

June 27, 1939.

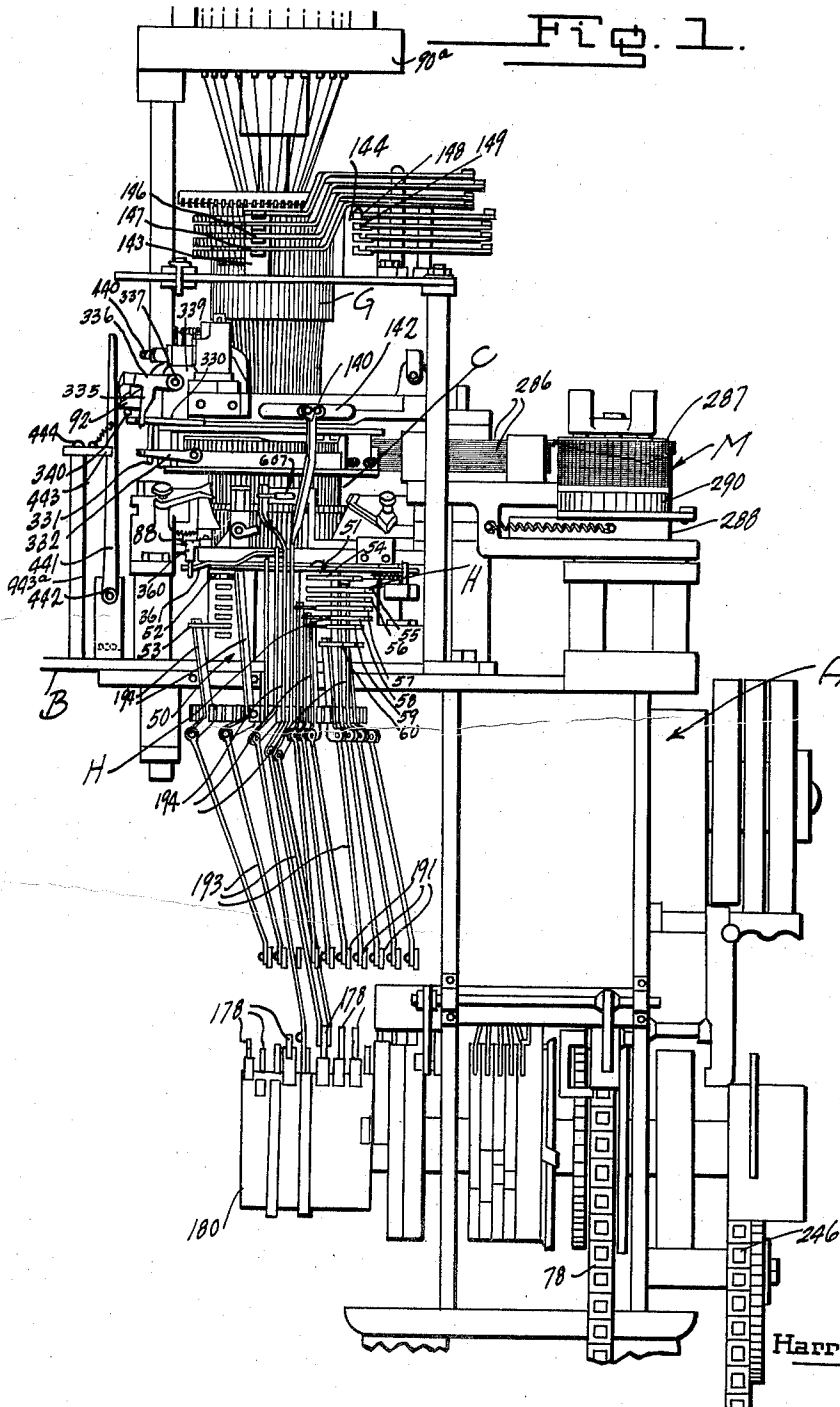
H. McADAMS

2,164,119

KNITTING MACHINE

Filed June 14, 1934

12 Sheets-Sheet 1



INVENTOR.
Harry McAdams

BY *Lancaster, Allwin & Rommel*
ATTORNEYS.

June 27, 1939.

H. McADAMS

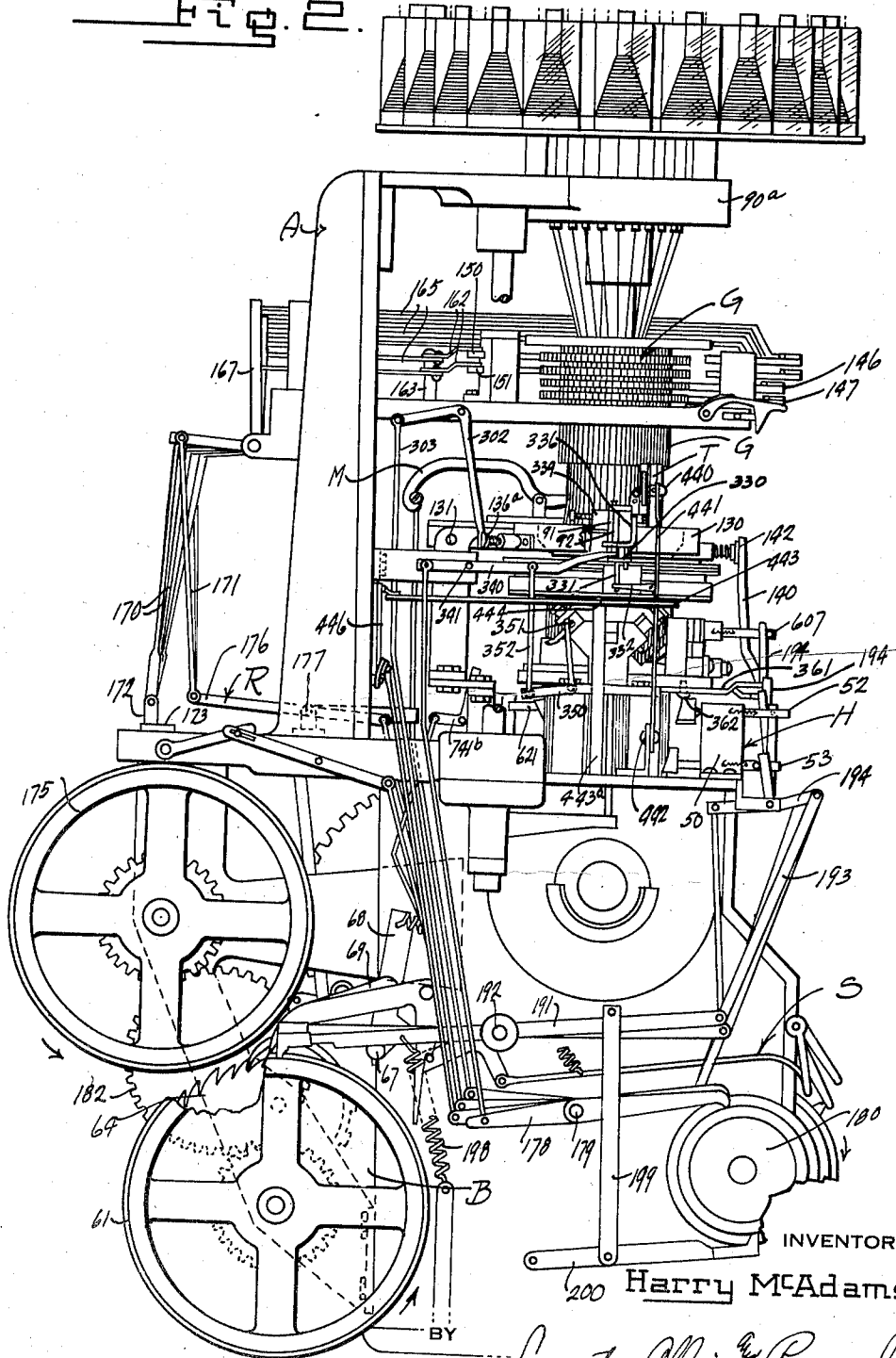
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KNITTING MACHINE

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Fig. 2.



INVENTOR.

Harry McAdams

Lancaster, Allwin & Rommel
ATTORNEYS

June 27, 1939.

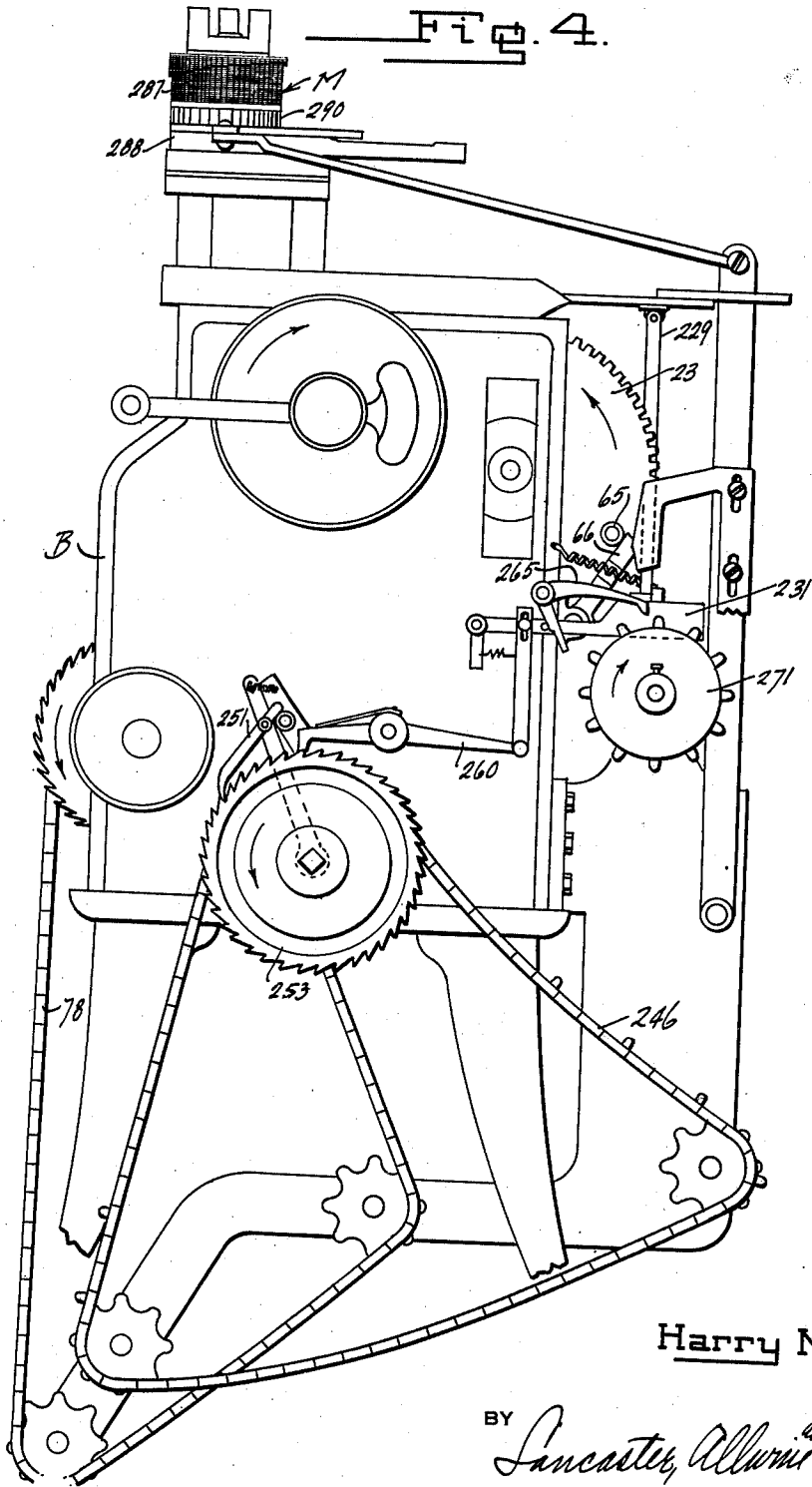
H. McADAMS

2,164,119

KNITTING MACHINE

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12 Sheets-Sheet 4



INVENTOR.
Harry McAdams

BY *Lancaster, Allmar and Rommel*
ATTORNEYS.

June 27, 1939.

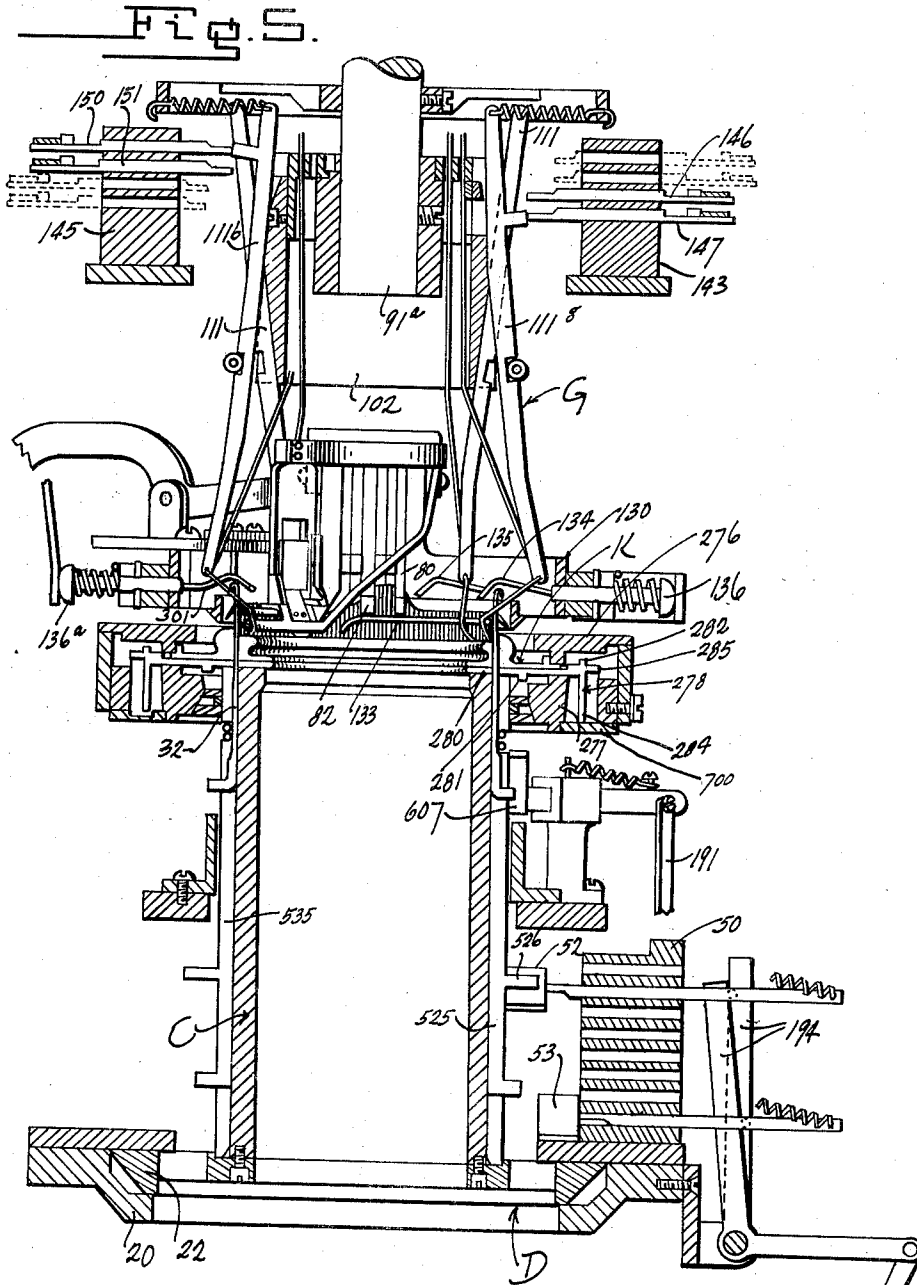
H. McADAMS

2,164,119

KNITTING MACHINE

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12 Sheets-Sheet 5



INVENTOR.
Harry McAdams

BY *Lancaster, Allison & Rommel*
ATTORNEYS.

June 27, 1939.

H. McADAMS

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KNITTING MACHINE

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Fig. 6.

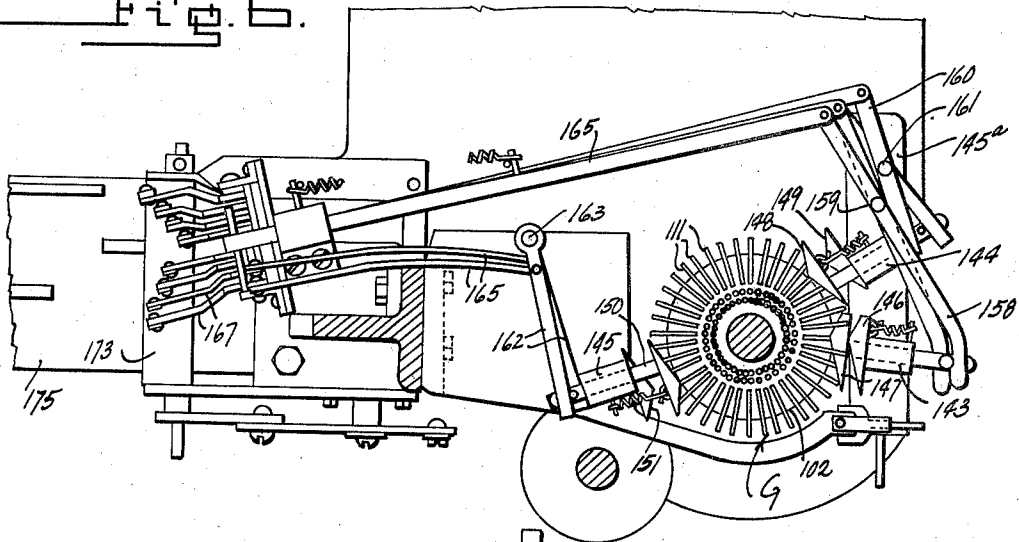
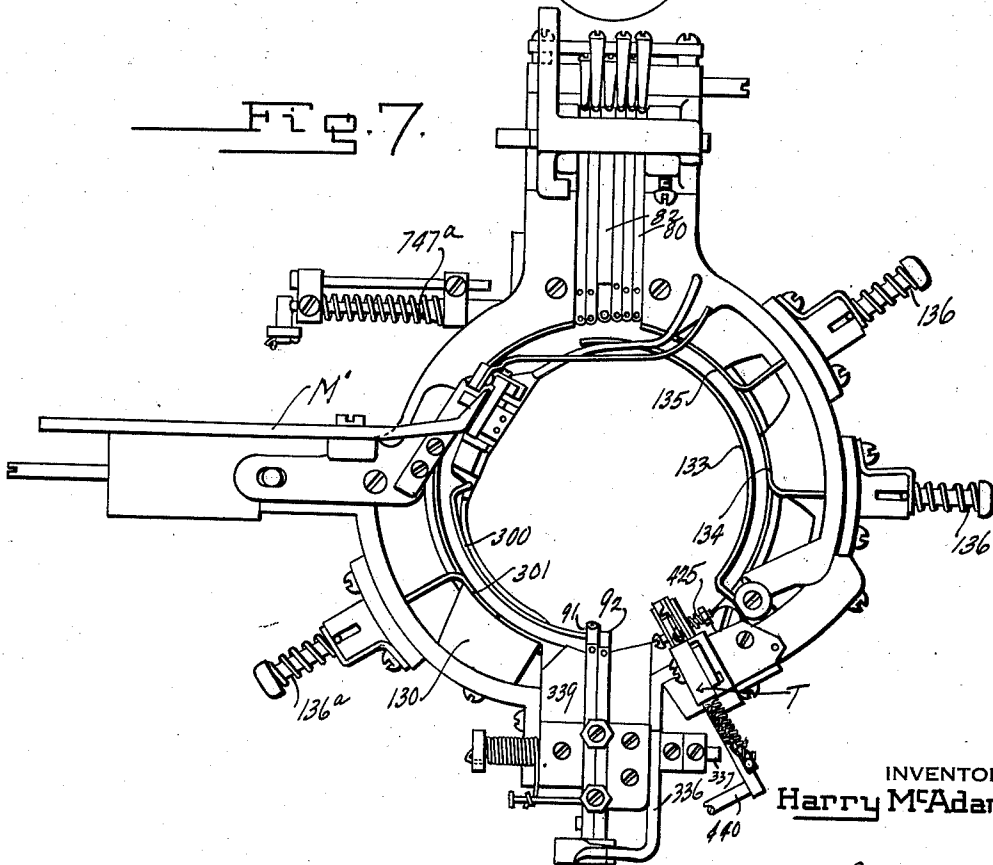


Fig. 7.



INVENTOR.
Harry McAdams

BY *Lancaster, Allison & Rommel*
ATTORNEYS.

June 27, 1939.

H. McADAMS

2,164,119

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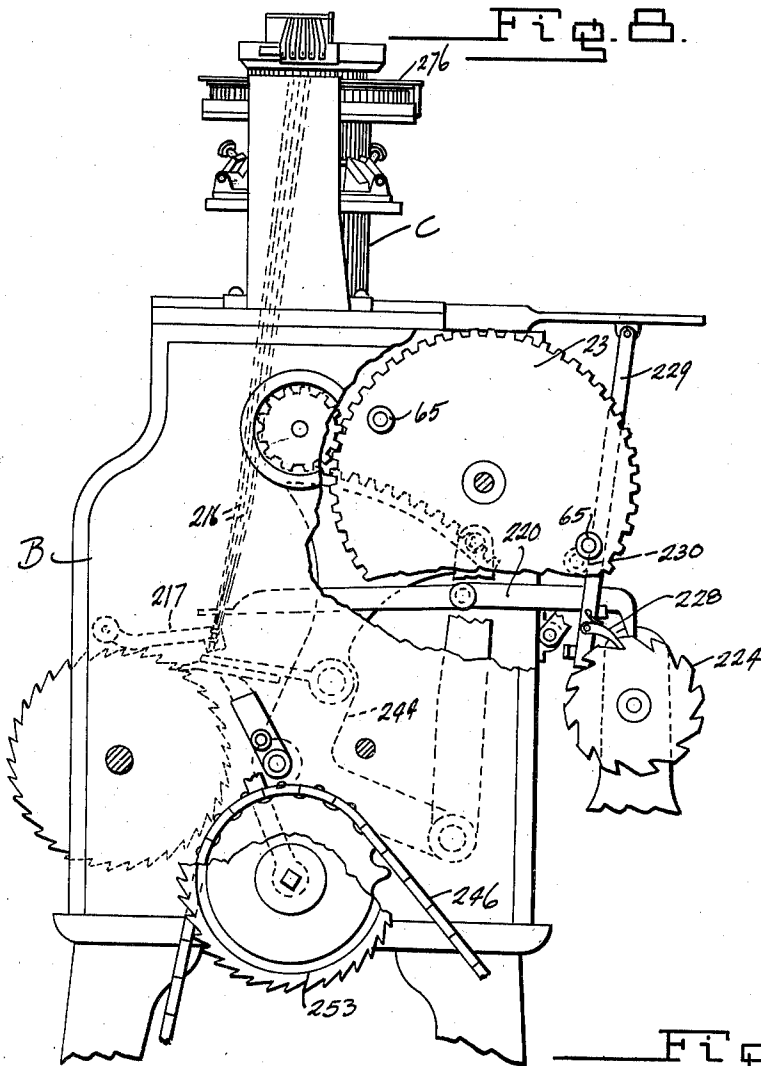
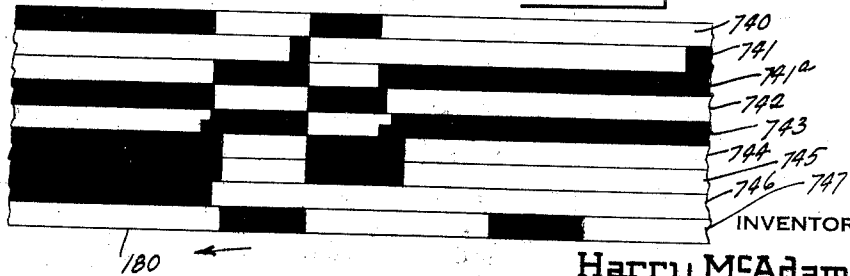


Fig. 20.



Harry McAdams

BY *Sancaster, Allwin and Rommel*
ATTORNEYS

June 27, 1939.

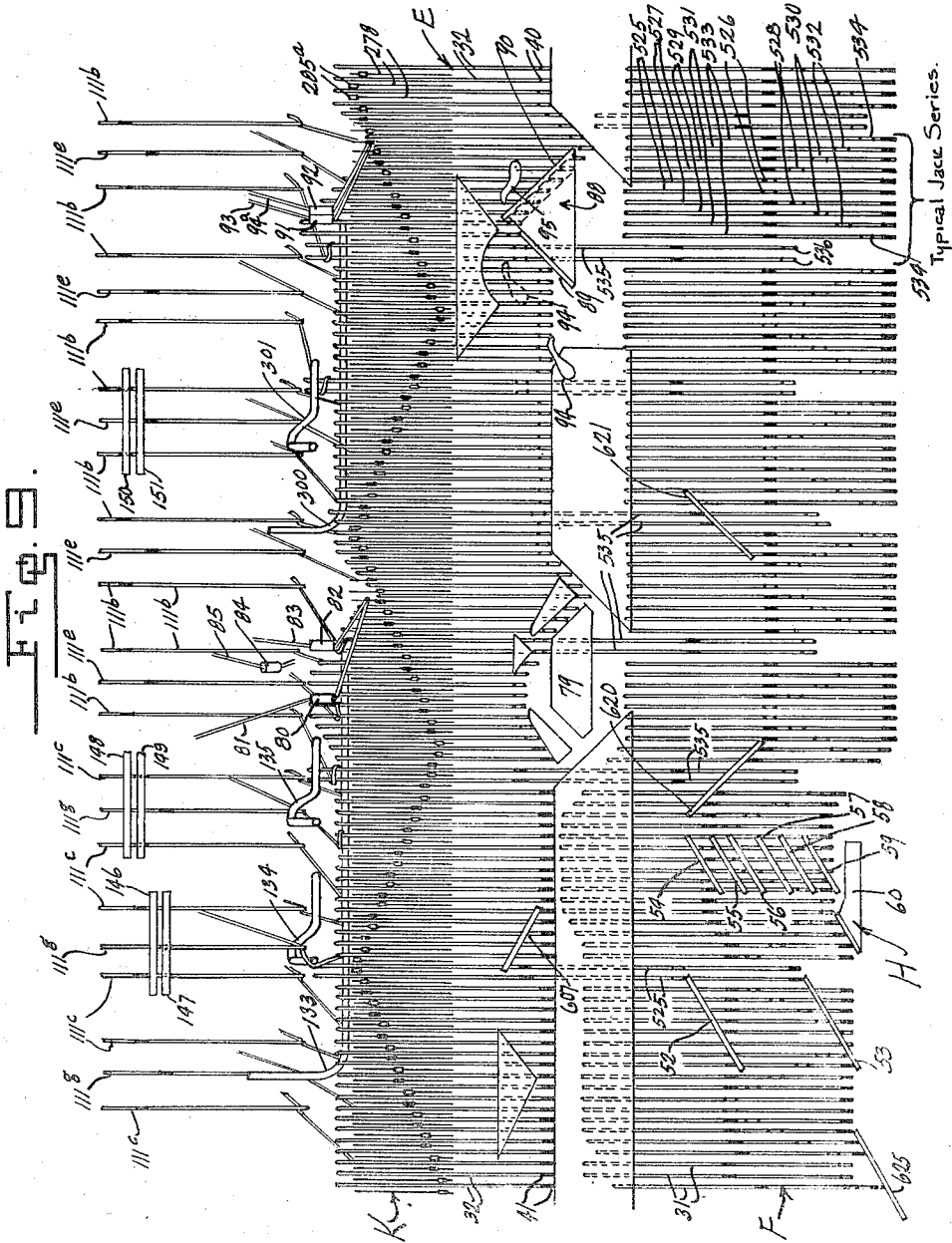
H. McADAMS

2,164,119

KNITTING MACHINE

Filed June 14, 1934

12 Sheets-Sheet 8



INVENTOR.
Harry McAdams

BY *Lancaster, Allario and Rommel*
ATTORNEYS.

June 27, 1939.

H. McADAMS

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KNITTING MACHINE

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Fig. 10.

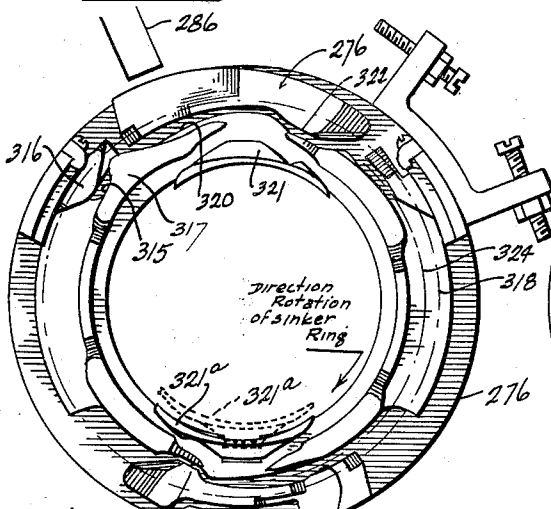


Fig. 11.

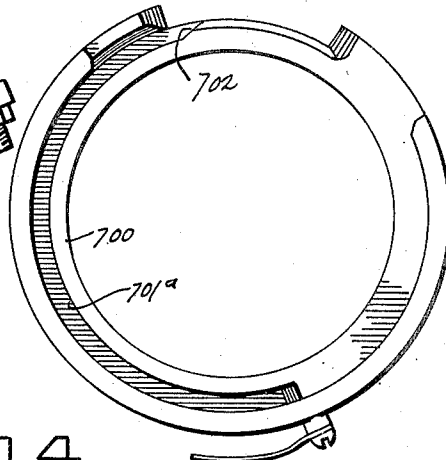


Fig. 12.

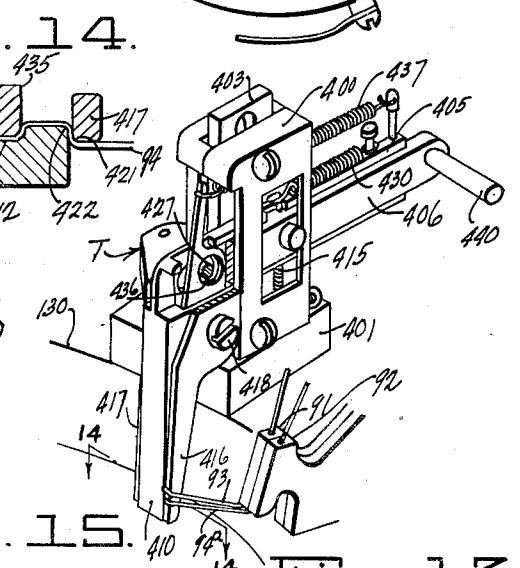
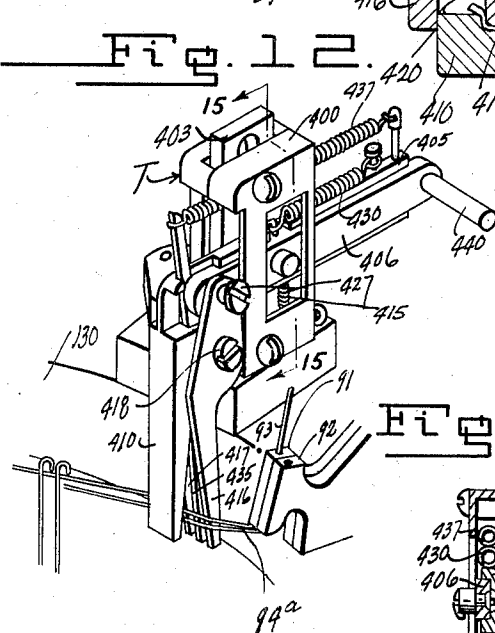


Fig. 14.

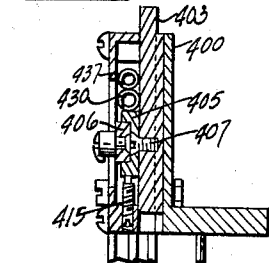
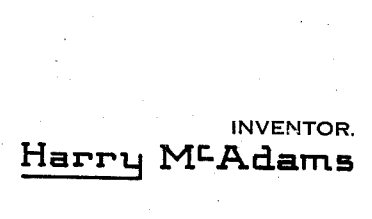


Fig. 15.



INVENTOR.
Harry McAdams

BY *Lancaster, Allison & Connell*
ATTORNEYS.

June 27, 1939.

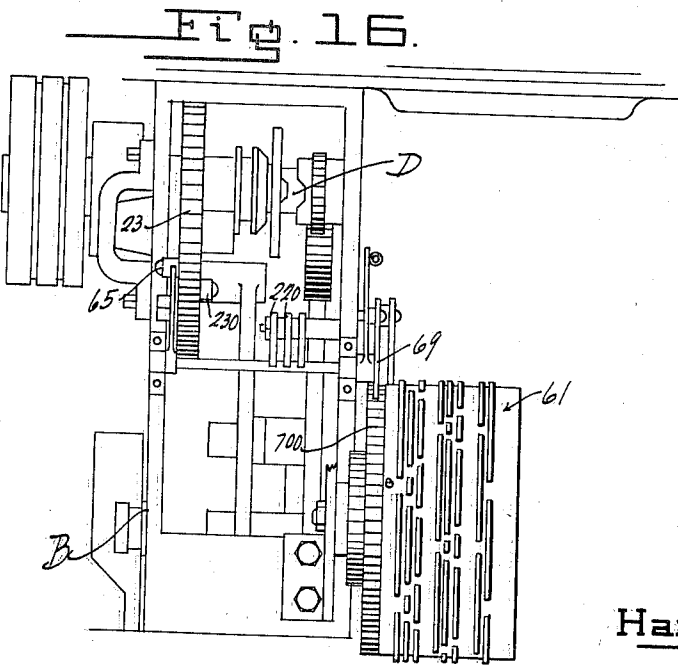
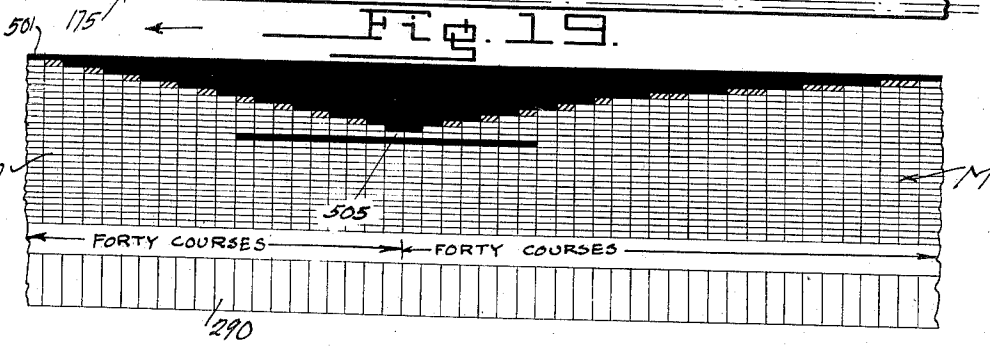
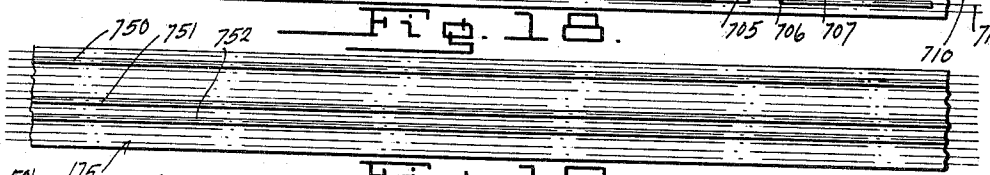
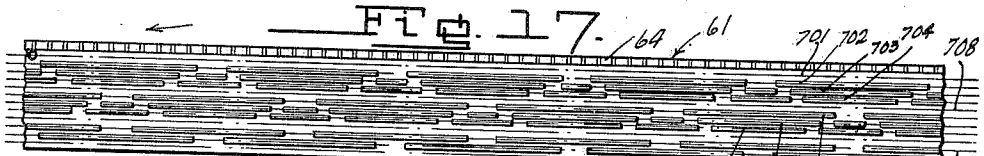
H. McADAMS

2,164,119

KNITTING MACHINE

Filed June 14, 1934

12 Sheets-Sheet 10



INVENTOR.
Harry McAdams

BY *Lancaster, Alburn & Rommel*
ATTORNEYS

June 27, 1939.

H. McADAMS

2,164,119

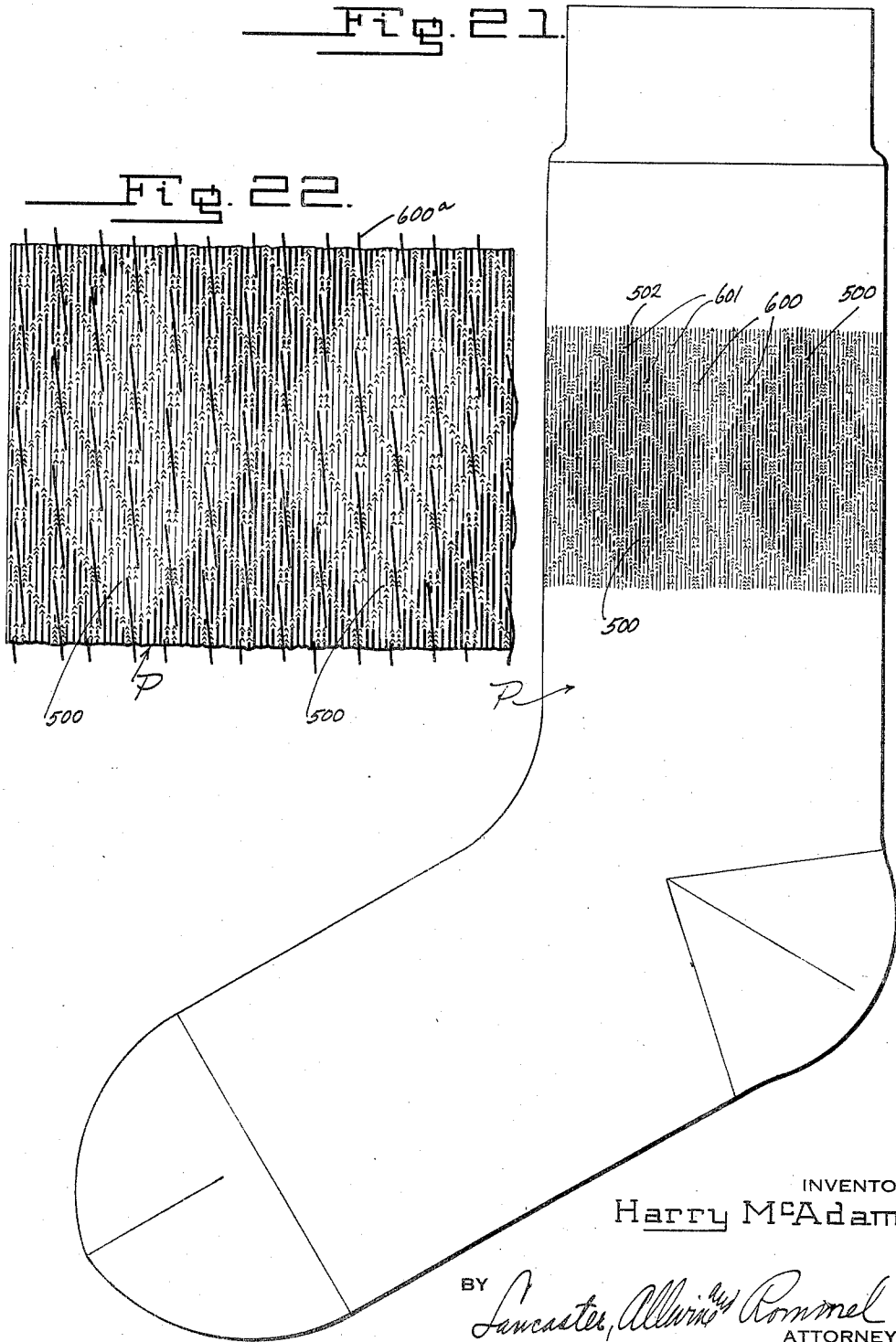
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Fig. 21.

Fig. 22.



INVENTOR.
Harry McAdams

BY *Lancaster, Allvin & Rommel*
ATTORNEYS.

June 27, 1939.

H. McADAMS

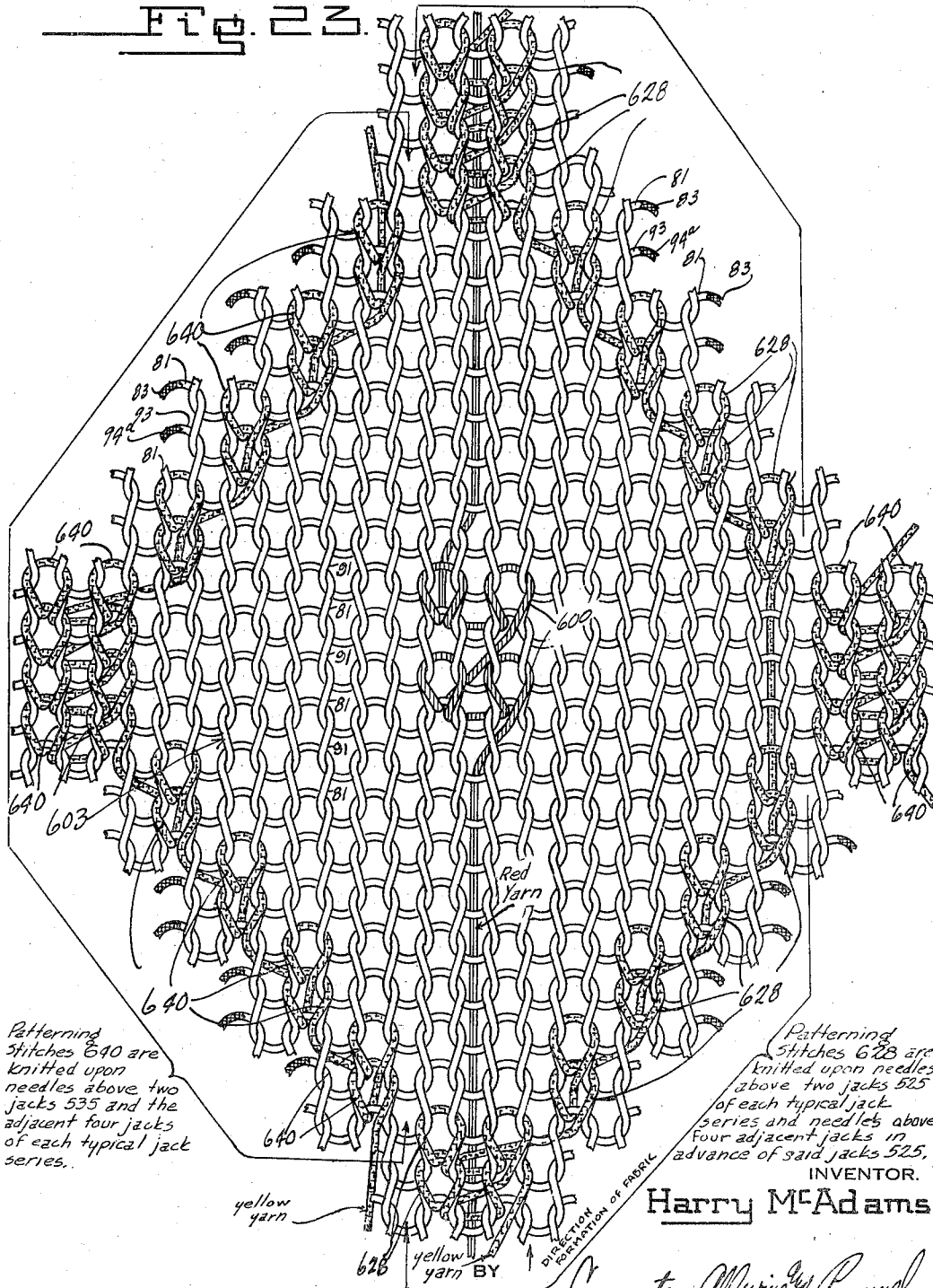
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KNITTING MACHINE

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Fig. 23.



Patterning stitches 640 are knitted upon needles above two jacks 535 and the adjacent four jacks of each typical jack series.

Patterning stitches 628 are knitted upon needles above two jacks 525 of each typical jack series and needles above four adjacent jacks in advance of said jacks 525.

INVENTOR.
Harry McAdams

Lancaster, Allison & Rommel
ATTORNEYS.

UNITED STATES PATENT OFFICE

2,164,119

KNITTING MACHINE

Harry McAdams, Reading, Pa., assignor to Nolde and Horst Company, Reading, Pa., a corporation

Application June 14, 1934, Serial No. 730,666

4 Claims. (Cl. 66—135)

This invention relates to improvements in knitting machines.

The primary object of the invention is the provision of an improved knitting machine whereon a plurality of feeds are provided and which embodies improved means for knitting a wide variety of patterns in seamless tubular fabric, such as hosiery; the improved machine embodying improved means to provide selective reverse plating, horizontal striping, and selective pattern striping and designing such as set forth in my co-pending application, Serial No. 662,354.

A further object of the invention is the provision of an improved hosiery knitting machine whereon seamless hosiery may be knitted; said machine using a plurality of feeds in combination with selective wrap stripe "color within color" patterning.

A further object of this invention is the provision of an improved binder and cutter mechanism for knitting machines.

A further object of this invention is the provision of improved reverse plating mechanism adaptable for a plural feed knitting machine.

Other objects and advantages of this invention will be apparent during the course of the following detailed description.

In the accompanying drawings, forming a part of this specification, and wherein similar reference characters designate corresponding parts throughout the several views,

Figure 1 is a front elevation of the improved knitting machine with certain parts thereof omitted, such as the bobbin support and yarn tensioning means associated therewith.

Figure 2 is a side elevation of the knitting machine shown in Figure 1 with certain parts omitted for the purpose of clarifying the improved details of the machine.

Figure 3 is a rear elevation of the improved knitting machine with certain portions omitted.

Figure 4 is a fragmentary side elevation of the machine at the opposite side from that shown in Figure 2, with portions of the knitting machine omitted to better illustrate other details.

Figure 5 is a vertical cross sectional view taken through the cylinder of the knitting machine, showing more particularly the improved yarn wrapping mechanism associated with the double feed knitting machine.

Figure 6 is a cross sectional view taken through the knitting machine above the wrapping finger supporting head.

Figure 7 is a plan view of the latch ring of the improved knitting machine, showing yarn

feeding, guiding, and cutting and binding details associated with the double feed knitting machine.

Figure 8 is a fragmentary side elevation of the knitting machine showing certain operating details within the machine for controlling the yarn feed fingers.

Figure 9 is a developed view of the needle, cam and yarn feed and wrapping finger mechanism.

Figure 10 is a bottom plan view of the sinker cam ring showing the cam construction for controlling the double feed of the sinkers and sinker jacks of the reverse plating attachment.

Figure 11 is a top plan view of the bottom ring of the sinker ring construction showing certain guide grooves and details essential for the improved double feed knitting machine.

Figure 12 is a perspective view of an improved binding and cutting mechanism which is used on the double feed knitting machine of this application immediately following the second yarn feed.

Figure 13 is a perspective view of the binder and cutter mechanism of Figure 12, after the same has acted to cut the yarn and bind it.

Figures 14 and 15 are cross sectional views taken substantially on their respective lines in Figures 13 and 12.

Figure 16 is a fragmentary rear view of the bottom of the knitting machine, showing more particularly the main pattern drum and certain controlling details of the same.

Figure 17 is a developed view of the cam layout upon the lower rear pattern drum.

Figure 18 is a developed view of the cam layout for the upper rear drum.

Figure 19 is a developed view of the cam layout upon the reverse plating drum.

Figure 20 is a developed view of the pattern layout upon a front lower drum of the machine.

Figure 21 is a side elevation of a stocking, showing a portion of the plating and selective pattern wrapping which may be provided in a stocking, with the improved machine of this application.

Figure 22 is a fragmentary inside view of a section of the stocking, showing more particularly the plating, wrapping yarns and the float portions of the latter.

Figure 23 is an enlarged section of the fabric of Figures 21 and 22, showing the face thereof and the knitted stitches of the various yarns forming the plating, reverse plating, and complementary selective needle wrapped patterning yarns.

In the drawings, wherein for the purpose of illustration is shown a preferred form of the im-

proved knitting machine, and by way of example a piece of fabric which may be knitted thereon, the letter A may generally designate a knitting machine which may include a frame B; cylinder C; means D for operating the cylinder and driving machine; a set of needles E; a set of jacks F cooperating with the needles E. Means G may be provided for selective feed of wrapping and striping yarns to the needles of the machine, with which may cooperate means H for selective control of the jacks and needles of the machine in order that the latter may take the yarns from the means G. A set of web holders K may be provided, with which may cooperate reverse plating means for the selective reverse plating of designs in the fabric. A horizontal striping attachment O may also be provided.

The drawings illustrate only one sample of fabric P, and it is to be understood that a wide variety of reverse plated, wrap striped and designed seamless fabric may be knitted upon the improved machine, as desired.

The improved knitting machine is generally of the Banner type, as disclosed in U. S. Patent 933,443. Its frame B has a supporting bed 26 upon which the cylinder C of the machine is revolubly mounted, as shown in Figure 5. The means for rotating and oscillating the cylinder C are of the usual type. The means D for driving the cylinder includes a main shaft 21, shown in Figure 3, provided with the usual gearing and clutch mechanism connected with the cylinder gear 22, shown in Figure 5. The drive mechanism also controls a gear 23 conventionally known as a "104" gear.

The cylinder C may be of the character set forth in my co-pending application, Serial No. 662,354. It is provided with the usual needle grooves for receiving the needles and jacks of the sets E and F.

The needles of the set E, individually indicated at 32 are preferably of the latch type, and half of them are provided with long butts 40 and the remainder with short butts 41. The short butts are indicated in solid black in Figure 9 of the drawings. The set of jacks F cooperate with the needles of the set E, and of course an individual jack 31 is provided for each needle 32. The jacks are of the character set forth in my above identified co-pending application, and may be provided with a desired arrangement of frangible butts so that they may be selectively actuated for elevating predetermined needles in order that various striping or design providing yarns may be fed thereto by the means G to be subsequently described.

The jack actuating means H preferably includes a pair of cam supporting blocks 50 and 51, shown in Figure 1 of the drawings, each of which is provided with a vertical series of slots arranged radially to the cylinder. Independently movable horizontally positioned cams are slidable therein for actuation upon the butts of the jacks 31 of the set F in order to control said jacks with relation to the needles. Preferably eight slots are provided in each cam block, although the number may vary as desired.

For the knitting of the sample of fabric P shown in Figures 21, 22 and 23, the block 50 is provided with upper and lower jack actuating cams 52 and 53. The block 51, on the other hand, is preferably provided with similar cams 54 to 60 inclusive. Each of the jack actuating cams in the blocks 50 and 51 is provided with an angular sloping head adapted to ride into and out of en-

gagement with respect to the butts of said jacks, at different levels, for obvious purposes.

The cams 52 to 60 are normally spring urged into butt engaging and jack elevating position, and may be moved out of such position by means of suitable levers controlled off of pattern mechanism to be subsequently described.

The jack actuating means H furthermore includes a pattern control drum 61, shown in Figures 2, 3, and 16 of the drawings, having a pattern lay-out, designated in the developed view shown in Figure 17, for the purpose of actuating the various jack cams thru a system of levers in accordance with the teaching set forth in my co-pending applications Serial Nos. 558,798 and 591,689. The lugs of this drum comprising the lay-out may be detachable and removable for the purpose of suiting the lay-out to any desired pattern to be knitted in the fabric.

The drum 61 is actuated in a step-by-step movement off of the cylinder driving means of the machine, in the manner set forth in my co-pending applications above mentioned. Briefly the drum has a ratchet wheel 64 with sixty teeth about its circumference. The gear wheel 23 is provided with diametrically opposed lugs 65 thereon, shown in Figure 8 of the drawings, positioned to actuate a lever 66, shown in Figure 4. This lever is keyed upon a shaft 67 which has an arm 68 keyed therewith, as shown in Figure 2, controlling a pawl 69. The pawl operates upon the teeth of the ratchet wheel 64 in a manner which has been set forth in my above identified co-pending applications for the purpose of intermittently advancing the drum 61.

Means is provided to cut the advancing mechanism of the drum 61 out of operation, that is, to prevent rotation of the drum 61. This means may be generally indicated at S. It has been described in detail in my co-pending applications above referred to, and will not be specifically described herein. It is sufficient to say that this mechanism is actuated off the pattern chain 78, shown in Figure 1 of the drawings, for selectively throwing the drum in or out of operation, as the pattern demands.

Referring to the yarn wrapping attachment as adapted for a double feed type of knitting machine, such as herein provided, by reference to Figure 9 of the drawings it will be seen that a main set of stitch cams 79 is provided, which may actuate the needles of the knitting machine for producing fabric knitted with one or more yarns. As shown in the drawings a feed device or finger 80 is provided for feeding a body yarn 81 to the needles in advance of the knitting point produced by the stitch cams 79, and another feed device or finger 82 may also be provided for feeding another body or main knitting yarn 83. Other feed fingers may also be provided at this point, such as a feed finger 84 for feeding a heel and toe knitting yarn 85. Of course the usual picks may be provided in cooperation with the stitch cam arrangement 79.

Another set of stitch cams 88 may be provided in cooperative relation with the needles of the set E, consisting of needle elevating and needle lowering cams 89 and 90 respectively, with which may be associated yarn feed devices or fingers 91 and 92, corresponding respectively to feed fingers 80 and 82 above mentioned, for needle feeding yarns 93 and 94, which may correspond respectively to the yarns 81 and 83. The usual picks 94 and 95 may be duplicated at the stitch cam arrangement 88, and the pick 94 is

to be particularly noted since it is normally maintained inactive in an unusual position during knitting of the striping or design patterning in the fabric.

The means G includes a yarn wrapping attachment and means for actuating the same, substantially as set forth in my co-pending application, Serial No. 591,689. Generally the same includes a bracket 90^a rotatably supporting a bobbin stand and drive gearing therefor. The bobbin stand has a rotary spindle 91^a in axial alignment above the cylinder. A yarn feed finger head or support 102 is keyed to the shaft 91^a, as set forth in my above identified co-pending applications, and the yarns extend from the bobbins in the bobbin stand downwardly through suitable passageways in the head 102. The head 102 is provided with slots vertically provided therein, wherein are disposed individual yarn guide and feed fingers 111. They are oscillatively fulcrumed thereon. At their lower ends said fingers are positioned in spaced relation above the hook ends of the needles, and may move from the inner to the outer side of the circular line of needles for the purpose of wrapping the yarns thereon upon the needles. Each guide finger 111 at its lower end is apertured to receive the particular yarn therethrough. Other details of operation and arrangement of these feed fingers are similar to that described in my copending application, Serial No. 662,354, and need not be specifically described herein.

The means for actuating the fingers comprises, as is best shown in Figure 6 of the drawings, a pair of cam supporting blocks 143 and 144, and a third cam supporting block 145. The blocks 143 and 144 are securely mounted upon a pivoted supporting arm 145^a. Each of the blocks 143, 144, and 145 are suitably slotted to slidably receive horizontally positioned cams. The number of these slots may vary, but as shown in the drawings four are provided in each cam block, since it is intended, in the present machine, to provide four levels of butts upon the yarn feed fingers 111. It is shown in Figure 1 of the drawings that the cam block 143, and also the cam block 144, are each provided with four cams. For the particular pattern P, however, as can be seen from Figure 9 of the drawings, only the two lower cams 146 and 147 of the cam block 143 are active; the two upper cams 148 and 149 of the cam block 144 are active, and the two upper cams 150 and 151 are provided in the two upper slots of the cam block 145 at respectively the same levels as the cams 148 and 149, for purposes to be subsequently described.

It can readily be understood from Figure 6 of the drawings that springs normally urge the cams of the blocks 143, 144, and 145 away from the butts of the yarn feed fingers 111. In order to move the cams into operating relation with the butts of the fingers 111, levers 158 are pivoted at 159 for the cams of the block 143; levers 160 pivoted at 161 are provided for the cams of the block 144, and levers 162 pivoted at 163 are provided for the cams of the block 145. The pivoted support 145^a is of the same nature as the similar support provided in my above identified co-pending application Serial No. 662,354, and need not be further described. The cam actuating levers 158, 160 and 162 have pivoted therewith connecting rods 165 suitably supported or guided upon the machine. The latter are connected with suitable bell crank levers 167, shown in Figures 2 and 6 of the drawings. The upper

ends of these bell crank levers are offset at various distances for acting against the pins or other means upon the ends of the connecting rods 165. The opposite ends of the bell crank levers 167 are pivotally associated with length adjustable push rods 170, or with other connecting rods 171 and actuated off of suitable patterning means upon drums of the knitting machine to be subsequently mentioned. For the connecting rods 170 plungers 172 are provided, reciprocable within individual passageways of an eccentrically supporting block 173. This block is mounted to turn upon a horizontal axis, and in a manner and for a purpose more specifically set forth in my co-pending application Serial No. 662,354. These plungers 172 are actuated by suitable lugs or in suitable depressions provided in an upper rear drum 175 provided upon the knitting machine, as shown in Figure 2 of the drawings. On the other hand the connecting rods 171 are pivoted to a suitable lever 176 pivoted intermediate their ends at 177 upon the knitting machine; said lever 176 being connected by a suitable connecting rod to one of a number of levers 178 pivoted at 179 upon the knitting machine, and actuable off of a lower front drum 180.

The drums 61 and 175 are synchronously actuable through gearing 182.

The drum 175 is driven in the same direction and at the same speed ratio as the drum 61, and the feed of patterning yarns to the needles is cut out under certain circumstances by moving the plunger mounting block 173 in a manner set forth in my above described co-pending application Serial No. 591,689.

It should be particularly noted that the cams mounted in the blocks 143 and 144 are provided for directing variously colored or otherwise contrasting yarns upon the needles of the knitting machine in advance of the main knitting cam set 79, for producing wrap striping or other selected pattern designing in the fabric being knitted, such as set forth in my co-pending applications above mentioned. On the other hand the cam block 145 is so mounted that the cams thereof actuate the yarn feed fingers of the wrap striping mechanism for the feeding of various yarns upon selected needles of the knitting machine in advance of the stitch cam set 88 and succeeding the stitch cam set 79, so that the wrap striping or patterning yarns may be fed upon the needles of the knitting machine for knitting into succeeding courses of the fabric being knitted.

The operating means for each cam mounted in the blocks 50 and 51 includes a lever 191 pivoted at 192 upon the side of the machine, intermediate its ends, as shown in Figure 2 of the drawings. These levers 191 have one end thereof riding on the drum 61, and the opposite end is suitably connected by a connecting rod 193 to an end of a bell crank lever 194. The latter levers are pivotally mounted upon suitable brackets upon the machine, in two series below the two sets of jack actuating cams, and in such position that the upper ends of the bell crank levers 194 operate against pins of said cams. Suitable springs are provided for normally urging the cams or other devices, which said bell crank levers actuate, in the direction of the cylinder of the machine. The lugs on the drum 61 maintain the cams actuated off the levers 194 inoperative, and when the drum ends of the levers 191 drop into depressions on the drum 61 between the lugs, the springs of the various cams and devices which are actuated off of the bell crank lever 194 are

urged into operative relation to the various parts which they actuate. Mainly the cams of the blocks 50 and 51 are provided to raise and lower the jacks and needles of the cylinder of the knitting machine into and out of operative relation with respect to the striping and design patterning yarns controlled off of the feed finger head 102. The specific sequence in which the cams are actuated to produce the specific fabric P will be subsequently mentioned.

The levers 191 have individual springs 198 to keep the ends thereof in engagement with the drum 61. Means 199 actuated off a lever 200, which is in turn actuated off the drum 180, is provided for throwing all of the levers 191 out of operating relation with respect to the drum 61 during certain knitting operations.

The horizontal striping mechanism 0 may be the same as set forth in my above identified co-pending application Serial No. 662,354, for the purpose of feeding differently colored or otherwise contrasting yarns to the fabric. The yarn variation may be selective, and a large number of yarn changes may be effected with the horizontal yarn striper or change mechanism. The striping or plating yarns may be provided in any desired numbers at the two feeds of the machine, as can readily be appreciated. Thus, at the main feed of the machine additional feed fingers than those shown at 80 and 82 may be provided, for horizontal yarn change, and similarly at the auxiliary feed other additional feed fingers than those shown at 91 and 92 may be provided for selective horizontal yarn change. In Figure 7 is shown a latch ring having a large number of yarn feed fingers. They are pivoted upon a common pivot and spring urged in the usual manner into feeding position with respect to the needles. As shown in Figure 8 of the drawings the usual connecting wires 216 are provided for the yarn feed fingers upon the latch ring, the lower ends thereof being connected in the usual manner to levers 217 and actuated in the usual manner. When horizontally striping the fabric the feed fingers controlling the horizontal yarns are selectively disposed in operating and feeding relation to the needles of the machine by means of levers 220, as shown in Figures 3 and 8 of the drawings, pivoted intermediate their ends. At their forward ends they are connected with the wires 216, and at their opposite ends they are controlled off a pattern drum 223 for the purpose of rocking the proper levers 220 in order to throw the desired yarns into and out of operating relation to the needles, for the obvious purpose of providing horizontal striping. This horizontal striping attachment has been more specifically detailed in my above identified co-pending application Serial No. 662,354. It has not been brought into play in the production of the sample of fabric P.

The means for advancing the drum 223 is the same as described in my above identified co-pending application Serial No. 662,354, and generally including a ratchet wheel 224 keyed on the same shaft as the drum 223. The ratchet wheel 224 is intermittently advanced by pawl 228 mounted on a pivoted lever 229, as shown in Figure 8. The lever 229 is actuated off a lug (provided in desired numbers), shown at 230 on the "104" wheel 23. A detent 231, in the shape of a bell crank lever, is pivoted on the machine, as mentioned in said co-pending application, for the purpose of holding the pawl 228 inoperative with respect to the advancing lug 230 of the gear 23, under certain circumstances. The control of

this detent lever 231 is maintained through an operating lever 260 off of suitable lugs upon a pattern chain 246. The pattern chain 246 is advanced step by step in synchronism with operation of the knitting machine, by a suitable pawl 251, adapted to act upon the teeth of a ratchet wheel 253 keyed on the same shaft as the sprocket wheel of the chain 246. As has been more specifically described in my above co-pending application the pawl 251 is actuated in synchronism with rocking movement of the conventional oscillating segment 244 of the knitting machine, so that both pattern chains 78 and 246 are advanced for the same distances and in a cooperative relation; it being understood that the chain 78 is advanced in the manner usual upon the Banner type of knitting machine.

The detent 231 is tripped by pulling it downwardly by the lever 260, so that the pawl 228 may be brought into proper position for actuating the horizontal striper drum. The said lever 231 is held in such inoperative position by means of a restraining lever 265, which is operated off a pattern control mechanism 271 keyed on the same shaft as the drum 223, and in a manner and for a purpose which is more specifically set forth in my last mentioned co-pending application.

Referring generally to the reverse plating attachment of the improved machine A, the same consists of a set of web-holders K and the means M for actuating the same. This reverse plating attachment is generally the same as set forth in my co-pending application Serial No. 662,354, except the same has been altered to reverse plate the yarns in those courses of stitches which are knitted in the fabric at the extra feed upon the improved double feed machine, so that reverse plating is accomplished in succeeding courses knitted in the fabric of the machine at a single revolution of the cylinder of the machine.

It will be noted from Figure 5 of the drawings that the web-holders indicated at K are provided with butts acted upon by suitable cams provided upon the cam ring 276. These sinkers or web-holders are mounted in the usual manner for radial sliding movement in individual grooves of the web-holding bed ring 277. Individual jacks 278 are provided for the individual web-holders K, in each groove of the web-holding bed ring 277 for controlling the position of the web-holders and the proper tensioning of the body and plating yarns in order to effect normal and reverse plating. The jacks 278 each include the horizontal bar portion 280 upon which the respectively associated sinker is slidably mounted. The bar 280 has a shoulder which upon radial inward movement of the jack engages the sinker so that it will be pushed radially inward for reversing the normal plating. This bar portion 280 is provided with a depending butt 281 which limits the radial outward movement of the jack. Each jack also includes an upstanding butt 282 which is cam actuated off of the cam ring 276 in a manner which will be subsequently mentioned. The jack 278 also includes the depending bar or leg 284 along which butts 285 are placed at desired levels and adapted for actuation by selective cam device of well known construction. This selective cam device consists of a plurality of longitudinally slidable plunger cams 286, shown in Figure 1 of the drawings, suitably mounted for horizontal movement upon the knitting machine in the vicinity of the main knitting cam set. The cams 286 are located at different levels for actuation upon the butts 285 of the jacks 278 in

order to vary the reverse plating pattern, as desired.

The cams 286 are selectively controlled by a lug arrangement upon a rotary pattern drum 287.

5 The manner in which these lugs are placed upon the drum may vary widely, although it is preferred to fabricate the drum so that the lug arrangement may be made selective, for pattern variation. The drum 287 is mounted upon a base
10 288 eccentrically pivoted (not shown) so as to move the lugs of the drum out of active cooperation with the cams during knitting of the heel and toe, and partway out during knitting of the sole. These are conventional features and need
15 not be further described. The drum is intermittently advanced by a pawl and ratchet arrangement comprising a ratchet wheel 290 upon the drum as a part thereof, shown in Figure 1, actuated in usual manner, as has been set forth
20 in my above identified co-pending applications Serial Nos. 662,354 and 703,483, and in a manner well known in the art to which this invention relates. It is sufficient to say that the pawl advances the drum 287 a distance of one tooth for each engagement of a lug 65, shown in Figures 4
25 and 8 of the drawings, against the pawl advancing leverage mechanism of the reverse plating attachment, as shown in Figure 4. Thus the pattern drum 287 is advanced a distance equal
30 to the distance between the centers of adjacent pattern lugs for each two knitted courses of the fabric. This arrangement may vary if desired.

Referring again to feed of the striping and patterning yarns upon selected needles of the
35 machine, off of the fingers 111, the said yarns are assisted in being wrapped upon the needles in a manner similar to that set forth in my co-pending applications, Serial Nos. 591,689; 619,779, and 662,354. A latch ring 130 is pivoted in the
40 usual manner at 131. As shown in Figures 5, 7 and 9 of the drawings a guide wire 133 is attached upon said latch ring and curved closely along the inside of the line of knitting needles at a
45 location below the hooked ends thereof, when the latter are lowered, to prevent the yarns fed from the fingers 111, as actuated off of the cams of the blocks 143 and 144, from becoming entangled
50 with the web-holders and needles other than those intended. Yarn guide wires or bars 134 and 135 are respectively provided upon the latch ring for the series of cams in the blocks 50 and 51,
55 in order to cooperatively assist the yarns in wrapping upon a desired number of needles elevated by any of the cams of the respective blocks 50 and 51, in accordance with the selective arrangement described in my above identified co-pending applications. Each of these wires is mounted
60 upon a plunger 136, slidable in suitable bearings provided upon the latch ring, and spring urged to a normally retracted relation with respect to the feed of yarn to the needles. These plungers are of the nature set forth in my above mentioned co-pending application Serial No. 662,354. The yarn guide wires 134 and 135 are adapted
65 for simultaneous operation into either operative or inoperative relation to the knitting needles. This may be controlled by means of a bell crank lever 140 having a top plate 142 operable against the plungers 136. The bell crank lever 140 is
70 pivoted on the same axis as the bell crank levers 194 above described and actuated thru a suitable lug arrangement upon the lower front pattern drum 180, as shown in Figures 1 and 2 of the drawings.

75 Inasmuch as it is desired to provide means for

wrapping or otherwise placement of design providing yarns in wrapped relation upon the needles of the machine, in those courses of the fabric which are knitted at the extra stitch cam arrangement 88, similar guide and control means
5 for the said striping and patterning yarns must be provided to cooperate with those yarn feed fingers 111 which are actuated off of the cams 150 and 151 of the cam block 145. Accordingly I provide a guide wire 300 which is similar to the
10 wire 133 above mentioned, having a curved bar portion extending closely along the inside of the line of needles at a location below the hooked ends of the needles when the latter are lowered, to prevent yarn from the feed fingers 111 becoming
15 entangled with the web-holders and needles other than those intended. Similarly, a yarn guide wire or control member 301 is provided, reciprocally mounted upon a suitable plunger 136^a, similar to the plungers 136 above
20 mentioned, and actuable by means to be subsequently described into and out of operating relation upon those striping and patterning yarns which are fed to the needles of the knitting machine off the feed fingers 111 as controlled by the
25 cams 150 and 151. If desired additional cam sets and guide or control wires or members may be provided for the knitting of the patterning yarns with a "color within color" arrangement at the extra feed of the knitting machine, in the same
30 manner as is provided for the knitting of "color within color" in those courses of the fabric which are produced at the regular feed of the knitting machine. Only one set of yarn finger controlling cams and yarn guide wire controlling arrangements have been provided at the auxiliary feed
35 of the knitting machine, to avoid a complicated illustration and description of the knitting machine.

As is shown in Figure 2 of the drawings the
40 plunger 136^a is actuated by a bell crank lever 302 and a connecting rod 303 operating off one of the levers 178 of the pattern drum 180. The lug arrangement on the drum 180, to be subsequently mentioned, throws the plunger 136^a inwardly for
45 the purpose of moving the control wire 301 into yarn guiding position in order that the yarns which are fed onto selected needles by means of the cams 150 and 151 will be properly held in position to take the required elevated needles.
50 Thus, it can be seen that striping and other design producing yarns may be selectively provided in the courses of fabric which are knitted at the auxiliary or extra feed of the knitting machine.

Referring to the reverse plating mechanism,
55 and particularly the cam construction of the sinker ring cam plate 276, the same is altered over conventional construction in that means is provided to reverse plate in the knitted courses produced by the yarns at the extra feed in the
60 same manner as the previously knitted course produced by the knitting yarns at the main set of stitch cams. In Figure 10 is shown a cam arrangement upon the under side of the sinker ring cam plate 276. The direction of rotation
65 is designated by the arrow, and the position of the reverse plating cams 286 for actuating the sinker jacks 278 is also shown. The cam ring 276 is of course held stationary in the usual manner, and the butts 282 of the sinker jacks 278 are
70 guided through a channel 315 between the cams 316 and 317 to bring said jacks to a position where the butts 282 are positioned equi-distant from the center of the cam ring. The dot and dash line 318 designates the path that the butts
75

will travel after riding through the channel 315. Of course the reverse plating cams 286 are then selectively actuated off of the lugs of the pattern drum 287, and this throws the jacks whose

5 sinkers are to reverse plate into the groove 320; the remainder of the jacks riding with their butts on the arc designated by the dot and dash line 318. The sinker cam 321 of course radially moves

10 the sinkers outwardly, and at the cam projection 322 those jacks which were pushed in by the reverse plating cams 286 will be actuated (by the cam projection 322) for a radial inward movement, which will likewise move the respective

15 sinkers therewith and cause reverse plating of yarns to be accomplished at the knitting point, due to yarn tension variation. Those sinker jacks which were acted upon by the cam projection 322 to cause reverse plating upon predetermined needles will then ride along an arcuate

20 line, designated by the dot and dash line 324 in the drawings, and the jacks not actuated by the cams 286 will continue to ride along the path indicated by the previously designated dot and dash lines 318. The jacks riding along the path 324

25 will then enter a cam groove 326 and continue along this path until they are actuated by the cam projection 327 where reverse plating is again effected of those yarns 93 and 94^a fed onto the needles at the knitting point succeeding the extra feed fingers 91 and 92. Thus it should be

30 noted that the same jacks actuated upon by the reverse plating cam projection 322 in the same revolution of the knitting machine cylinder will also be acted upon by the cam projection 327, so

35 that the stitch loops of the yarns at both feeds of the knitting machine will be similarly reverse plated in those two courses which are knitted during any revolution of the knitting machine cylinder. Of course the usual pressure cams are

40 provided for depressing the jacks whose butts are not actuated upon for reverse plating, that is, those that ride along the dot and dash lines 318. The cams 316 and 317 will then bring all of the butts into the groove or channel 315 in readiness

45 for a selected actuating of the jacks by the reverse plating cams 286 for a selected reverse plate knitting of stitches in succeeding courses of the fabric.

The sinker cam 321 is duplicated at a diametrically opposed point on the cam ring 276, at

50 321^a. This cam 321^a, however, is radially movable so that it may be radially cammed inward during knitting of the heel and toe in order to miss the sinkers, or rather the butts thereof, so

55 that the sinkers will hold the stitch and prevent the riding thereof upwardly upon the needles. This sinker cam 321^a is shown in its proper position for knitting during full circular rotation of the cylinder, but when knitting the heel and toe it is moved to the dotted position

60 shown in Figure 10, in a manner to be subsequently described.

The cam 321^a has a top plate or bar 330 designated in Figures 1, 2 and 10 of the drawings, which at the free end thereof has a depending

65 pin 331 spring urged at 332 so that the sinker cam 321^a is normally positioned inoperative, that is, in the dotted position shown in Figure 10. The supporting bar 330 has a notch 334 therein, shown

70 in Figure 10 of the drawings, into which the depending end 335 of a lever 336 enters. The lever 336 is pivoted at 337, shown in Figure 1 of the drawings, on the supporting block 339 wherein the extra yarn feed fingers 91 and 92 are

75 pivoted.

The yarn feed fingers 91 and 92 have outwardly projecting ends, and below them the free end of an operating lever 340 is disposed. This operating lever 340 is pivoted at 341 and upon upward movement at said free end it will throw the feed

5 fingers 91 and 92 into position for feeding yarn to the needles of the knitting machine, that is, in the position shown in Figure 9. Upward movement of the outer ends of the feed fingers

10 91 and 92 will also throw the aforesaid lever 336 upwardly, since a portion thereof is disposed in resting relation above the outer ends of the feed fingers 91 and 92, and this in turn will throw the

15 cam 321^a into operating relation upon the sinkers, that is, in the full line position shown in Figure 10 of the drawings. The parts thus affected are shown in Figures 1, 2 and 10 of the drawings. As is also shown in Figure 2 of the drawings the lever 340 is connected for operation

20 through a connecting rod to one of the drum actuated levers 178. In addition to this dual function of the lever 340, the same has another function, namely, in throwing the pick 94

25 disposed at the additional stitch cam arrangement 88 from its normal operative position indicated in dotted lines in Figure 9, to an out of the way position indicated by the full line position thereof, in Figure 9. This operation is performed through the intermediary of a bell crank

30 lever 350 actuating against a pin 351 on the arm of the pick 94; the other end of the bell crank lever being connected by a rod 352 to the operating lever 340 as shown in Figure 2 of the drawings. Thus actuation of the lever 340 will

35 perform the triple functions of moving the feed fingers 91 and 92 into inoperative position; move the sinker cam 321^a into inoperative position, and move the pick 94 into operative position with respect to the butts of those needles active during cylinder reciprocation.

The additional stitch cam block 88 is pulled out of operating relation with respect to the needle butts during knitting of the heel and toe of the

40 stocking. To that end said stitch cam device 88 is radially movable with respect to the cylinder. It has a depending pin end 360, shown in Figure

45 1 of the drawings, actuated by means of a lever 361, shown in both Figures 1 and 2 of the drawings. The lever 361 is pivoted intermediate its ends at 362, shown in Figure 2. This lever 361

50 is operated at its end remote from the stitch cam 88 by means of one of the bell crank levers 194, and said bell crank lever 194 is actuated in turn off of a lug strip upon the drum 180, as will be

55 subsequently mentioned. A spring normally urges the cam block assemblage 88 into operating relation with the butts of the needles, that is, into the position shown in Figure 9 of the drawings.

An improved yarn cutting and binding device T is provided, shown in detail in Figures 12, 13,

60 14 and 15 of the drawings, and in position upon the machine in Figures 1 and 2 of the drawings, for the purpose of cutting and binding the yarns

65 93 and 94^a during the knitting of the heel and toe of the stocking, although this improved yarn cutter and binder may be used in any other environment upon a knitting machine or wherever

70 desired. It includes an additional safety factor in the secure binding of the yarn without injury or liability of breakage thereof. It consists of a supporting frame 400 fixedly secured upon a

75 block 401 which may be detachably connected to any part of the knitting machine. In the present invention it is connected upon the top of the latch ring, as shown in Figures 1, 2 and 7 of the

drawings. A vertically slidable frame 403 is in turn carried in the frame 400. This vertically slidable frame is shown in Figures 12, 13 and 15 of the drawings. It has attached thereto a horizontal bar 405, which is channeled on one side for slidably receiving a reciprocating bar 406. At its inner end the bar 405, which is secured to the vertically slidable frame 403, as by a screw 407, shown in Figure 15, is provided with a depending cutter and binder portion 410, which is shown in cross section in Figure 14. Portion 410 has a sharp cutter edge 411, and upon its side facing the inner periphery of the latch ring it is provided with a binder groove 412. Upon vertical movement of the slidable frame portion 403 the portions 405 and 410 move therewith. The said parts are limited in their downward movement by an adjustable screw 415, shown in Figure 15, so that the lower cutting and binding end of the cutter and binder mechanism may be lowered or elevated to any desirable level suitable for the purpose for which the cutter and binder mechanism is adapted, in any particular case.

Cutting and binding arms 416 and 417 respectively are pivotally attached upon a pin or shaft 418 at opposite sides of the cutting and binding portion 410 of the frame. They are movable scissors-like with respect to the depending portion 410, and the cutter arm 416 is provided with a sharp edge 420 cooperating with the edge 411 to sever yarn as the cutter bar 416 is moved from the position shown in Figure 12 to the position shown in Figure 13. The binder arm 417, on the other hand, is provided with a rounded edge 421 in a co-operating relation with an adjacent rounded edge 422 of the bar 410 to squeeze the yarns 93 and 94^a therebetween in a binding relation, in contrast to a cutting action. A spring, shown at 425 in Figure 7 of the drawings, may assist on the pivot pin 418 in maintaining the cutting and binding arms 416 and 417 into proper position against the opposite sides of the cutting and binding bar 410. The bar 406 is connected at its forward end by a pin 427 to the upper ends of the cutter and binder bars 416 and 417, on a fixed axis, so that forward sliding of the bar 406 will open the arms 416 and 417 with respect to the bar 410, and rearward sliding of the bar 406 will bring the arms 416 and 417 into cutting and binding relation with the yarn of the bar 410. A spring 430 assists in pulling the cutting and binding arms into the cutting and binding positions shown in Figure 13.

An auxiliary binding arm 435 is pivoted upon the pivot pin 418. Below the pivot 418 it operates in the binder groove 412 of the bar 410 in order to more securely bind the yarn against release, as is shown in Figure 14 of the drawings. The upper end of the auxiliary binder arm 435 is spring urged at 437 into the binding position shown in Figures 13 and 14 of the drawings. As is shown in Figure 13 the portion of the auxiliary binder arm 435 above the pin 418 is provided with a large opening 436 which will permit the spring 437 to bring about the binding action upon the yarn and prevent the pin 427 from effecting a too positive binding action which might result in cutting the yarn. The pin 427 does act in this slot of the auxiliary binder arm 437 to insure that the auxiliary binding arm 435 will move to the open position upon radial inward sliding of the operating bar 406.

With respect to the matter of actuating the binder and cutter mechanism T, in the particular environment in which it is used upon the im-

proved machine A, it is to be noted that the slide bar 406 which actuates the cutting and binding arms is provided with a laterally extending pin 440. This pin, as is shown in Figures 1 and 2 of the drawings, is operated upon by a lever 441 pivoted at 442 upon the frame of the machine A. A lever 443 is pivoted between its ends upon a post 443^a at a pivot 444 in order to operate against the lever 441 for forcing the cutting and binding bars and arms 416 and 417 and 435 from a closed to an open, and then to a closed position for cutting and binding yarn when the said lever 444 is actuated through suitable linkage 446 off one of said levers 178, by riding of the latter from a low point on the drum 180 upwardly upon a lug and then down to the low point again.

Referring to the fabric P, as generally shown in Figures 21, 22 and 23 of the drawings, the same represents a seamless knitted stocking. The general design, as shown in Figures 21 and 22, is to provide reversely plated diamond-shaped areas 500, which are stepped from course to course to provide diamonds extending forty wales or needles in width and eighty courses in length or height. As can readily be understood by those skilled in the art the knitting yarns 81 and 83, which may be designated as gray and black yarns respectively, are used to knit stitches in the fabric in one course, the needles for such course being manipulated off the main stitch cam 79, and during the same revolution of the cylinder the gray and black yarns 93 and 94^a knit the stitches in the next succeeding course by reason of manipulation of the needles off the extra stitch cam arrangement 88. As previously explained, due to the fact that the cam arrangement on the under side of the sinker cam plate is adapted to reverse plate at the two points adjacent the main stitch cams 79 and auxiliary feed stitch cams 88, the reverse plating of the sets of plating yarns 81—83 and 93—94^a will be the same in the two courses knitted during any single revolution of the cylinder. It is thought unnecessary to dwell in detail upon the lug arrangement of the reverse plating control drum 287 but such has been shown in a developed view in Figure 19. The direction of rotation of this drum is shown in Figure 19. With reference to Figure 9 of the drawings, the butt lay-out upon the sinker controlling jacks is shown, wherein the butts of the sinker jacks shown in solid black are short butts and the remainder, showing open squares, are full length butts. The lugs shown in solid black in Figure 19 are full length lugs and those shown in cross section have been cut. The full length lugs of the drum 287 will through the plunger cams 286 actuate both the long and short butt sinker jacks, but the short lugs of the reverse plating control drum will only act upon the long sinker jack butts, by limiting the throw of the plunger cams 286. In the layout shown in Figure 19 the drum 287 rotates in the direction of the arrow. The lug 501 will actuate the uppermost presser cam 286 for operating against the jack butts 285^a shown in Figure 9. The timing is so set that the fabric will be knitted through two courses while the lug 501 is active. This starts the reverse plating at the top of the diamond at 502 (see Figure 21). Two courses are knitted at each revolution of the cylinder and then the drum 287 is advanced so that the next lugs operate upon the two uppermost presser cams for actuating the sinker jacks having butts at the two uppermost

levels. The reverse plating of the diamond proceeds in this manner, as well understood in the art, and since the lugs on the drum increase in number and in stepped relation, the width of the reverse plated diamond will increase until the point 505 is reached (see Figure 19), at which point the lugs of the drum are actuating all of the presser cams 286 for reverse plating upon all of the sinkers of the machine (in the particular fabric shown). It has been set forth in my co-pending application Serial No. 703,483 that an increased throw of the intermittent advancing of the reverse plating drum is necessary at times in order to bring the pattern drum even, in its rotatable relation with respect to the fabric being knitted. This need not be further described. It is sufficient to say that the invention so far as the reverse plating mechanism of the present invention is concerned inheres in the ability of the cam mechanism upon the sinker cam cap to permit the sinker jacks which have been actuated by the presser cam to maintain their position after reverse plating at the main knitting cams, so that a similar reverse plating of the yarns may occur at the second feed in the next course, during the same revolution of the cylinder.

It will be readily understood that many varied reverse plated designs may be provided upon the fabric knitted upon the machine A, since obviously the lug arrangement of the drum 287 is capable of wide variation, and the butt arrangement upon the sinker jacks of the sinker ring are capable of practically unlimited variation.

The needle wrapping yarns controlled by the attachment G are shown as red and yellow. The yellow yarns are diagonally knitted to provide wrap stripe diamonds, and the red yarns are spotted in the centers of the diamonds, producing the so-called "color within color" effect.

Referring further to the needle wrapping of yarns upon selective needles, a plurality of series or groups of needle operating jacks are provided for producing the striped diamonds and other patterning. A typical group of jacks in such a series is indicated in Figure 9 wherein two jacks 525 are provided with long butts 526 at the uppermost level; jacks 527 at each side thereof being provided with similar long butts 528 at the next lower level. The next outermost jacks 529 in each series are provided with long butts 530 at the next lower level. The next outermost jacks 531 are provided with long butt jacks 532 at the next lower level. The next outermost jacks 533 are provided with long butts 534 at the next lower level. The series is completed with a pair of jacks 535 having long butts 536 at the lowest level. All of the jacks in this series with the exception of the two jacks 525 are provided with short butts at the same level as the long butts 526. Similarly all of the jacks in each series with the exception of the jacks 535 are provided with short butts at the same level as the long butts 536 of said jacks 535.

The cams mounted in the blocks 144 and 145 control those fingers 111 of the wrap yarn finger supporting head 102 which direct the yellow striping or patterning yarns to the predetermined elevated needles for producing the striped diamonds shown in the fabric P. The cams 148 and 150 are positioned at the same level, and the cams 149 and 151 are positioned at a lower level. The cams 148 and 150 actuate yarn feed fingers 111^b for directing the feed of yellow striping yarn therefrom onto the long butt needles.

The said fingers 111^b are provided with butts at the level of the cams 148 and 150 in order to accomplish such feed of the yarn to the long butt needles. The lower cams 149 and 151 are for the purpose of directing and feeding the yellow striping yarns from feed fingers 111^c onto the short butt needles which are out of operation during knitting of the sole. That is the reason for providing separate feeds of yellow striping yarns to the long and short butt needles.

The cams 146 and 147 are disposed in the block 143 at levels below the levels of the cams for the feed of yellow striping yarns. The cam 146 actuates those yarn feed fingers of the striping mechanism, designated at 111^e, which have butts at the level of said cam 146, for the purpose of feeding the red spotting patterning yarns from said feed fingers 111^e onto the long butt needles. The cam 147 at a level below the cam 146 is adapted to actuate those feed fingers 111^f which have butts at the level thereof, for the feed of the red spotting or patterning yarns to the short butt needles. The patterning mechanism for actuating the cams 146 to 151 inclusive is such that the cams 146, 148 and 150 will be pushed in to actuate the yarn feed fingers controlled thereby for feed of yellow and red patterning yarns to the long butt needles during knitting of the instep of the stocking, and at such time the remaining cams 147, 149 and 151 will be withdrawn in order to avoid placement of the patterning effects produced by the yellow and red yarns in the sole of the stocking being knitted. The patterning cams for actuating the said cams 146 to 151 inclusive are shown in Figures 17 and 20 of the drawings, and will be subsequently mentioned.

It will be obvious from Figure 9 that each typical jack series is provided with three fingers for feed of patterning yarns thereto, to produce striping, spotting, or other design effects. The central of these three yarn feed fingers controls the red yarn, and the two at each side thereof control yellow yarns. Of course it will be understood that any other colored yarns may be used in lieu of those mentioned, since yellow and red have been selected merely by way of contrasting example.

The cam 52 mounted in the block 50 is actuated off of pattern mechanism on the lower drum 61 of the machine, and when thrown in engages only the long butts 526 of the jacks 525 of each typical jack series for the purpose of elevating said jacks 525 and respective needles in the cylinder grooves thereabove, as shown in Figure 9 of the drawings, so that said elevated needles will cooperate with the cams 146 and 147 and the feed fingers 111^e and 111^f and the guide member or wire 134 for the feed of red spotting yarns, to produce the knitted stitches 600 in the fabric, indicated in Figure 23 of the drawings. The lower cam 53 in the block 50, on the other hand, only actuates the long lower butts of the jacks 535, for the purpose of elevating the needles thereabove in order to take the red spotting yarns from the yarn feed fingers 111^e and 111^f, as controlled by the cams 146 and 147, and in accordance with the feed of such striping yarns to needles, in cooperation with the yarn guide wire or member 134, as has been set forth in my co-pending applications above referred to, for the purpose of producing red spotted areas 601, in patterning effects in the fabric P, in other striped diamond areas at different courses other than those courses in which the stitches 600 oc-

cur, as is shown in the fabric P of Figure 21. In the arrangement of details shown in Figure 9 the needles, jacks, needle wrapping yarn feed fingers and cams and parts therefor are shown in position for the knitting of the fabric P in the course of stitches indicated by the numeral 603 in Figure 23 of the drawings. Thus the cam 53 is out of actuation when the cam 52 is in position to elevate the needles which will produce the patterning stitches 600 above mentioned.

A cam 607, shown in Figure 9 of the drawings, controlled off one of the operating levers 194, is provided for the purpose of lowering the needles elevated by the cams 52 and 53, after they have received the patterning yarns from the feed fingers 111^e and 111^f, so that the needles will be in readiness to receive other patterning yarns, or for the purpose of placing them in an out of the way position so that they will not take patterning yarns with those needles which are elevated by the cams in the block 51. The most common use for the cam 607 will be to retract the needles which have taken wrapping yarns from the feed fingers controlled by the cams 146 and 147 so that said needles will be out of the way when other striping or patterning yarns are fed by the cams of the block 144.

Referring to the cams in the block 50 the uppermost cam 54 is provided to take only the long butts 526 of the jacks 525 for elevating the needles thereabove for the purpose of taking yellow striping yarns directed onto said elevated needles by the cams 148 and 149 and the guide wire 135. Similarly the cams 55, 56, 57, 58 and 59 are provided to take yellow striping yarns from the feed fingers 111^b and 111^c as directed by the cams 148 and 149. The cam 55 is provided for actuation upon the butts 528 of the jacks 527; the cam 56 is provided for actuation upon the butts 530 of the jacks 529; the cam 57 is provided for actuation upon the butts 532 of the jacks 531; the cam 58 is provided for actuation upon the butts 534 of the jacks 533, and the cam 59 is provided for actuating only the long butts 536 of the jacks 535. All of these jacks are thus elevated by the various cams in the block 50 for the purpose of elevating the needles thereabove in order to receive the yellow yarn from the fingers 111^b and 111^c.

The cam 60 is also mounted in the block 50 for the purpose of bringing the jacks to a proper level where they may be properly acted upon by the remaining cams of the block 50.

Bearing in mind that two courses of the fabric are knitted for each revolution of the cylinder, it will be readily understood that the red striping yarn fed to the needles as directed by the yarn fingers and cams of the block 51 will appear only in alternate courses. Each yellow striping yarn however is directed to the elevated needles twice during each cylinder revolution so that it may be knitted into adjacent courses of the fabric. This is accomplished by providing a movable cam 620 shown in Figure 9. It is positioned so as to act upon all of the long and short butts at the uppermost level, on those jacks which have not been elevated by any of the cams 54 to 59 inclusive. Any jack that has been elevated by any of the cams 54 to 59 inclusive will have the uppermost butt thereof in a position to pass the cam 620, as is shown in Figure 9 for jacks 535, so that as the cylinder rotates these jacks will be acted upon by a second elevating cam 621, shown in Figure 9 of the drawings in order to elevate the needles thereabove (which in the preceding

course took yellow striping yarns from the cams of the block 144) in order to again take yellow striping yarns from the fingers 111^b and 111^c, as directed by the cams 150, 151, and the guide wire 301, as will be apparent from Figure 9 of the drawings. Thus the yellow striping or patterning yarns will be fed or knitted into each course of the fabric, to complete the pattern. In this manner a compact pattern of variable predetermined outline may be provided. A cam 625 is provided to bring the jacks into proper leveling position for cooperation with the cams 52 and 53, as well as the cams of the other block 51, as is shown in Figure 9 of the drawings.

In each typical jack series it will be noted from the stitches producing the yellow diamond pattern in Figure 23 of the drawings that the yellow striping yarns are not fed to a balanced arrangement of needles. This may be altered in any relation desired, but in the set-up shown in Figure 9 the yellow patterning yarn feed fingers 111^b and 111^c which are disposed to the right sides of the red yarn feed fingers 111^e and 111^f direct their yellow yarns to the needles above the two central jacks 525 and the four jacks immediately adjacent and to the right of said two central jacks 525, for the purpose of producing in the fabric P the yellow patterning stitches 628, shown in Figure 23. On the other hand the yellow patterning yarns fed by the yarn feed fingers 111^b and 111^c, as shown in Figure 9 at the left of the red yarn feed fingers 111^e and 111^f will feed the yarns therefrom to the needles controlled above the two jacks 535 and the four immediately adjacent jacks to the right thereof, for the purpose of producing in the fabric the patterning stitches 640, shown in Figure 23. This control of needles for the taking of the patterning yarns holds true with respect to each typical jack series.

It should be noted from Figure 23 of the drawings that each yellow or patterning yarn may be reproduced in adjacent courses of the fabric, and floated on the inside of the fabric, wherever desired. The adjacent courses of the web of the fabric are, however, formed of different plating or body yarns.

If desired another needle wrapping yarn feed may cooperate with the needles adjacent the cam block 145 to produce "color within color" patterning effects at the extra feed knitting cam set 881 the same as is produced by feed of the red and yellow patterning yarns at the main stitch cam set 79.

The inside view of the fabric P, shown in Figure 22, shows the float portion 600^a of the red patterning yarns, and the small float portions of the yellow striping yarns from course to course, etc., is clearly indicated in Figure 23 of the drawings.

It will of course be realized that many different reverse plated patterns, and striping and pattern effects of the needle wrapping yarns may be produced in the fabric, since the pattern drums are capable of lug adjustment and variation to suit, and the butt arrangements upon the jacks and feed fingers for the needle wrapping yarns may be provided to suit. Also the cam arrangements for all of the different blocks of the improved knitting machine may be arranged and manipulated to produce various complicated or simple patterns, as desired.

In Figure 17 is indicated the pattern lug layout for the lower rear left drum of the improved knitting machine. The numeral 64 indicates the

ratchet wheel teeth, a dot and dash line 701 designates the heel and toe re-setting lug line, which has been described in some of my above identified co-pending applications. The line of lugs shown on the dot and dash line 702 are used to actuate the lever mechanism for controlling cam 54. In like manner the dot and dash lines designated in Figure 17 by numerals 703, 704, 705, 706, 707, and 708, designate the lug arrangements for actuation of the cams 55 to 59 respectively. The drum 61 also has a line of lugs 710 for actuating the cam 52 and a second line of lugs 711 for actuating the cam 53. The manner in which the lugs on the drum 61 actuate the various cams respectively designated therefor will be apparent from a study of my above identified applications, and will not be further described herein.

Figure 20 of the drawings shows a fragmentary developed view of the lug arrangement upon the lower front drum 180 of the knitting machine A. The direction of rotation is indicated by the arrow. The lugs on the circumferential line designated by numeral 740 are for the purpose of actuating one of the levers 178 in order that through the lever 340 the yarn feed fingers 91 and 92, the pick 94, and the sinker cam 321^a of the sinker cam ring will be actuated as above described. The lugs on the drum 180 in the circumferential line 741 are for the purpose of actuating the auxiliary feed binder and cutter mechanism T in the manner above described, and through the leverage mechanism above mentioned. The line of lugs 741^a on the drum 180 is for the purpose of actuating the cam 621, through leverage mechanism indicated at 741^b in Figure 2 of the drawings, in order that the needles will be properly controlled for receiving wrapping yarns at the second or auxiliary feed. The line of lugs in the circumferential path 742 of the drum 180, as indicated in Figure 20 are provided for operating the eccentrically pivoted plunger block 173 whereby to throw out the wrapping finger actuating cams during knitting of the heel and toe. The lug arrangement in the circumferential path 743 of the drum 180 is provided for the purpose of moving the auxiliary additional feed stitch cam block 88 into and out of actuating relation with the needles. This stitch cam set 88 is thrown out when riding on the lugs of the drum 180, as during reciprocation of the cylinder. The lugs in the path 744 of the drum 180 are provided for actuating the yarn guide wires 134 and 135 for the purposes above mentioned, and for throwing the needle lowering cam 607 into and out of operating relation. The leverage mechanism which performs these functions actuates on the drum 180 to drop into the depressions thereon along the path 744 to throw the cam 607 out of actuating relation with respect to the needles, during knitting of the heel and toe. The lug arrangement in the path 745 of the drum 180 is provided for the purpose of actuating the lever 200 so as to pull all of the levers 191 out of actuating relation with the drum 61 when the lever 200 rides on the lugs of the drum 180 in the path 745. The arrangement of lugs and depressions in the path 746 of the drum 180 is provided for the purpose of operating the needle wrapping yarn finger actuating cams 147, 149 and 151, through the leverage mechanism 176, shown in Figure 2 of the drawings, so that the said yarn feed finger cams 147, 149 and 151 will be pulled out of operating relation with respect to their respective fingers (in order that

the needle wrapping yarns will not be fed to the short butt needles) during knitting of the instep and sole. The lug and depression arrangement in the path 747 of the drum 180 actuates the gap closing bar 747^a, shown in Figure 7, in a conventional manner.

In Figure 18 is shown the upper rear drum 175, which is provided with continuous lugs 750, 751, and 752 circumferentially thereabout for respectively actuating the cams 148, 146 and 150 of the wrapping yarn feed mechanism.

The bottom plate 700 of the sinker ring is provided with a groove 701^a from just past the knitting point at the main knitting cam set to past the knitting point at the auxiliary stitch cam set. This permits the sinker jacks to remain depressed so that they are kept in proper positions for the depressing and actuating cam arrangement on the sinker ring cam plate shown in Figure 10. This avoids liability of misplating. During reciprocation of the cylinder the jacks are properly cammed at 702 to avoid their breakage.

The usual binding and cutting mechanism M' is provided upon the knitting machine, as shown in Figure 7 and elsewhere.

The application of the present invention is equally adaptable to a circular knitting machine having a stationary cylinder and revoluble cam set.

Various changes in the shape, size, and arrangement of parts may be made to the form of invention herein shown and described, without departing from the spirit of the invention or the scope of the claims.

I claim:

1. In a circular rotary knitting machine the combination of a cylinder, needles for the cylinder, means for feeding yarn to the needles and cooperatively actuating the needles for knitting a plurality of courses during a single revolution, and means cooperating with the last mentioned means for knitting patterning yarns in wrap within wrap patterned effect upon selected needles in a course of the fabric, and knitting a wrap yarn upon selected needles in the next succeeding course formed during the same revolution as the course wherein the other patterning yarns are knitted.

2. In a knitting machine the combination of a circular set of needles, means to feed body yarns to the said needles at each of several spaced locations, means to knit fabric out of said body yarns upon said needles to produce in said fabric alternate plated courses formed of body yarns and the remaining courses formed of other body yarns, means to feed a plurality of wrap yarns upon predetermined needles and to inter-knit said yarns in wrap within wrap effect in one or more of the fabric courses formed by the first mentioned body yarns, and means for knitting upon selected needles another wrap yarn in one or more of the other courses of the fabric in complementary patterned relation with the first mentioned wrap yarn.

3. In a rotary knitting machine the combination of a cylinder, a set of independent needles therefor, a main yarn feed including means for selectively feeding one or more of a number of yarns to selected needles, an auxiliary yarn feed having means to feed one or more yarns to the selected needles at the auxiliary yarn feed, yarn cutting and binding means for each of said feeds, means for feeding a selection of wrapping yarns to the needles at each of said feeds, and means for selectively manipulating the wrap yarns and

5 needles for one of said feeds to produce wrap within wrap effect of a plurality of said wrap yarns to the needles for the knitting of a wrap within wrap pattern in the course wherein they appear.

4. In a knitting machine the combination of a cylinder, a set of independent needles therefor, cam means for manipulating the needles, means for feeding a body yarn or yarns to the needles

at one feed location, means for feeding another body yarn or yarns to the needles at another feed location, means for feeding each of a plurality of wrap yarns to selected needles at one of said feed locations to produce a "wrap within wrap" effect, and selective needle wrap yarn feeding means at the other body yarn feed. 5

HARRY McADAMS.