

Nov. 10, 1959

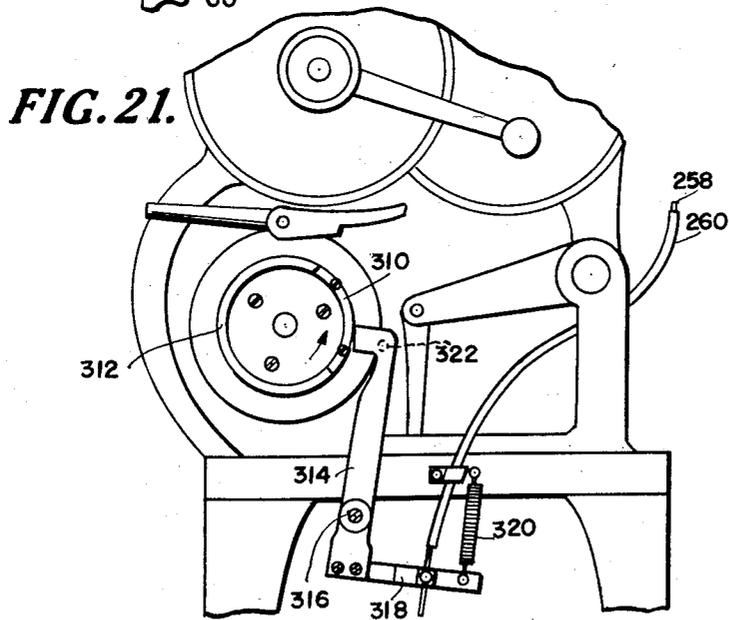
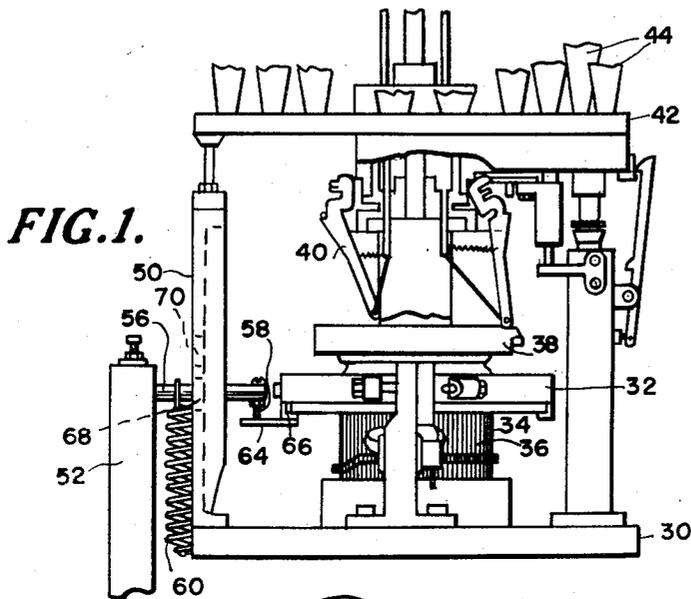
J. S. MACON

2,911,806

TWO-FEED KNITTING MACHINE

Filed Dec. 31, 1957

8 Sheets-Sheet 1



INVENTOR

JOHN S. MACON

BY *Cushman, Darby & Cushman*

ATTORNEYS

Nov. 10, 1959

J. S. MACON

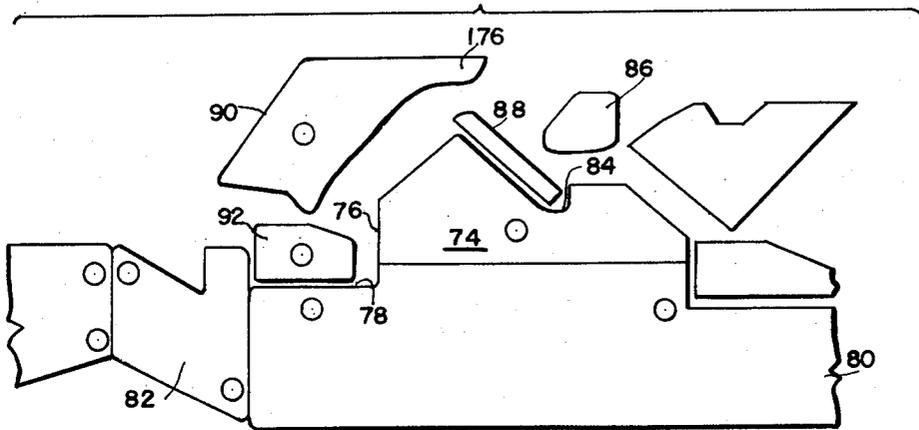
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TWO-FEED KNITTING MACHINE

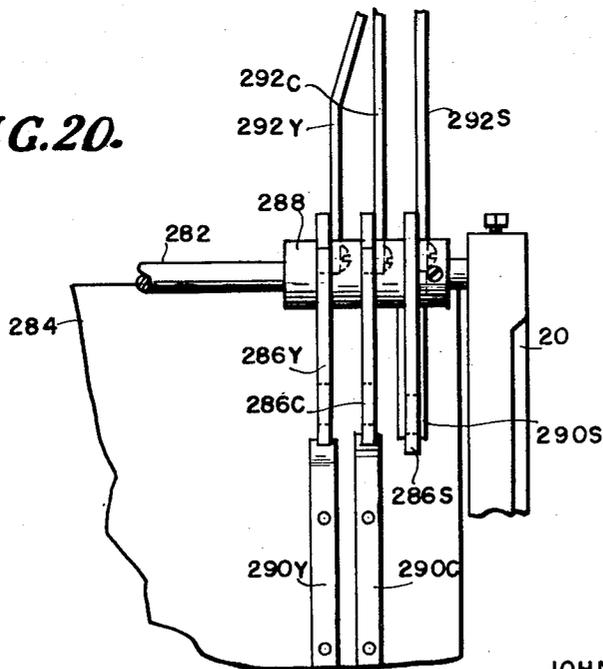
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**FIG. 2.**



**FIG. 20.**



INVENTOR  
JOHN S. MACON

BY *Lushman, Darby & Lushman*  
ATTORNEYS



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J. S. MACON

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FIG. 4.

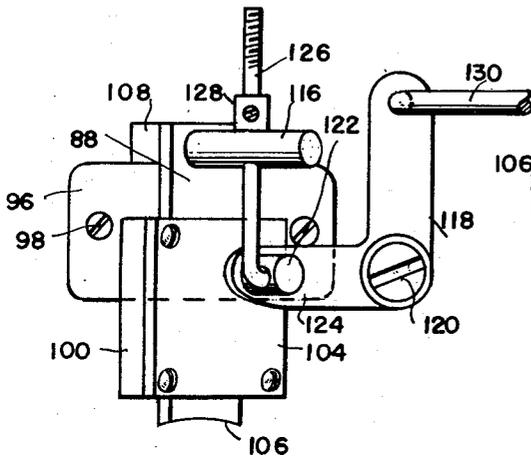


FIG. 6.

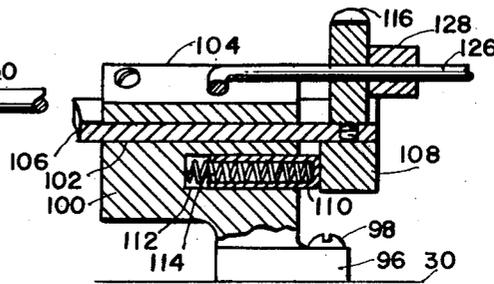


FIG. 5.

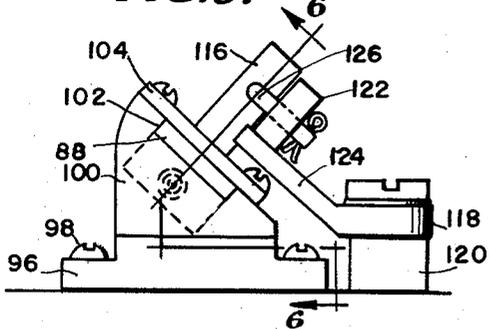
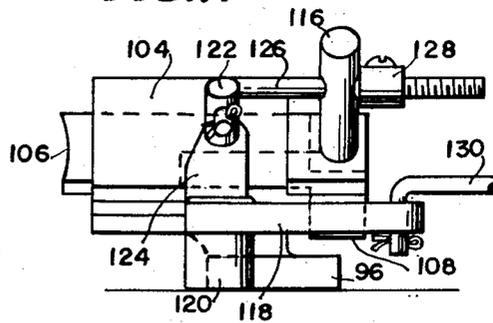


FIG. 7.



INVENTOR

JOHN S. MACON

BY *Cushman, Darby & Cushman*

ATTORNEYS

Nov. 10, 1959

J. S. MACON

2,911,806

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FIG. 8.

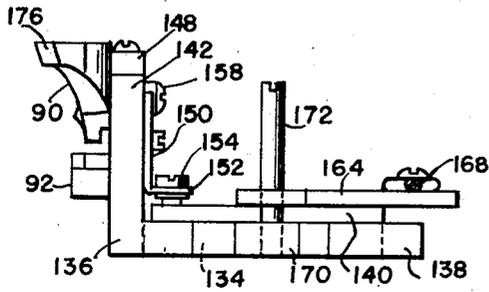


FIG. 9.

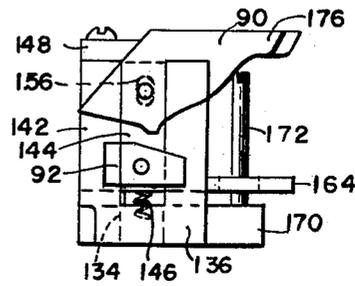


FIG. 10.

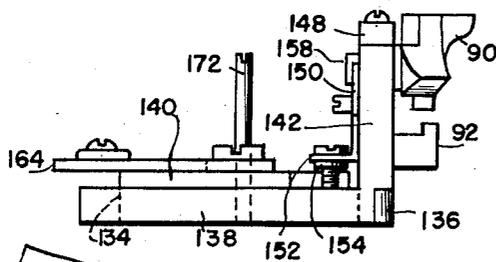
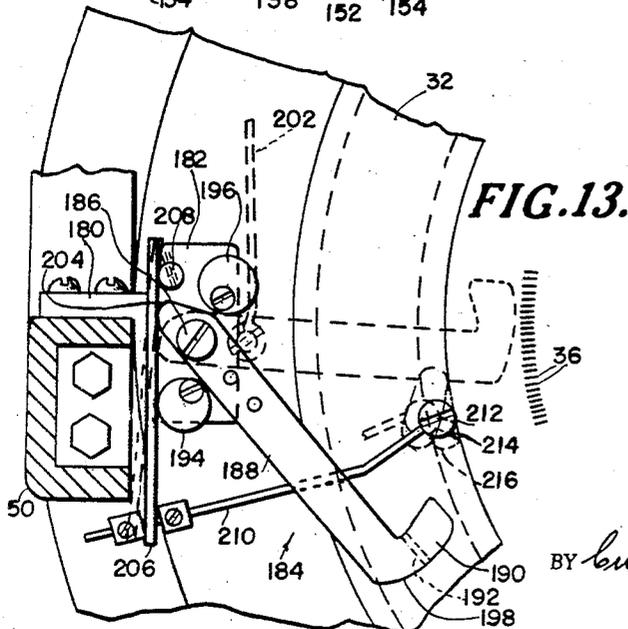
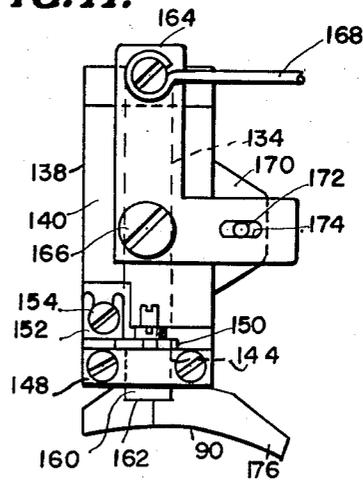


FIG. 11.



INVENTOR

JOHN S. MACON

BY *Cushman, Darby & Cushman*

ATTORNEYS

Nov. 10, 1959

J. S. MACON

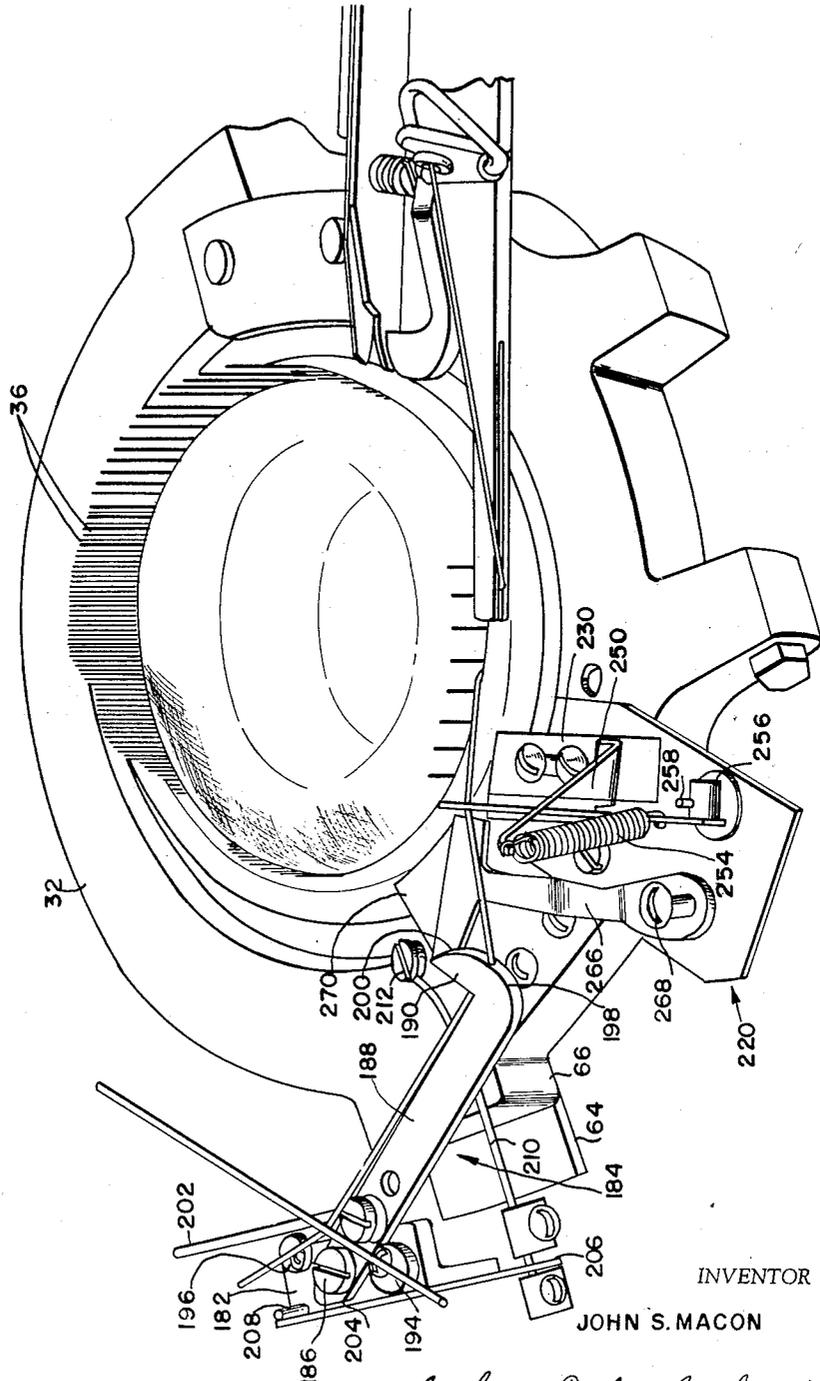
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FIG. 12.



INVENTOR

JOHN S. MACON

BY *Cushman, Darby & Cushman*

ATTORNEYS

Nov. 10, 1959

J. S. MACON

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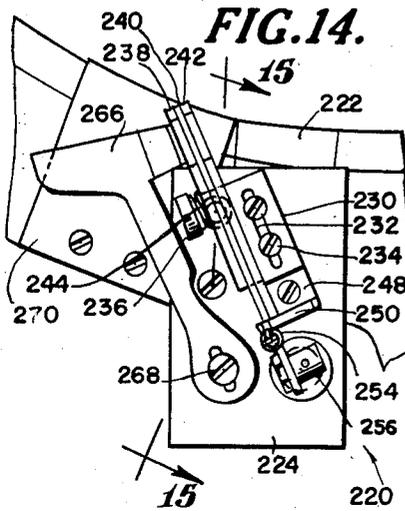


FIG. 14.

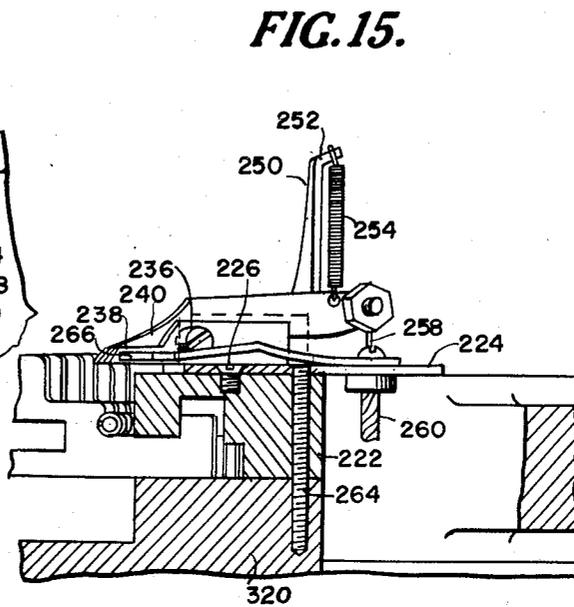


FIG. 15.

FIG. 16.

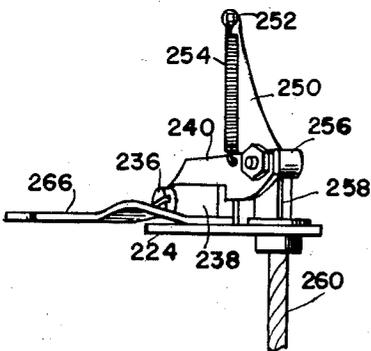
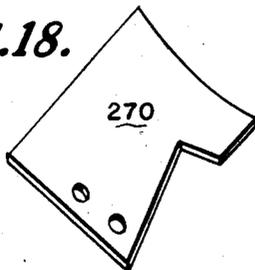


FIG. 17.

FIG. 18.



INVENTOR

JOHN S. MACON

BY *Cushman, Darby & Cushman*  
ATTORNEYS



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2,911,806

**TWO-FEED KNITTING MACHINE**

**John Spurgeon Macon, High Point, N.C., assignor to Burlington Industries, Inc., Greensboro, N.C., a corporation of Delaware**

**Application December 31, 1957, Serial No. 706,414**

**11 Claims. (Cl. 66—42)**

This invention relates to circular knitting machines, and in particular to half hose knitting machines of the Scott & Williams HH-PW type. These machines are provided with panel wrap or color-in-color attachments, as generally disclosed in United States Patent 1,906,204, and with rib interlaced rubber attachments of the type generally disclosed in United States Patent 2,174,439.

A principal object of the invention is to provide an auxiliary feed station in HH-PW machines, to permit two-feed knitting through the elastic top of a sock, whereby the rubber yarn will be interlaced in every other course, giving a better fitting and appearing, and more economical welt. As will be evident, the two-feed knitting may be extended as well through the leg and foot. A related object is to add an auxiliary knitting station to machines of the type described with minimum modification of the machine, the operating controls for the auxiliary station utilizing regular machine movements. In general, by the present invention the basic machine can be converted to two-feed operation without altering any essential function of the machine, the conversion requiring little time and expense, and effecting a durable and efficient machine.

A specific object of the invention is to provide in circular knitting machines a novel side mounted yarn finger, pivotal about a vertical axis.

Another specific object of the invention is to provide an improved yarn shear, mounted on the sinker gate of the sinker cap of the machine, and removable therewith. Further objects will be in part evident and in part pointed out hereinafter.

The invention and the novel features thereof may best be made clear from the following description and the accompanying drawings in which:

Figure 1 is a partial side elevational view of a typical circular knitting machine constructed in accordance with the present invention;

Figure 2 is a linear development of the auxiliary knitting station cams;

Figure 3 is a top plan view of the upper bed plate of the machine, illustrating the positional relationship of the auxiliary knitting station cams and their mountings;

Figure 4 is a top plan view of the auxiliary knitting station clear cam assembly, with associated controls;

Figure 5 is a front elevational view of the assembly of Figure 4;

Figure 6 is a sectional view taken along the line 6—6 of Figure 5;

Figure 7 is a side elevational view of the clear cam assembly, as viewed from the right hand side of Figure 4;

Figure 8 is a side view of the auxiliary knitting station stitch and landing cam assembly and mounting;

Figure 9 is a front elevational view of the assembly of Figure 8;

Figure 10 is a side elevational view of the mechanism of Figure 8, viewed from the opposite side thereof;

Figure 11 is a top plan view of the mechanism of Figure 8;

Figure 12 is a perspective view of the sinker cap and associated elements of the machine, illustrating the positional relationship of the yarn finger and yarn shear of the auxiliary knitting station;

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Figure 13 is a top plan view of the auxiliary yarn finger, illustrating its mounting and the associated sinker cam;

Figure 14 is a top plan view of the yarn shear and associated guide;

Figure 15 is an elevational section taken substantially on the line 15—15 of Figure 14, showing the mounting of the yarn shear on the sinker gate;

Figure 16 is a rear elevational view of the yarn shear;

Figure 17 is a front elevational view of the yarn shear;

Figure 18 is a perspective view of the guard plate underlying the yarn guide;

Figure 19 is an elevational view showing the operating controls for the auxiliary station cams and yarn finger;

Figure 20 is a rear elevational view of the mechanism illustrated in Figure 19; and

Figure 21 is an elevational view of the operating controls for the auxiliary knitting station shear.

Referring to the drawings, Figure 1 illustrates a portion of the conventional Scott & Williams HH-PW circular knitting machine, the portion illustrated including the upper bed plate 30 and sinker cap 32 encircling the rotary cylinder 34, which carries the independent needles 36. The latter may be, for example, 220 in number, 110 being long butt needles and 110 being short butt needles. At the top of the cylinder is the latch ring 38, surmounted by the pattern yarn fingers 40 and the yarn bobbin stand 42. The bobbin stand, as will be understood, mounts a plurality of individual bobbins 44 of pattern yarn.

A support bracket 50 extends from the upper bed plate 30 to the yarn bobbin stand 42. Outside the support bracket 50 is disposed the cylinder hold down arm 52, the lower end of which (see Figure 19) is mounted on the cylinder raising tube 54. From the upper end of the cylinder hold down arm 52, a cylinder hold down pin 56 extends inwardly through a slot provided therefor in the support bracket 50, and from the inner end of the cylinder hold down pin 56 an adjustable screw 58 extends downwardly into pressure contact with the sinker cap 32.

A heavy tension spring 60 extends from the cylinder hold down pin 56 to the upper bed plate 30, this spring acting through pin 56 and its screw 58 to maintain downwardly directed pressure on the sinker cap and the cylinder assembly. All of the elements described to this point are conventional.

While multiple feed circular knitting machines are well known, it has not heretofore been practical to incorporate a second feed in conventional machines of the HH-PW type, primarily because of the bed plate space taken up by the rubber attachment. In accordance with the present invention, an auxiliary knitting station is incorporated in the immediate vicinity of the support bracket 50 of the machine, that is at a position trailing the main knitting station by about 90°. For the sake of simplicity, the invention is described below as a reconstruction of the standard machine, although it will be understood that the invention may be manufactured as a basic design.

In the standard HH-PW machine, a mechanical stop motion is commonly mounted on the upper bed plate, approximately 20° beyond the support bracket 50. Also, conventionally, a lowering cam and bracket may be mounted on the upper bed plate, substantially inside the support bracket 50, to lower the needles 36 into alignment with the mechanical stop motion. In reconstructing the machine in accordance with the present invention, the mechanical stop motion and the lowering cam and bracket referred to are removed, and not utilized.

To incorporate an auxiliary knitting station at the desired location, it is also necessary to clear the space above

the sinker cap, immediately inside the support bracket 50. This space is normally occupied by the cylinder hold down pin 56 and its screw 58. In accordance with the present invention, an outwardly extending bracket or plate 64 is welded onto the bottom of the sinker cap clamp 66. The cylinder hold down arm 52 is shortened or remounted on the cylinder raising tube 64 at a lower position, and a new slot 68 is formed in the support bracket 50, at a position below the original slot 70. The thus lowered cylinder hold down pin 56 extends inwardly through the new slot 68, and is appropriately withdrawn or shortened, whereby the adjustable screw 58 is positioned to bear on the newly provided plate 64. Tension spring 60 is remounted outside the support bracket 50, and extends as before from the hold down pin 56 to the upper bed plate 30. For a purpose presently apparent, the short side pad normally extending from the trailing side of the support bracket base is removed.

Referring to Figure 2, the trailing end of the left hand riser cam or side cam 74 is cut away at 76, and a slot 78 is cut therebelow in the cam ring 80, the slot 78 being immediately ahead of the jack gate 82. Also, a slot or notch 84 is cut into the left hand side cam 74 at the position illustrated. The clear cam 86 is moved from normal position about one quarter inch closer to the main knitting station, or to the right as illustrated in Figure 2. The machine is thus made ready for the addition of the auxiliary clear cam 88 and the auxiliary stitch cam 90. With the latter is associated a cooperative landing cam 92.

In Figure 3, M indicates the standard main knitting station, and A the auxiliary knitting station provided in accordance with the present invention. At the auxiliary knitting station A is mounted the auxiliary clear cam 88, positioned, as shown in Figure 2, immediately above the left hand side cam 74. The leading and lower end of the auxiliary clear cam 88 extends below the cam 86, into the notch 84 provided in the side cam 74. The auxiliary clear cam assembly, illustrated in detail in Figures 4 to 7, is mounted on the upper bed plate 30, at a position about 80° beyond the main knitting station M. The clear cam assembly precedes and immediately adjoins the support bracket 50.

As shown in Figures 4 to 7, the clear cam assembly comprises a base 96, suitably mounted on the upper bed plate 30 as by screws 98, supporting a block 100 having an inclined upper surface. A radial guide slot 102 is provided in the upper surface of the block 100, and the auxiliary clear cam 88 is slidably retained therein by the covering retainer plate 104. The inner or working face 106 of the cam is appropriately cylindrically curved, and the rear or outer end of the cam extends beyond the block 100, as shown. On the underside of the outer end of the cam is provided a tail block 108, and from the tail block a retainer sleeve 110 extends into the bore 112 of block 100. A spring 114 is retained within the bore 112 and retainer sleeve 110, and exerts outward pressure on the tail block 108 and the auxiliary clear cam 88 at all times.

From the outer end of the auxiliary clear cam a post 116 extends upwardly. A bell crank 118 is pivotally mounted at 120 on the upper bed plate 30, and a post 122 extends upwardly from the angulated arm 124 of the bell crank 118. A rod 126 is engaged to the bell crank post 122, and extends through the cam post 116. A sleeve 128 adjustably engaged to the rod 126 engages the cam 88 to the bell crank in operative relationship. An operating rod 130 extends from the other end of the bell crank.

Again referring to Figures 2 and 3, the auxiliary stitch cam assembly, including stitch cam 90 and its landing cam 92, is also mounted at the auxiliary knitting station A, at a position trailing the main knitting station by about 110°. As shown in Figure 3, the auxiliary stitch cam assembly follows and immediately adjoins the support bracket 50, and it will be recalled that the side pad

normally extending from the trailing side of the support bracket was removed, permitting this close positional relationship.

As shown in Figures 8 to 11, the auxiliary stitch cam assembly comprises a guide block 134, radially aligned with respect to the needle cylinder and fixedly mounted on the upper bed plate 30. A slide 136 comprises outwardly extending legs 138, which extend along both sides of the guide block 134, and a retainer plate 140 is mounted on the top of the guide block 134 and extends over the slide legs 138, maintaining the guiding relationship. Spaced upwardly extending legs 142 extend from the slide 136, guidably enclosing therebetween the cam block 144. The cam block 144 is biased upwardly by a spring 146, retained between the cam block and the slide, and the upward movement of the cam block is limited by the retainer plate 148 extending between the outer ends of the legs 142. The landing cam 92 is fixedly mounted on the outer face of the cam block 144, and a bracket 150 is fixed to the outer or rear surface of the cam block. Bracket 150 is provided with an outwardly extending tail 152, which is engaged by a screw 154 extending into one of the slide legs 138. As will be understood, the screw 154 functions in cooperation with the spring 146 to adjustably position the cam block 44 in vertical direction. Above the landing cam 92, the cam block 144 is vertically slotted at 156 and the stitch cam 90 is engaged to the cam block by means of a screw 158 extending through the slot 156 into the stitch cam. The slot 156 provides for vertical adjustment of the stitch cam relative to the cam block and landing cam, and the cam block and stitch cam may be correspondingly formed, as with the key 160 and slot 162 (see Figure 11), to limit the relative movement of the stitch cam to vertical direction.

A bell crank 164 is pivotally mounted at 166 on the fixed guide block 134, and an operating rod 168 extends from the outer end of one arm thereof. One of the slide legs 138 is provided with a side pad 170, from which a post 172 extends upwardly through the slot 174 provided in the other arm of the bell crank 164. The stitch cam 90 and landing cam 92 are cylindrically formed, in conventional manner, and are conventional in other respects, except that the stitch cam 90 is provided with an extended leading projection 176, which overhangs the trailing end of the auxiliary clear cam 88, as shown in Figure 2.

At about the level of the sinker cap 32, a bracket 180 is side mounted on the support bracket 50, see Figures 12 and 13. The bracket 180 supports a horizontal pad 182 disposed inwardly of the support bracket, and on the pad 182 the yarn finger indicated generally as 184 is mounted on a vertical pivot 186. The yarn finger 184 comprises a straight leg 188, and on the leading side of the outer end thereof a lateral projection 190. A yarn eye 192 extends substantially radially through the base of the projection 190. Eccentrics 194 and 196 may be provided on the pad 182, constituting adjustable limits to the movement of the yarn finger. As illustrated in Figures 12 and 13, the yarn finger is in outward or inoperative position, in contact with the eccentric 194. As will be understood, the yarn finger is adapted to swing inwardly from the position illustrated, to operative or active position whereat it is disposed substantially radially of the machine cylinder 34, as illustrated in dotted lines in Figure 13. The outer end 198 of the yarn finger is suitably curved or rounded, as viewed in plan, substantially about the pivotal axis of the finger, and is positioned and adapted to approach the path of the needles 36 very closely, when the finger is in operative or active position. Since the yarn finger in active position almost touches the needles elevated by the auxiliary stitch cam to take the yarn, the lower edge of the latch ring must be cut away at this position to clear the path of movement of the yarn finger.

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An important feature of the yarn finger design involves the underside of the yarn finger projection 190, which is downwardly sloped from its leading and outer edges, at 200, to engage and deflect downwardly any needle latches which may happen to extend outwardly, under the influence of centrifugal force or otherwise, as the needles approach the yarn finger.

An operating rod 202 extends from the yarn finger leg 188, and the opposite end of the yarn finger is formed into a cam 204 which bears against the bar 206. The bar 206 extends across the rear of the pad 182 and is pivotally mounted thereon at 208, on a vertical axis. A link or rod 210 is adjustably engaged to the free end of bar 206, and extends to the screw 212 (see Figure 13) which extends through a slot 214 in the sinker cap 32, into the pivotally mounted auxiliary sinker cam 216. As will be understood, the auxiliary sinker cam 216 is adapted to appropriately actuate the sinkers when knitting is being effected at the auxiliary station A, in conventional manner, and by means of rod 210 the auxiliary sinker cam is linked to and actuated in unison with the yarn finger.

Beyond the yarn finger 184, a yarn shear indicated generally as 220 is mounted on the gate of the sinker cap 32. As illustrated in Figures 12 and 14 to 17, the yarn shear 220 according to the preferred embodiment of the invention is mounted on and engaged to the conventional sinker gate 222 of the machine, which in turn is mounted on the sinker bed in customary manner. As best illustrated in Figure 15, the yarn shear comprises a rectangular base plate 224, fixedly engaged to the sinker gate 222 as by a screw 226 extending through the plate into the sinker gate.

A pivot block 230 provided with a longitudinal slot 232 is mounted on the upper surface of the base plate 224, as by the screws 234 extending through the pivot block slot 232 into engagement with the base plate 224, and optionally into engagement also with the sinker gate 222 therebelow. As will be readily understood, the pivot block slot 232 and the screws 234 provide for adjustment of the yarn shear relative to its base plate. A pivot pin 236 extends into the side of the pivot block 230, the pivot pin carrying an outer clamp blade 238, pivoting shear blade 240, and an inner fixed shear blade 242. The undersides of the clamp blade 238 and the fixed shear blade 242 are straight and adapted to rest on the upper surface of the base plate 224, whereby these elements are restrained from rotation when assembled. A small spring 244 may be interposed between the head of the pivot pin 236 and the clamp blade 238, to bias the blade assembly against the pivot block 230 at all times.

A bracket 248 mounted on the upper surface of the pivot block 230 comprises an upwardly extending leg 250, and a tail 252 extending from the upper end of the bracket leg 250 engages one end of a tension spring 254, which extends therefrom to the pivoting shear blade 240. The spring 254 tends to urge the outer end of the pivoting shear blade upwardly and the bracket leg 250 may extend laterally over the pivoting shear blade 240 to serve as a stop and limit the upward movement of this end of the shear blade. Beyond the bracket 248 and spring 254, a collar 256 is suitably mounted on the outer end of the pivoting shear blade, this collar being adapted to engage an end of the Bowden wire 258, which extends downwardly through the base plate and into the guide housing 260 extending below the base plate.

A long screw 264 extends through the base plate 224 and the sinker gate 222 into threaded engagement with the sinker bed 320. The yarn shear, it will be understood, is engaged by the screw 226 and the screws 234 to the sinker gate 222, whereby the yarn shear and the sinker gate constitute a unitary assembly, and the screw 264 constitutes means for engaging this assembly to the sinker bed. When it becomes necessary to remove and

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replace any of the sinkers, the entire assembly including the sinker gate may be removed as a unit, merely by removing the screw 264, and the same assembly may be replaced as a unit in exceedingly simple manner. The adjusted positioning of the yarn shear with respect to the needle circle, accordingly, is not disturbed by removal of the assembly to replace sinkers. A substantially T-shaped yarn guide 266 may be mounted on the base plate 224 by means of screw 268, at a position leading the yarn shear, the yarn guide being positioned and adapted to guide a yarn length extending from the yarn finger 184 to the needles into the shear, that is over the inner end of the clamp blade 238 and under the inner end of the pivoting shear blade 240, when the latter is in elevated shearing position. It is desirable, but not essential, to provide a guard plate 270 immediately below the yarn guide 266, to preclude inadvertent contact between the yarn and the sinkers passing therebelow. The guard plate may be of the shape illustrated in Figure 18.

Means are provided for independent actuation of the auxiliary clear cam 88, the auxiliary stitch cam assembly including stitch cam 90 and the associated landing cam 92, yarn finger 184, and the yarn shear 220. Referring to Figures 19 and 20, the conventional support bracket extension 280 of the machine mounts a stud shaft for supporting the operating lever associated with the main knitting station shear. In accordance with the present invention, the stud shaft 282, which parallels the main pattern drum 284 of the machine, is extended, and three additional operating levers 286S, 286C, and 286Y are pivotally mounted thereon, and suitably positioned as by collars 288. The operating levers, it will be understood, are provided for actuation of the auxiliary stitch cam assembly, auxiliary clear cam, and auxiliary yarn finger, the letters applied to the individual operating levers 286 indicating the element with which it is associated. As will be understood, the operating levers 286 may be aligned with any main drum races not otherwise employed. Suitable drum cams 290S, 290C and 290Y are mounted on the main drum, in alignment with the corresponding operating levers.

One end of the operating lever 286S is spring biased toward the main drum 284 in the usual manner, and from the other end of the operating lever 286S a link 292S extends upwardly to an arm of the bellcrank 294S, which is pivotally mounted on a pin 296 extending into the lower end of the aligning yoke 298 which is associated with support bracket 50 on the upper bed plate of the machine. A link 300 is pivotally engaged to the other arm of bellcrank 294S, and engaged also to the auxiliary stitch cam assembly operating rod 168. A similar link 292C extends upwardly from the corresponding end of the operating lever 286C, and the upper end of link 292C is pivotally engaged to the bellcrank 294C, also mounted on pin 296. The other end of bellcrank 294C is pivotally engaged to a link 302, which is engaged also to the auxiliary clear cam operating rod 130.

From the free end of operating lever 286Y, a link 292Y extends upwardly into pivotal engagement with an arm or bellcrank 294Y, which is pivotally mounted on the pin 304 extending into the upper end of the aligning yoke 298. From the other end of the bellcrank 294Y extends the operating rod 202, which is engaged to the leg 188 of yarn finger 184. The shape and relative disposition of the drum cams 290 is illustrated in Figure 19.

Means for operating the auxiliary yarn shear 220 are illustrated in Figure 21. For this purpose, a segmental cam 310 approximately 90° in extent is applied to the outer end of the operating drum 312 of the machine, and operating lever 314 is mounted in alignment therewith. The operating lever 314 is pivoted at 316, and an arm 318 extends fixedly from the other end thereof. A tension spring 320 engages the arm 318 and biases the operating lever 314 towards the operating drum 312, and the Bow-

den wire 258 extending from the auxiliary yarn shear is fixedly engaged to the arm 318.

#### Operation

Operation of the device will now be described in detail. At the end of each knitting cycle, the machine knits a "looper clip," about 24 courses of knitting at the main knitting station. This looper clip is cut off when the toe is closed. At the end of the looper clip, the machine begins knitting loose courses. The loose courses, usually about twelve in number, are knit on alternate needles at the main knitting station.

At the end of the looper clip knitting, immediately prior to initiation of the loose course knitting, the auxiliary clear cam, the auxiliary stitch cam assembly, and the auxiliary yarn finger are all in inactive or withdrawn position. The auxiliary shear is closed, and the auxiliary yarn end is securely clamped between clamp blade 238 and the pivoting shear blade 240. The auxiliary shear is closed, it will be understood, when the operating lever 314 is not riding the cam 310, but rather is displaced inwardly with respect to the operating drum 312 from the position illustrated in Figure 21. A stop pin 322 may be provided on the operating lever 314 to engage the drum 312 and limit the inward movement of the operating lever 314.

The position of the main pattern drum 284 and the drum cams 290S, 290C and 290Y during the knitting of the looper clip is illustrated in Figure 19. As there shown, the operating lever 286S is elevated by cam 290S. This elevated position of the operating lever 286S corresponds to inactive or withdrawn position of the auxiliary stitch cam assembly. The operating levers 286C and 286Y are riding the drum 284, this position corresponding to inactive or withdrawn disposition of the auxiliary clear cam and yarn finger.

At the end of the looper clip knitting, an auxiliary movement of the main pattern drum 284 initiates knitting of the loose courses. This drum movement moves the cam 290S out from under the operating lever 286S, permitting the lever 286S to drop in against the drum, and causing the auxiliary stitch cam assembly to move in towards the needles of the machine, to active position. The auxiliary stitch cam assembly moves in first against the short butt needles, and then drops into fully active position after the short butt needles have passed.

At the end of the loose course knitting, a movement of the main pattern drum 284 initiates the knitting of the top or welt of a new sock. This movement is utilized to displace the auxiliary clear cam 88 and the auxiliary yarn finger 184 to active position. As shown in Figure 19, the leading end of drum cam 290C is stepped, whereby the operating lever 286C is raised in two steps, and the auxiliary clear cam is accordingly moved in against the needles in stepwise fashion, first against the short butt needles and then against the cylinder. The leading end of the drum cam 290Y trails the leading end of cam 290C very slightly, whereby the auxiliary yarn finger is displaced to active position, as shown in dotted lines in Figure 13, momentarily after actuation of the clear cam. As will be understood, by the time the auxiliary yarn finger reaches active position, the needles reaching this position are elevated and cleared, and take the auxiliary yarn. Movement of the auxiliary yarn finger to active position is effective, through its end cam 204, bar 206 and rod 210, to displace the auxiliary sinker cam 216 to knitting position.

In the course of the main pattern drum movement which initiates welt knitting, the operating drum 312 rotates, whereby the leading end of cam 310 (Figure 21) engages the operating lever 314 and displaces it outwardly to the position illustrated, riding the cam 310. This movement elevates the inner end of the pivoting shear blade 240 of the auxiliary yarn shear, and releases the auxiliary yarn end. Desirably, activation of the

auxiliary yarn shear occurs momentarily after activation of the other auxiliary knitting station elements.

The rubber attachment of the machine goes into action on subsequent auxiliary movements of the main pattern drum, in conventional manner. The auxiliary knitting station elements remain in active position, as described immediately above, throughout the knitting of the welt. The sock welt is accordingly knitted two feed, whereby the rubber yarn is laid in every other course, resulting in an elastic top of superior properties. Also, of course, the rate of welt knitting is doubled, with corresponding increase in overall efficiency.

Knitting at the auxiliary knitting station may proceed through the leg of the sock, with novel pattern effects, and obviously may extend also through the foot. For the sake of simplicity, however, the operation will be described wherein the two feed knitting is confined to the welt. On the first main pattern drum movement coming out of the welt, and preferably in the latter part of this movement, the drum cams 290C and 290Y pass out from under the operating levers 286C and 286Y. As shown, the trailing end of cam 290C slightly precedes the trailing end of the cam 290Y, whereby the operating lever 286C falls to the drum 284 first, and the clear cam is withdrawn thereby to inactive position. The operating lever 286Y falls to the drum 284 momentarily thereafter, and the auxiliary yarn finger is displaced thereby to inactive position, shown in full lines in Figure 13. Retraction of the yarn finger effects corresponding retraction of the associated auxiliary sinker cam 216. The interval of time between the inactivation of the clear cam and the yarn finger may correspond to the passage of about eight needles. The retraction of the auxiliary yarn finger removes the auxiliary yarn from the needle path, whereby the auxiliary yarn is no longer engaged by the needle hooks, and knitting at the auxiliary knitting station accordingly terminates.

On a subsequent auxiliary movement of the main pattern drum 284, the operating drum 312 jogs correspondingly, and this movement permits the operating lever 314 (Figure 21) to drop off the cam 310, and move inwardly with respect to the operating drum 312. This movement of the operating lever 314 displaces the Bowden wire 258, and permits the spring 254 to elevate the outer end of the pivoting shear blade 240 of the auxiliary yarn shear. The inner end of the shear blade 240 is accordingly moved downwardly between clamp blade 238 and fixed shear blade 242, whereby the auxiliary yarn is clamped and sheared. This operation takes place when the last needle to take the auxiliary yarn has passed slightly beyond the position of the auxiliary yarn shear. The auxiliary movement of the main pattern drum which actuates the auxiliary yarn shear, in the exemplary procedure, may be the movement which normally deactivates the rubber attachment.

On the last main pattern drum movement coming out of the welt, the leading end of drum cam 290S passes under the operating lever 286S, and lifts the lever 286S onto the cam, whereby the auxiliary stitch cam assembly is moved outwardly and displaced to inactive position. It will be recognized that all the drum movements referred to are conventional movements of the machine, whereby operation of the auxiliary knitting station is effected without alteration of the basic machine operation. It will be equally evident, as previously indicated, that the auxiliary knitting station may be inactivated at a later stage in the knitting cycle, for example, at the end of leg knitting, and may be inactivated and activated one or more times through the knitting cycle.

It will thus be seen that there has been provided by this invention a structure in which the various objects hereinbefore set forth, together with many practical advantages, are successfully achieved. As various possible embodiments may be made of the mechanical features of the above invention, all without departing from the scope

thereof, it is to be understood that all matter hereinbefore set forth or shown in the accompanying drawings is to be interpreted as illustrative, and not in a limiting sense.

I claim:

1. In a circular knitting machine of the half hose type provided with pattern wrap and rubber attachments, an upper bed plate, a yarn bobbin stand above said upper bed plate, a main knitting station, a support bracket extending from said upper bed plate to said yarn bobbin stand at a position trailing the main knitting station by approximately 90°, a retractable auxiliary clear cam mounted on said upper bed plate and adjoining said support bracket on the leading side thereof, a retractable auxiliary stitch cam mounted on said upper bed plate and adjoining said support bracket on the trailing side thereof, and a yarn finger mounted on said support bracket and pivotal on a vertical axis.

2. In a circular knitting machine of the half hose type provided with pattern wrap and rubber attachments, an upper bed plate, a yarn bobbin stand above said upper bed plate, a main knitting station, a support bracket extending from said upper bed plate to said yarn bobbin stand at a position trailing the main knitting station by approximately 90°, a retractable auxiliary clear cam mounted on said upper bed plate and adjoining said support bracket on the leading side thereof, a retractable auxiliary stitch cam mounted on said upper bed plate and adjoining said support bracket on the trailing side thereof, a yarn finger mounted on said support bracket and pivotal on a vertical axis, and means for independent actuation of said auxiliary cams and yarn finger.

3. Apparatus as defined in claim 2, wherein said yarn finger includes a straight leg and a projection extending laterally from the leading side of said leg at the outer end thereof, the underside of said projection being sloped downwardly from its leading and outer edges to deflect needle latches, and a yarn eye extending through said projection in substantial alignment with the leading side of said leg.

4. Apparatus as defined in claim 2, wherein the outer edge of said yarn finger is rounded substantially about the pivotal axis of said finger.

5. In a circular knitting machine of the half hose type provided with pattern wrap and rubber attachments, an upper bed plate, a sinker cap disposed above said upper bed plate, a yarn bobbin stand disposed above said sinker cap, a main knitting station, a support bracket extending from said upper bed plate to said yarn bobbin stand at a position trailing the main knitting station by approximately 90°, a retractable auxiliary clear cam mounted on said upper bed plate and adjoining said support bracket on the leading side thereof, a retractable auxiliary stitch cam mounted on said upper bed plate and adjoining said support bracket on the trailing side thereof, a yarn finger mounted on said support bracket and pivotal on a vertical axis, and a yarn shear mounted on said sinker cap at a point trailing said yarn finger.

6. In a circular knitting machine of the half hose type provided with pattern wrap and rubber attachments, an upper bed plate, a sinker cap disposed above said upper bed plate, a yarn bobbin stand disposed above said sinker cap, a main knitting station, a support bracket extending from said upper bed plate to said yarn bobbin stand at a position trailing the main knitting station by approximately 90°, a retractable auxiliary clear cam mounted on said upper bed plate and adjoining said support bracket on the leading side thereof, a retractable auxiliary stitch cam mounted on said upper bed plate and adjoining said support bracket on the trailing side thereof, a yarn finger mounted on said support bracket and pivotal on a vertical axis in a plane overlying said sinker cap, a yarn shear mounted on said sinker cap at a point trailing said yarn finger, and yarn guide means mounted on said sinker cap and leading said shear.

7. In a circular knitting machine of the half hose type provided with pattern wrap and rubber attachments, an upper bed plate, a sinker cap disposed above said upper bed plate, said sinker cap having a removable gate, a yarn bobbin stand disposed above said sinker cap, a main knitting station, a support bracket extending from said upper bed plate to said yarn bobbin stand at a position trailing the main knitting station by approximately 90°, a retractable auxiliary clear cam mounted on said upper bed plate and adjoining said support bracket on the leading side thereof, a retractable auxiliary stitch cam mounted on said upper bed plate and adjoining said support bracket on the trailing side thereof, a yarn finger mounted on said support bracket and pivotal on a vertical axis, a plate mounted on said sinker cap gate, a yarn shear mounted on said plate, yarn guide means mounted on said plate and leading said shear, said guide means extending under the path of movement of said yarn finger and being positioned and adapted to guide yarn into said shear, and means for independent actuation of said cams, yarn finger and shear.

8. In a circular knitting machine, a sinker cap, a removable gate in said sinker cap, and a yarn shear mounted on said gate, said shear and gate being removable from the machine as a unit.

9. In a circular knitting machine, a sinker cap, a removable gate in said sinker cap, a plate mounted on said gate, a yarn shear mounted on said plate, and yarn guide means mounted on said plate and leading said shear, said guide means being positioned and adapted to guide yarn thereover into said shear.

10. In a circular knitting machine, a sinker cap, a removable gate in said sinker cap, a yarn finger pivotally mounted on a vertical axis and movable in a plane above said sinker cap, a plate mounted on said gate, a yarn shear mounted on said plate, yarn guide means mounted on said plate and leading said shear, said guide means extending under the path of movement of said yarn finger, and means for independent actuation of said yarn finger and shear.

11. In a circular knitting machine of the half hose type provided with pattern wrap and rubber attachments, an upper bed plate, a sinker cap disposed above said upper bed plate, a yarn bobbin stand disposed above said sinker cap, a main knitting station, a support bracket extending from said upper bed plate to said yarn bobbin stand at a position trailing the main knitting station by approximately 90°, a retractable auxiliary clear cam mounted on said upper bed plate and adjoining said support bracket on the leading side thereof, a retractable auxiliary stitch cam mounted on said upper bed plate and adjoining said support bracket on the trailing side thereof, a pivotal sinker cam mounted on said sinker cap at a position corresponding to that of said auxiliary stitch cam, a yarn finger mounted on said support bracket and pivotal on a vertical axis, means operatively linking said yarn finger to said sinker cam, a yarn shear mounted on said sinker cap at a point trailing said yarn finger, and means for independent actuation of said cams, yarn finger and shear.

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