with two yarns so that when either yarn guide is in its operative position plated fabric will be formed by knitting one of said yarns persistently toward the face of the fabric, both yarns being taken by the needle hooks, or I may provide yarns in an inward hole of one guide and outward hole of another, so that plating may be done when both are in operative position, that guide carrying the plating yarn or the body yarn being removable or exchangeable with another carrying a different yarn.

Each of said yarn guides F is provided at a point on the underside of the enlarged portion pivoted on the stud 554 with a spur for the engagement of a spiral spring F⁸, hooked at the other end into a hole in a flange of the plate F⁹ encircling the latch ring pivot 552. The yarn guides are inoperative when rotated on stud 554 to carry their inner ends above and within the heads of the needles.

Under the influence of said spring F⁸ said yarn guides tend to assume their operative position except as they are prevented by the upper rounded noses of the respective thrust bars 460, which engage directly with the arched undersides of said bars F. The yarn guides are therefore each put into and out of operation by simple thrusting movements of a thrust bar against the pull of a spring F⁸. It is obvious that as many of the yarn guides may remain in action, and they may be removed from action and put back into action, in such order and at such times as may be desired, all as determined by the cams 501, 502, 503, 504 and 505 upon cam drum 120, Fig. 21.

The operative engagement of said bars 460 with the yarn guides which they move is an engagement of contact only. The

parts necessarily carried by the latch ring, that is to say the individual yarn guide levers may be freely lifted with the latch guard ring when said ring is swung upward on stud 552 and returned to adjusted position without breaking any positive connections as will be plainly apparent from inspection of Fig. 2.

It will also be apparent that the actuation of all the parts carried by the latch ring has, by the device of the thrust bars 460, been concentrated at the neighborhood of the standard 401 upon which the latch ring is hinged, and that this position of the parts insures a minimum effect upon the adjustments due to wear and the necessary slight variation in the operative position of the latch ring with respect to its fastening means at standard 400, as well as providing the shortest possible distance between the operative yarn levers and the pattern cam for their actuation. The thrust bars 460 may be manufactured to rigidly standardized dimensions, and the assembly of the parts by the described construction is much facilitated. The device of the bars 460 also enables the operator of the machine merely to remove the bar 460 of a yarn guide desired not to operate, with the utmost convenience.

It has heretofore been regarded as impracticable to provide a hosiery knitting machine with splicing yarn devices and as many as four additional yarn feeding yarn guides, but I find that the improved devices above described for actuating the yarn guides enable the additional number to be included without unduly widening the space occupied by the yarn guide mechanism with respect to the cam and needle cylinders or increasing to an excessive extent the length of the pattern surface. Said four yarn guides may be employed for color changes, or for changes in the weight or texture of the yarn, as for instance to knit a stocking having a silk "boot" extending half way up the leg, and a cotton top, and several courses of cotton preceding the toe seam. One use of the fourth yarn guide is to exchange the light yarn in a thin stocking during circular knitting and before the narrowing and widening operation for the toe for a heavy yarn corresponding to that customarily used at the toe. This change may be accompanied by a change in the length of all of the loops by an upward movement of the column 280. The resulting stocking presents fabric of like texture on the two sides of the closure of the toe seam, to the reduction of the expense and difficulty of accurate looping. The idle and operative positions of each of the yarn guides with respect to the times of operation of each other and of the automatic operation of all the other parts of the machine

will be determined by the relative position of the cams for controlling that yarn guide. Said cams are fastened at the surface of the drum 120 at the requisite position in any suitable manner, as by the screws 20, and I have illustrated in diagram and in profile, for clearness, in Fig. 21, one typical arrangement of such cams. Assuming a woman's stocking as the desired product, and the line of thrust bars to rest at the line $x-x$, all of the yarn guides then being in an elevated position, movement of the drum will first result in causing the gap g in cam 502 to pass under one thrust bar, 460° for instance, to permit yarn guide F' to become operative. This yarn guide may carry a yarn suitable for the top of the leg. A subsequent movement of the drum will cause the bar 460° to ride up on cam 502, elevating the guide F' , immediately after bringing the gap l in cam 505 in line with thrust bar 460°, controlling yarn guide F^4 , to cause the yarn or yarns of guide F^4 to go into work. This yarn may, for instance, be a silk yarn, and the end of this part of cam 505 and the beginning of cam 502 may be timed to reach their respective thrust bars at any desired point below the top of the stocking. Yarn guide F^4 may be threaded with two yarns, one in each yarn hole f' , both of which will be fed to the needles, in a relation to cause plating. When one yarn is exchanged for another the guide for the incoming yarn will be rendered operative before the outgoing yarn is removed, as usual in the art, and by means presently to be described the free end of the outgoing yarn may be clamped and cut immediately after its removal.

As illustrated in Fig. 21, the yarn of guide F^4 may be kept in work until the heel is to be made, when the gap h in cam 503 permits a heavier yarn carried in yarn guide F^2 to be substituted for it during the reciprocatory movement yarn guide F^4 being removed by cam 505^b. At the end of the heel, gap f at the end of cam 505^a permits the leg yarn to go in work for the foot, before the completion of which gap t' in cam 504 permits a heavier yarn carried by guide F^3 to be additionally fed, to reinforce the tubular foot in the neighborhood of the toe. Or the yarn guide F^4 may be withdrawn at this time, by suitably replacing cam 505^a. When the toe is reached, yarn guide F^2 is substituted for both guides F^3 and F^4 , in the instance shown, and after completion of the toe, the drum having completed one revolution, yarn guide F^2 is elevated without depressing any of the others.

Sectional splicing.—One yarn guide F , which may be any one, such as that one at the left of the series, F^x , is utilized to knit the sectional splicing of the stocking, as for a high-splice at the back of the heel, or a

reinforcement at the sole of the stocking. This yarn guide F^* is shown as associated with the second thrust bar 460^b , which bar is unlike its fellows in the provision upon it of a lug s' upon the face of the bar at a point beneath the comb 462, and normally above the plane of the web-holder dial 295. Said bar 460^b is also provided with a rounded nose s^3 , preferably in a plane farther removed from the pivot 554 for the yarn guides than are the rounded upper ends of the remaining thrust bars; and with a recess s^2 , which when said bar 460^b is lowered is opposite the rear member of the comb 462. Movement of the bar 460^b toward the rear of the machine through a small arc is thus permitted when said bar is in its lowermost position, which is that illustrated in Figs. 2 and 3.

Upon said bar 460^b , at a point near the comb 451, I provide an adjustable stop lug s^4 in a position to encounter the upper face of said comb 451 when said bar 460^b is not elevated. This structure provides at the comb 451 a pivot point upon which the bar 460^b may swing through the limited arc allowed by the recess s^2 , whenever the cams 501 on the drum 120 permit said bar to drop to its lower position.

In Figs. 9 and 10 I have illustrated a modification of the adjustment device comprising a round disk 448 fastened on the face of bar 460^b by a screw 449, in an eccentric hole in the disk, access to the screw being provided by a hole 447 in bar 460^a . A delicate adjustment of the lower position of the bar 460^b can be made by releasing the screw 449, turning the disk 448 by hand, and resetting the screw.

Coöperating with the nose s^3 of said bar I provide upon the yarn guide F^* a cam lug s^5 .

On the flange of the web-holder dial 295 (see Figs. 3 and 5) and thus rotating with the needle-cylinder and needles and maintaining a constant angular relation to the web-holders, I provide an attached cam 296 having adjustable end faces 296^a and 296^b . As will be seen by reference to Figs. 2 and 3, when the bar 460^b has been permitted to drop, its lug s' will be in the path swept by the cam 296. The end faces 296^a , 296^b may be adjusted or replaced by others to vary the peripheral segment desired to be sectionally spliced. This segment may be more or less than a diametrical half of the tube.

The operation of the splicing yarn guide F^* will be apparent. Upon the passage from under the bottom end of the bar 460^b of one of the cams 501, the yarn guide F^* which before has been held in an elevated idle position by the upward thrust of the said bar, will be permitted to drop until its feet rest upon the plate 559, thus placing its yarn in action at the needles; but upon the passage

of the cam 296, the bar 460^b will be rocked upon the stop s^4 , now resting upon the lower comb 451, as a center, permitting the nose s^3 in coöperation with the lug s^5 to throw the splicing yarn guide sharply to its idle position at a predetermined needle, and upon the end of the cam 296 running off the lug s' , the spring F^s will restore the splicing yarn guide to operation at another predetermined needle.

The cam 296 is a direct attachment of the web-holder bed, so that its length may correspond to the series of long butt web-holders 298 in order to enable the spliced loops, and only these loops, to be locally elongated by the above described devices coöperating with said long butt web-holders. I am thus enabled to associate the local variation in the length of stitch with the area spliced, with the most rigid accuracy.

In one form of my devices as shown in Figs. 2, 4 and 6 the yarn feeding end of the splicing-yarn guide F^* is different from its fellows in that it is provided with a laterally offset overhanging projection s^7 to straddle the line of the needles, having a downward opening V-shaped notch s^8 on the underside of its extreme point. The purpose of this device is to coöperate with the end of the splicing yarn held in an internal guide presently to be mentioned, to present a short guided run of yarn extending from the bore s^6 to said notch, the notch taking over the run of splicing-yarn between the internal fixed guide 604, Figs. 2 and 8, and the needles whenever the splicing yarn-guide F^* is lowered.

The withdrawn and floated end of the splicing-yarn passing by the rotation of the needles under the guide 604, Figs. 2 and 8, may otherwise be presented at an unfavorable angle for entrance between pairs of the needles when the splicing yarn-guide is dropped, and one valuable function of the notch s^8 is to position a yarn which has been moved out of correct position by the travel of the needles backward to a more favorable angle for entrance between the needles, the yarn when encountered by the notch s^8 being moved to the position with respect to the yarn guide defined by the apex of the notch and the bore in the guide.

The said form of yarn lever or guide is especially useful when the splicing yarn is very smooth and very pliable, or when the conditions of the use of the machine tend to slackened yarns.

For usual yarns, under ordinary conditions of use, accurate entrance and exist of the splicing yarn at the desired pairs of needles may be secured by use of a yarn guide F^0 , as shown in Fig. 11, which may be like the other yarn guides except that it is provided with a lug s^5 .

It will be noticed that I have shown in

Fig. 21 cams 501 having gaps to introduce the splicing yarn through the segment measured by the high butt web-holders and the cam 296 at such times as to high splice the rear of the knit tube from a point above the heel, and the sole from the end of the heel to a point corresponding to the introduction of the yarn of guide F^3 to reinforce the entire tube of fabric near the toe. But it will be apparent that my devices are readily changeable by moving cams 501, or substituting others for them, to place the splicing at any desired point.

The yarn clamp and cutter.—Coöperating with the yarn-feeding devices above described I employ an internal yarn guide, clamp and cutter, which except in detail may be substantially the same as that shown, described and claimed in the application of Harry Swinglehurst, filed October 5, 1911, Serial No. 653,001, and therefore forms no part of my present invention except in so far as I provide different means to actuate said device and to coöperate with the device for sectional splicing.

Said device comprises briefly in overhanging arm 601 Figs. 8 and 12 attached to the latch guard ring, and thence extending inwardly and downwardly to join a base plate 602, the edges and bottom respectively of which provide guide surfaces for the fabric and for floating yarns connecting angularly spaced wales of said fabric.

The upper side of the said plate 602 is provided with a fixed guide upwardly curved at 604 to receive and guide between it and the face of plate 602 a yarn thrown out of work by the elevation of its yarn guide.

A yarn clamp lever 606 is pivoted at 607 on an upstanding central lug 605 on the upper face of the plate 602. One end of said lever is perforated to take over a pin 612 on a vertically movable slide 608 carrying at its lower end a movable shear blade 613, which blade is rounded at the bottom and sharpened on its top edge and projects toward the left of Fig. 12. Slide 608 is pressed upwardly by a spring plunger 60 in a bore in the body of the lug 605, which lug also presents a vertical channel to guide slide 608.

Fig. 18 shows an alternative construction in which the clamp lever 606 takes under pin 612, against the underside of which it is pressed by spring 62 housed in a bore in plate 602, in order to avoid limiting the closing movement of the cutter by the extent of movement permitted for the clamp, closure of which is effected by spring 62 whenever the cutter closes.

Said lug 605 is also provided with an integral guiding extension 616, which stands above the plane of the plate 602, and slightly inward of the vertical plane of the shear blade 613. Near the juncture of said extension with the body of the lug 605 and at one

side of and above a downward bend or depression of the under surface of plate 602 a fixed or ledger blade 614 is provided to coöperate with the movable blade 613. That part of the plate 602 nearest the shear cutter and the extension 616 form an opening 617 leading to the open shear blades 613, 614, in one position of said shears, and leading beneath the lower rounded edge of the blade 614 when said blade is in its upper closed position. A smoothed lug 61 may be provided on the under face of plate 602 to aid in guiding the forming fabric under plate 602.

The float yarns from the splicing yarn guide F^x do not enter the cutter 613, 614, which is not actuated upon each movement of the splicing yarn guide, but with its associated clamp 606, is permitted to remain closed during actuation of said guide F^x . When the guide F^x is elevated and passes inwardly over the needles, its yarn extends from the last needle which took it, by reason of the rotation of the machine, under the fixed guide 604, and above the plate 602. The end of the closed clamp lever 606 is squared off to provide a stop for said yarn, which upon further rotation is taken under the extension 616 of the lug 605, and through the opening 617 leading to the under face of the plate 602, passing under the closed shear blade 613. The yarn at the time of its next insertion thus extends from the back of the fabric at the front of the machine, under the shears and the extension 616, through the opening 617, and under the guide 604 at a point opposite the end of lever 606, in line with the laterally offset position of the notch s^3 , which takes over it just before said guide F^x reaches the needles on its downward stroke.

Pivoted on an upstanding lug 610 formed on one of the arms 553 of the latch ring 550 an operating lever 611, loosely pivoted to said slide 608 at one end and extending at the other end over the rounded upper nose of the thrust bar 460^s is provided.

Said thrust bar coöperates with the cams 506 on the drum 120, at its lower end (Fig. 21.) It will be noticed that a cam 506 is provided to lift the thrust bar 406^s and therefore to open the shear cutter and open the yarn clamp, at each change of the position of any of the yarn guides F^1 , F^2 , F^3 , F^4 , and that I may provide one cam 506^s to actuate the cutter after the completion of the toe and after the yarn guide F^2 , supplying the yarn to knit the toe, has been thrown out of action by the cam 503 to press off and eject the stocking by the operation of the knitting needles after removing the yarn from them. Such movement of the yarn guide F^2 and of the cutter 613, 614 may be the last step in the cycle of operations resulting in a complete stocking.

The yarn supporting guide and yarn take-

up.—Mounted in the integral boss *c* of the machine frame, a stout standard E carries an overhead guide for the yarn of any usual form, which may be provided with tension and yarn-oiling devices of any suitable construction. Said standard also supports an actuated yarn take-up or tension device E², not herein claimed, for control of the yarn or yarns employed for knitting when the machine is reciprocating. Control of this device is related to the time of the movement of the yarn-feeding devices by causing its actuation through thrust-bar 460¹ and cams on said drum 120. Yarns from the yarn guiding top and from the take-up and tension device E² are led to the yarn guide levers F through holes in a plate 600 screwed on the part 555 of the latch guard ring.

The operation of my yarn feeding device as a whole will now be apparent, and it will be obvious that my device provides means for readily exchanging the yarn or yarns for others at predetermined times, for splicing all, or a segment only, of the fabric, and for holding and guiding in an efficient manner the yarns in and out of work, as well as for cutting off and holding the cut end of a retired yarn or yarns. It will also be apparent that the times of actuation of the parts for these purposes are, by means of the drum 120, associated with accuracy with the times of action of the remaining automatic agencies of said machine, whether the indications determining the times of action of said agencies are carried upon said drum, or upon the parts related to the pattern shaft 80.

It will be apparent that the yarn-feeding and severing mechanism herein disclosed is suitable for coöperation with knitting devices of many different types, as well as for an element of the combination disclosed in my said parent application, and disclosed and claimed in my continuing application Serial Number 766,401, filed May 8, 1913, (Letters Patent No. 1,148,055, July 27, 1915,) wherein said feeding and severing devices are coördinated and combined with knitting devices for knitting a succession of articles, to enable said feeding devices to withdraw all of the knitting yarns and sever the last-used yarn or yarns, if desired, at the end of each article knit, and to introduce the same or another yarn for the beginning of another article, which combination I do not herein claim.

What I claim is:—

1. A knitting machine having in combination needles, a series of independently movable yarn guides, means to operatively position said guides to feed yarn to said needles at one end of their range of movement, a series of longitudinally movable thrust bars each for direct contact with one of said yarn guides, a pattern surface, and cams on said

surface to move each of said bars at predetermined times into contact with and to move its yarn guide to an inoperative position in opposition to said means.

2. A knitting machine having in combination a series of closely adjacent yarn guides, a cam-surface having thereon pattern cams spaced to a greater extent than said yarn guides, and a series of movable bars contacting with said yarn guides and said pattern cams whereby each of said pattern cams at predetermined times causes its yarn guide to move to an inoperative position.

3. A knitting machine having in combination a series of devices including closely adjacent yarn guides for changing the character of the knitting, a cam-surface having thereon pattern cams spaced to a greater extent than said yarn guides, and a series of movable bars contacting with said yarn guides and said pattern cams whereby each of said pattern cams at predetermined times causes one of said devices to move to a different position.

4. A knitting machine having a needle-carrier and needles, a series of closely adjacent independently movable yarn-feed guides, a series of flat detached thrust-bars, one for each of said yarn-guides, ways supporting said thrust-bars for free movement in the direction of their length, and a pattern-surface adapted directly to act upon and move the bars severally in their ways and thereby severally to move their respective yarn-guides.

5. In a knitting machine a pivoted latch ring, a yarn severing mechanism carried by said latch ring, an actuating lever for said yarn severing mechanism, yarn guide levers working in a gap in said latch ring, means to close said gap, an actuating lever for said gap closing means, means to support each of said levers in a position transverse to a plane parallel to and near the latch ring pivot, a pattern surface, and a series of like connections for operation by said surface terminating in said plane to actuate said levers, whereby the latch ring and its attachments may be swung about its pivot and returned to contact with said connections without disturbing the adjusted position of the parts.

6. In a yarn feeding mechanism for knitting machines, the combination with a movable yarn-guide of a sliding thrust-bar for moving it mounted in ways spaced apart, and means for operating another movable part mounted on said bar between said ways.

7. In a yarn feeding device for knitting machines, the combination with a pivoted yarn guide upwardly curved between its pivot and its yarn feeding end, of actuating means comprising a thrust-bar held to

move against the concave side of said guide in a plane passing between said pivot and said yarn feeding end.

8. In a knitting machine, a yarn guide, an instrument having freedom of movement in two dimensions in contact with said yarn guide, means to move said instrument in one direction at predetermined times to permit said guide to become operative, and means for moving said instrument in another direction to render said yarn guide alternately operative and inoperative.

9. In a knitting machine, a yarn guide, a thrust bar, and a pattern cam for moving the thrust bar to shift the yarn guide at predetermined times to an operative or to an inoperative position, in combination with means independent of the pattern cam cooperating with the thrust bar to cause the yarn guide to become operative and inoperative at short intervals.

10. In a knitting machine, a rotary needle cylinder and needles therein, a yarn guide, a longitudinally movable instrument and a pattern cam for moving said instrument longitudinally against the yarn guide at predetermined times to shift said yarn guide to an operative or to an inoperative position, in combination with a cam rotating in time with said needle cylinder to contact with said instrument and move it laterally to cause the yarn guide to become operative and inoperative during one revolution of said cylinder.

11. In a knitting machine, a pivoted yarn guide, a cam surface on said yarn guide, an instrument having freedom of movement in two dimensions in contact with said yarn guide, means to bodily move said instrument at predetermined times to permit said guide to become operative and means to rock said instrument through an arc to cooperate with said cam surface to render said guide operative or inoperative.

12. In a knitting machine, a pivoted yarn guide, a cam surface on said yarn guide, a bar having freedom of movement in two dimensions directly in contact at one end with said yarn guide, means to bodily move said bar at predetermined times to permit said guide to become operative, a rotating cam, and a lug on said bar in the path of said cam when said bar is in one longitudinal position, to rock said bar through an arc to cooperate with said cam surface to render said guide operative or inoperative.

13. In a knitting machine, the combination of a pivoted yarn guide, a spring for moving said yarn guide into its operative position to feed yarn, a longitudinally movable bar taking against the underside of said yarn guide, combs to guide said bar in contact with the under side of said yarn guide, a stop on said bar to limit its move-

ment with respect to one of said combs, a pattern cam surface, means to advance said pattern cam surface at predetermined times, to move said bar, a recess in said bar at the other comb, and a lug on said bar for co-operation with a cam rotating with a rotary element of said machine, when said bar is in the position determined by said stop-lug.

14. In a knitting machine, a latch ring having a gap therein for the operation of a plurality of yarn guides, a member movable on the latch ring to close said gap, a series of independently movable thrust bars for operating the yarn guides, means including a movable thrust bar for operating the gap closing means, and a pattern surface for moving each of said thrust bars in a predetermined order.

15. In a knitting machine, a pivoted latch ring having a gap therein for the operation of a plurality of yarn guides, a member movable on the latch ring to close said gap, a series of independently movable thrust bars terminating at one end near the pivoted part of said latch ring, each for operating a yarn guide, a similar bar in the said position, and means cooperating with said similar bar for operating the gap-closing means, in combination with a pattern surface for moving said thrust bars at predetermined times.

16. In a knitting machine, a movable latch ring having a gap therein, a plurality of yarn feed guides supported by said latch ring and movable through said gap, a device comprising a ring having a gap therein rotatable on said latch ring, in combination with a support for said latch ring, a lever mounted on said support, a connection from said lever to said rotatable ring, and a plurality of endwise movable bars having operative parts each in free contact with one of said yarn guides and said lever respectively, in one position of said latch ring.

17. The combination in a knitting machine of a latch guard ring having a gap therein for the operation of a plurality of yarn guides, a support on which said latch guard ring is pivoted, a member operating independently of said yarn guides, and automatic means for moving said member to close or open the gap, comprising a lever pivoted on said support, a thrust bar, and means on the said thrust bar to contact with said lever.

18. In a knitting machine a latch guard ring having a gap therein, a plurality of yarn guides for operation in said gap, a device for closing said gap, comprising an incomplete annulus rotatable on said latch ring, and means for operating said annulus comprising a bell crank lever having a vertical arm, a link connecting said arm to

said annulus, a spring for moving said bell crank lever in one direction and a thrust bar having an adjustable attachment for moving said bell crank lever in the other
5 direction.

19. A circular knitting machine having needles and an internal guide for a splicing yarn thrown out of operation above the needles, a movable yarn guide for inserting
10 and withdrawing a splicing yarn, in combination with means carried by said splicing yarn guide for positioning the splicing yarn between said needles and internal guide.

20. A yarn guide device for knitting ma-

chines comprising a movable yarn guide 15 having a part adapted to extend over and within the needles, said extension terminating in a notch opening downwardly, whereby to take over and position a run of yarn at the back of the needles.

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

ROBERT W. SCOTT

Witnesses:

M. G. CROZIER,
MARY F. GRIFFIN.