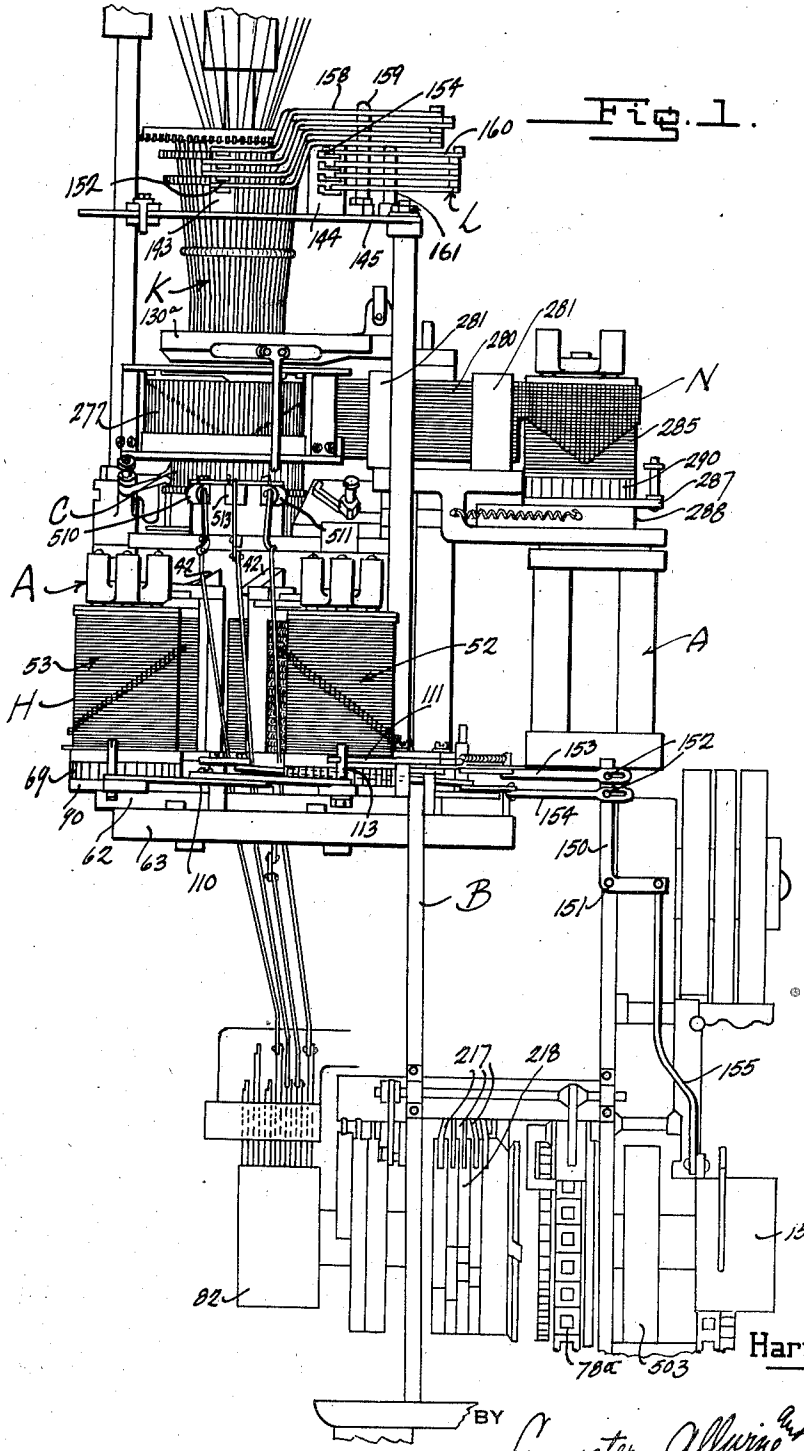
June 27, 1939. H. McADAMS 2,164,118

KNITTING MACHINE

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Fig. 1.



INVENTOR.
Harry McAdams

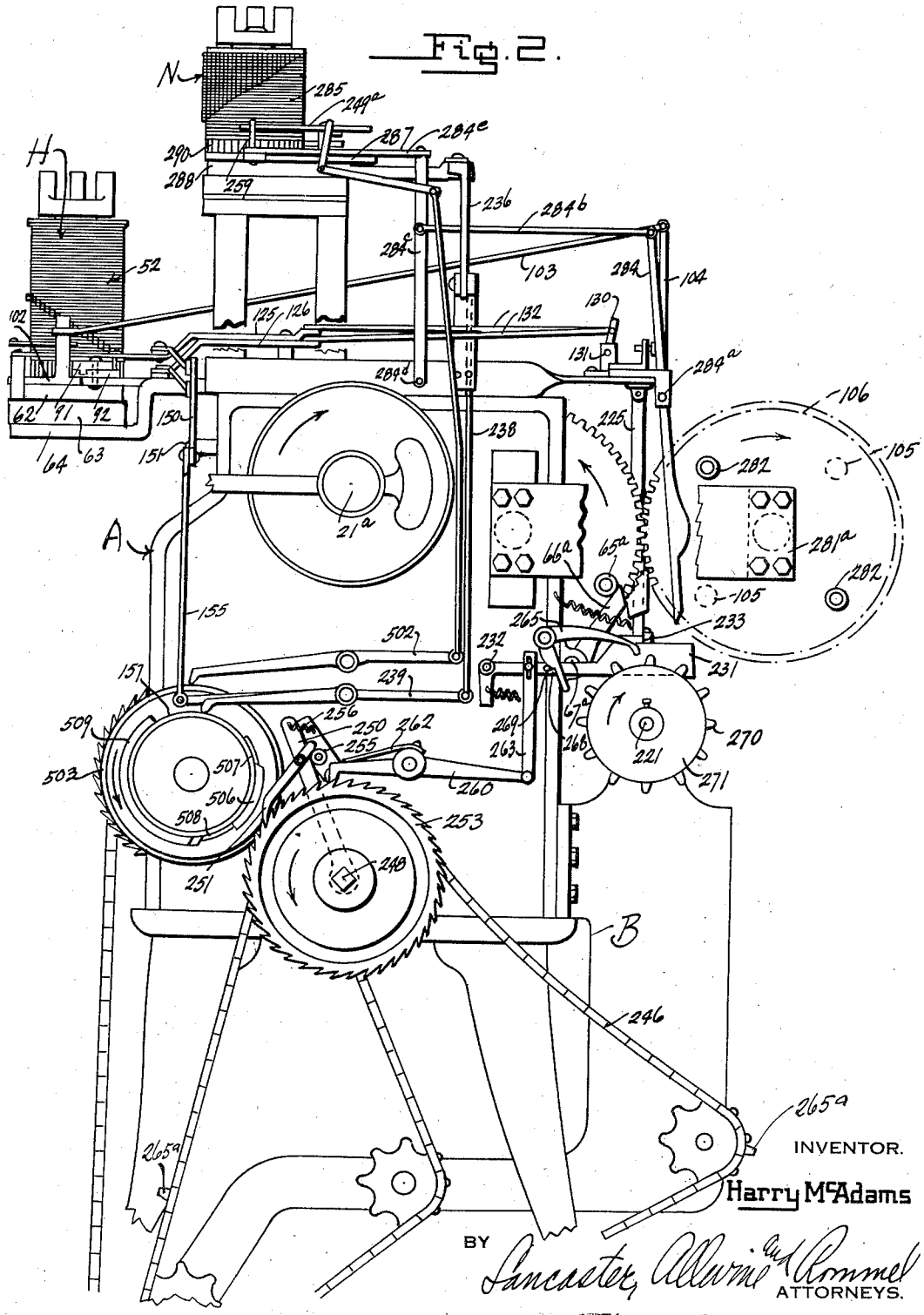
BY Lancaster, Allwine & Rommel
ATTORNEYS.

June 27, 1939. H. McADAMS 2,164,118

KNITTING MACHINE

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Fig. 2.



INVENTOR.

Harry McAdams

BY Lancaster, Allwine & Rommel

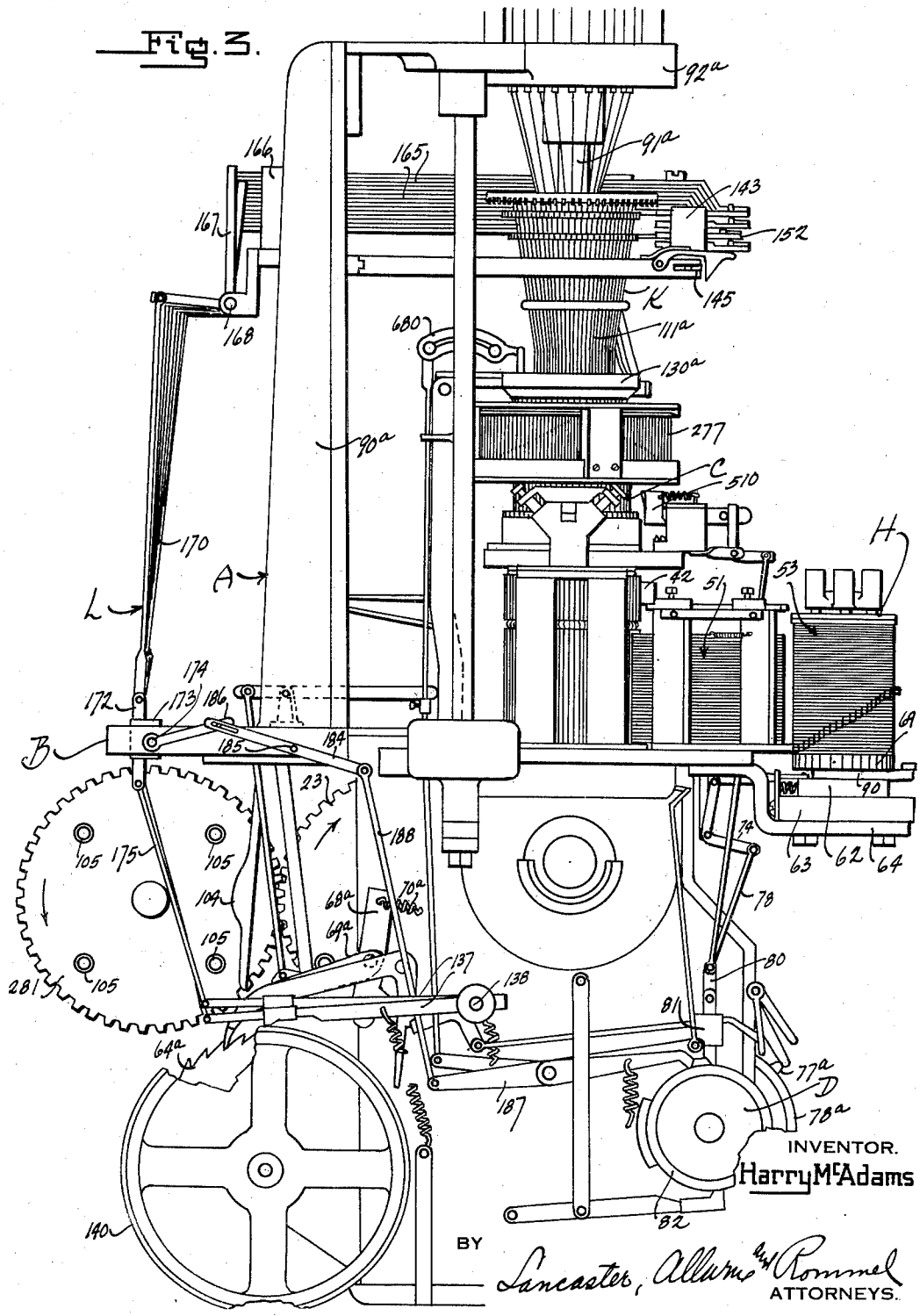
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June 27, 1939. H. McADAMS 2,164,118

KNITTING MACHINE

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Fig. 3.



INVENTOR.
Harry McAdams

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June 27, 1939. H. McADAMS 2,164,118

KNITTING MACHINE

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Fig. 4.

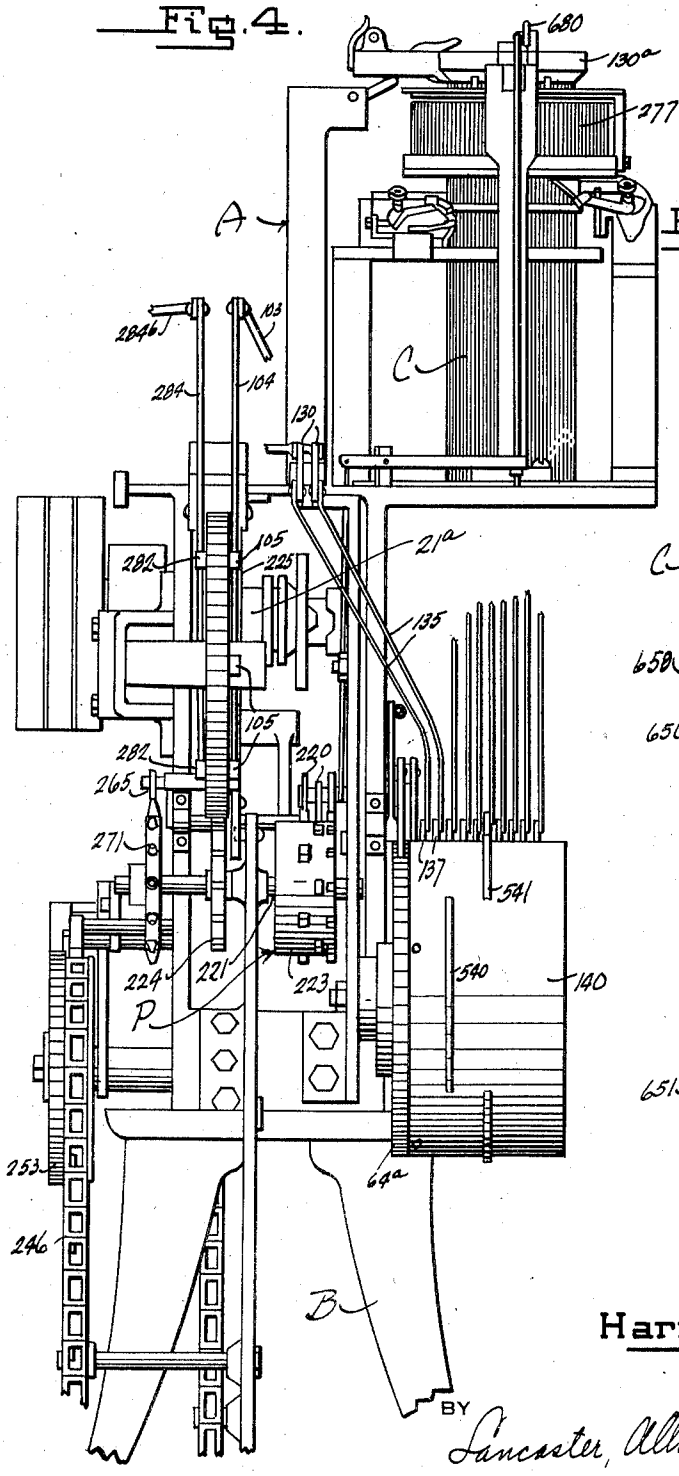
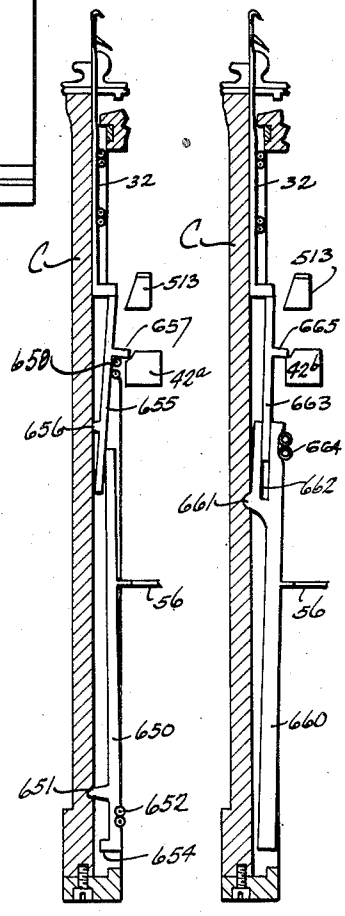


Fig. 24. Fig. 25.



INVENTOR.
Harry McAdams

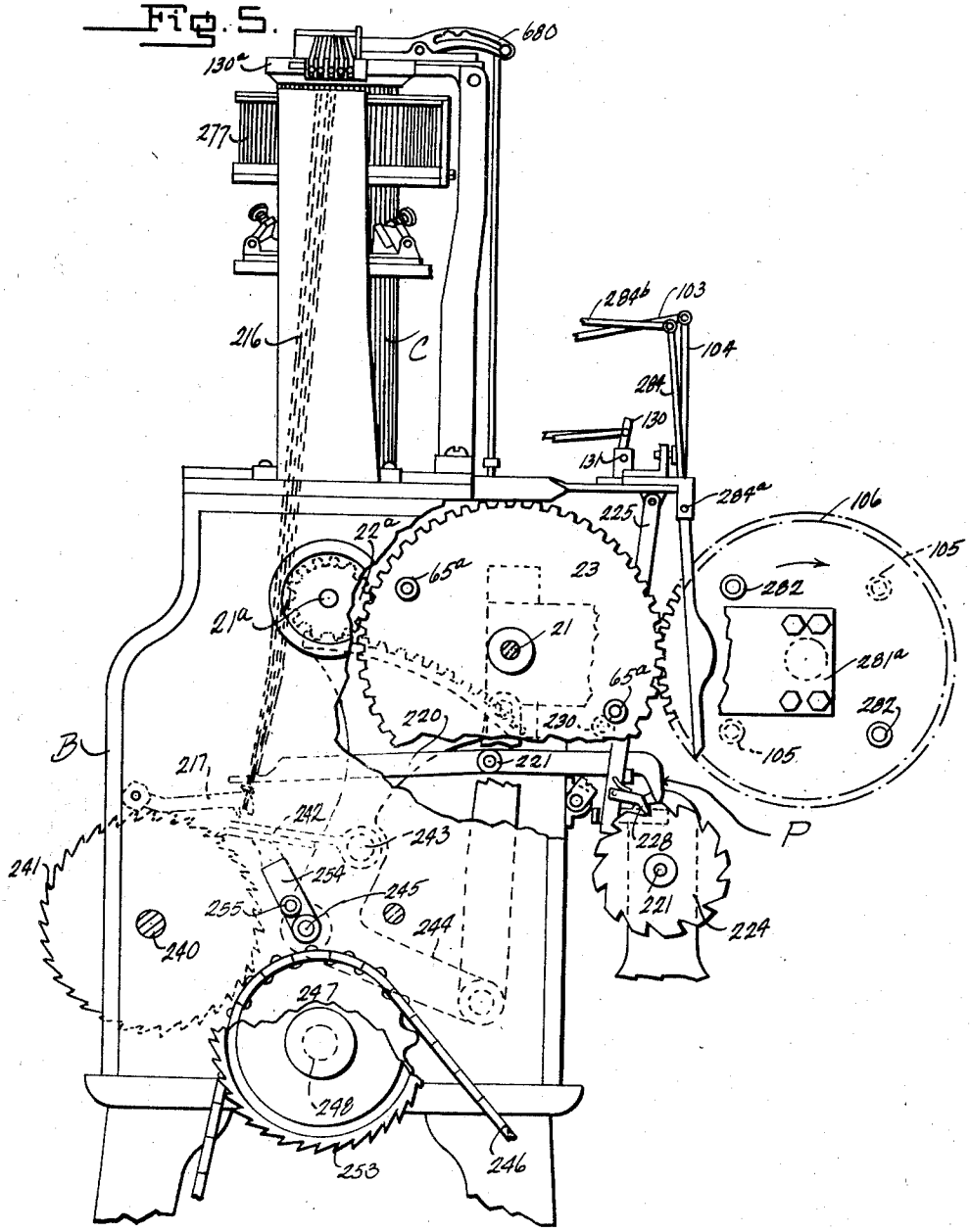
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June 27, 1939. H. McADAMS 2,164,118

KNITTING MACHINE

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Fig. 5.



INVENTOR.

Harry McAdams

BY

Lancaster, Allwine & Rommel

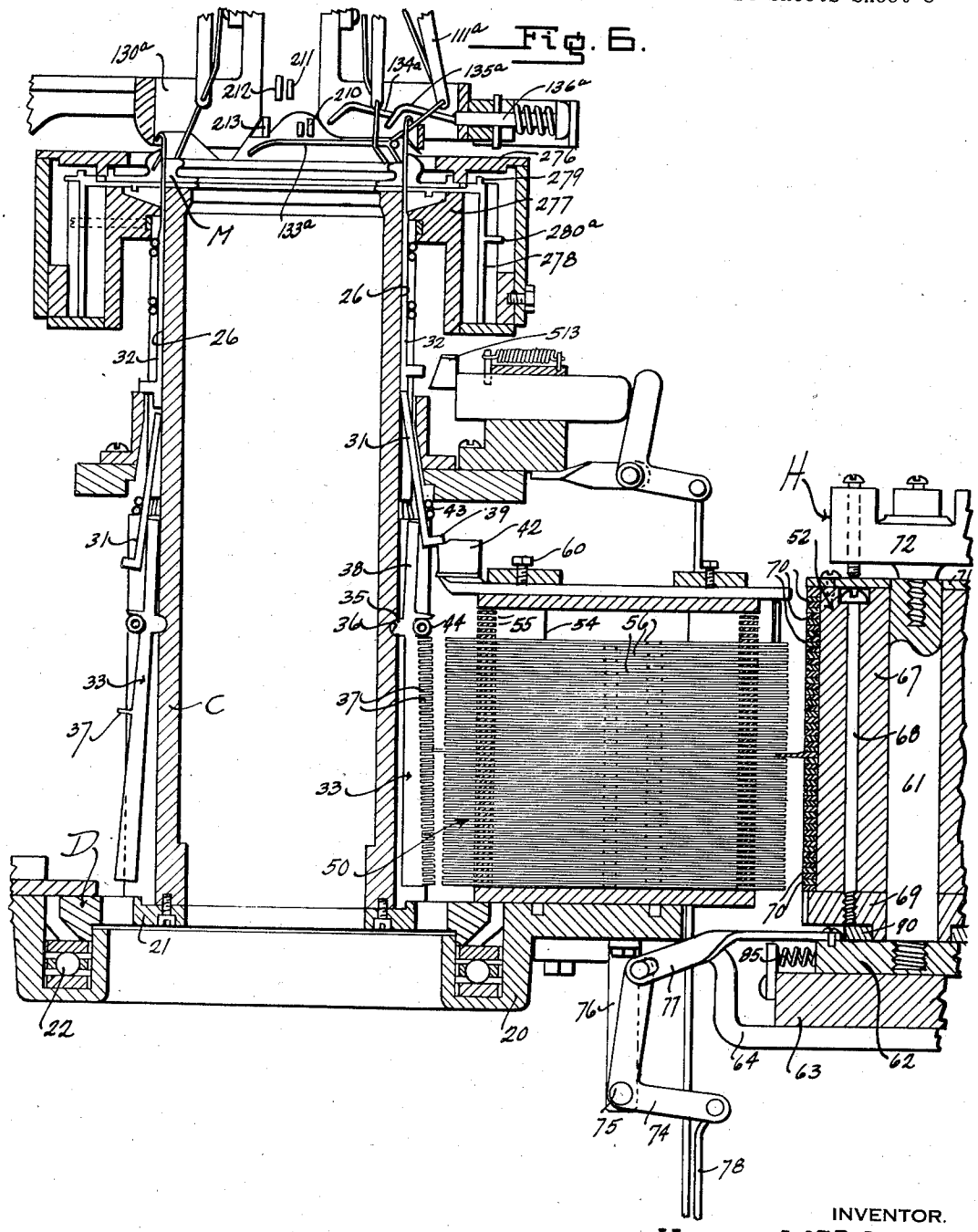
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KNITTING MACHINE

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Fig. 6.



INVENTOR.
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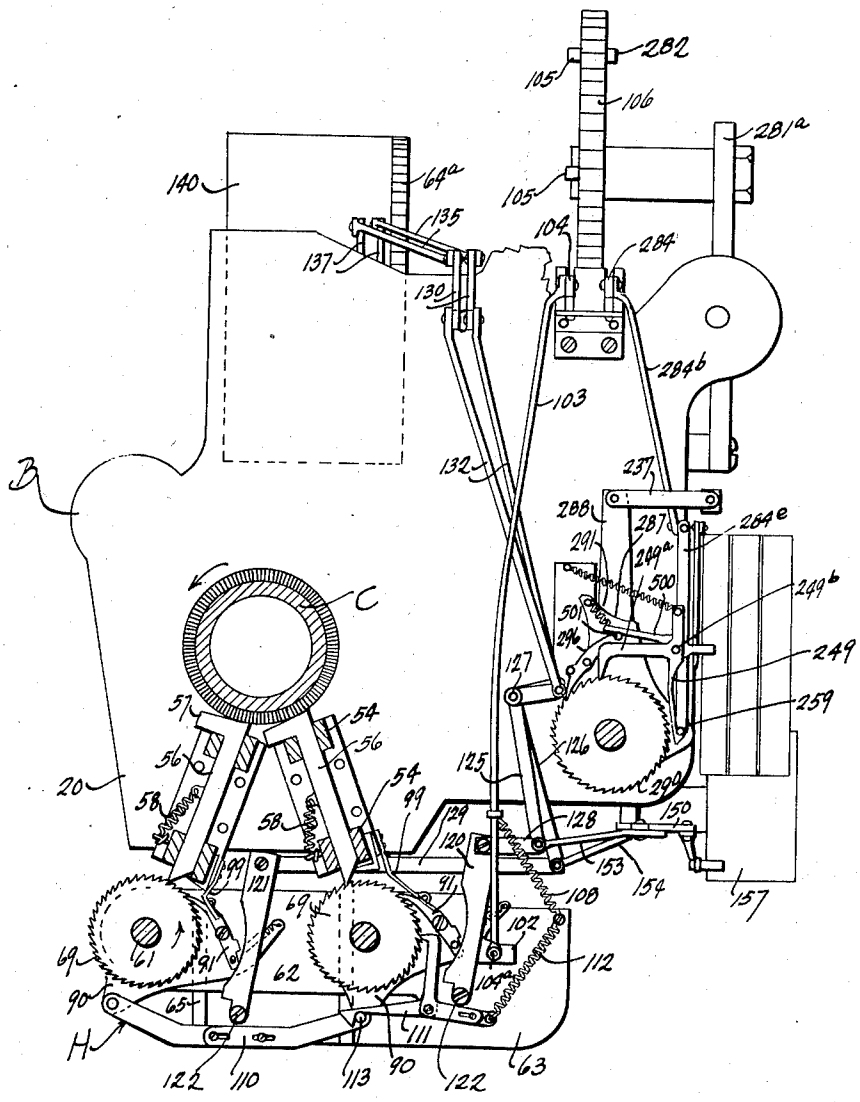
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KNITTING MACHINE

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Fig. 7.



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KNITTING MACHINE

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Fig. 8.

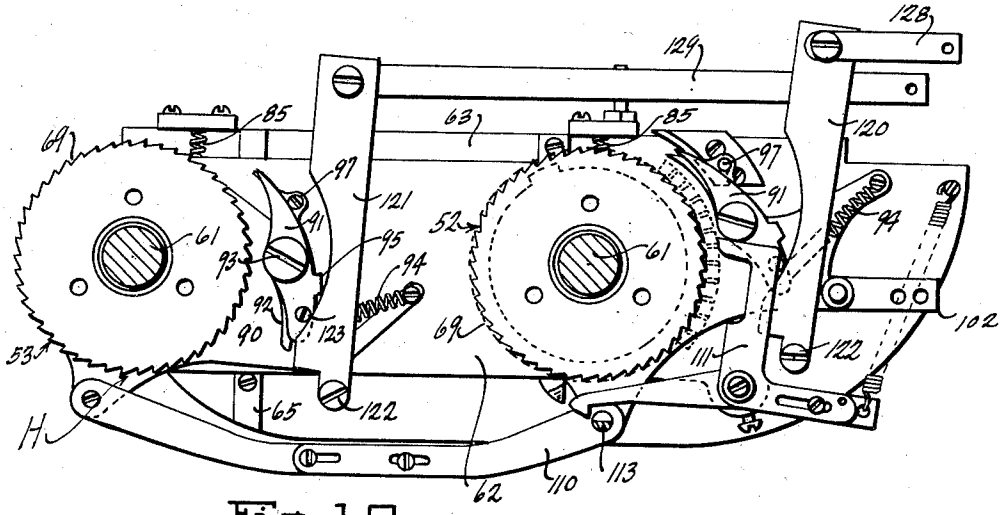


Fig. 10.

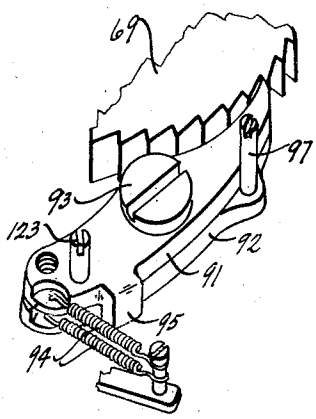
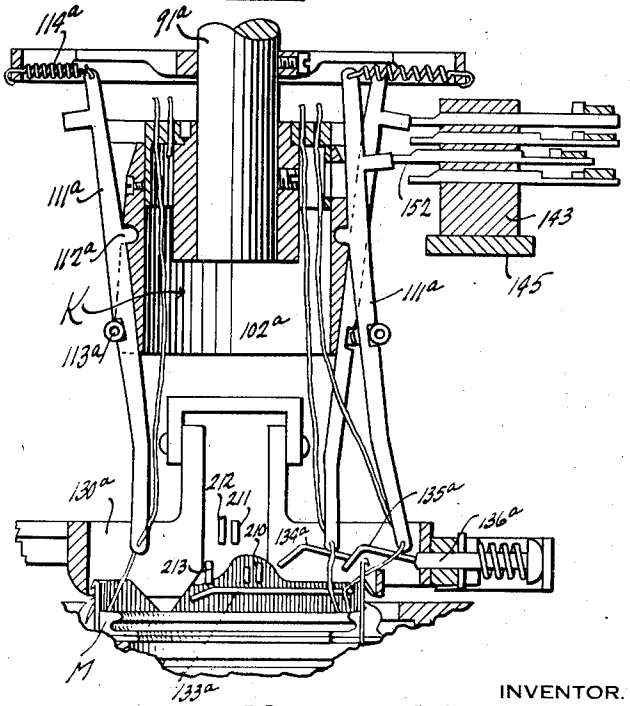


Fig. 9.



INVENTOR.

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KNITTING MACHINE

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Fig. 11.

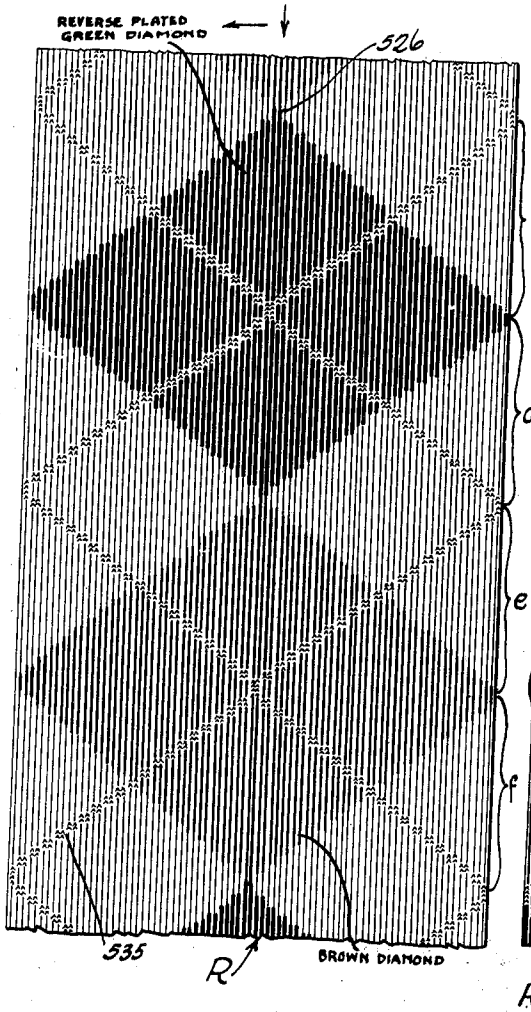
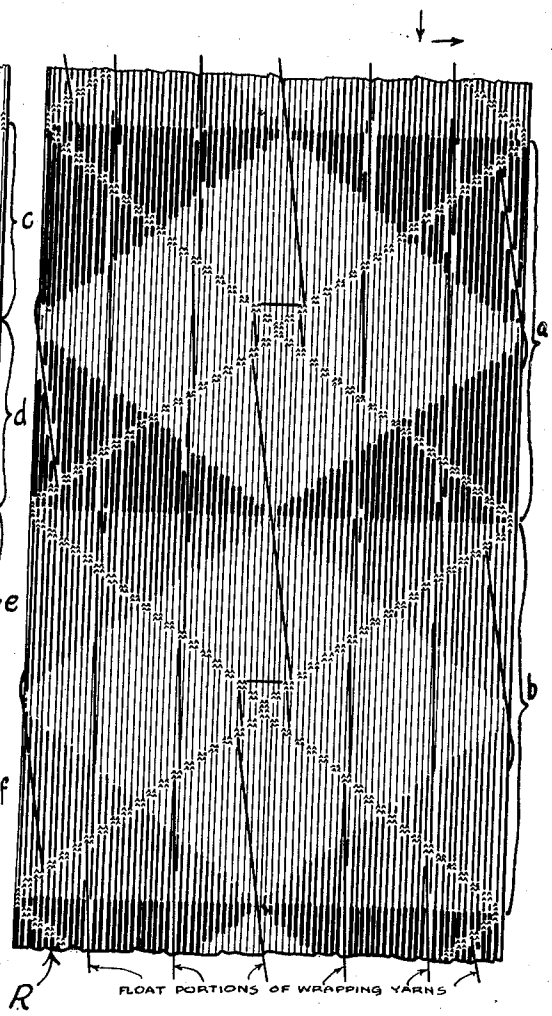


Fig. 12.



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BY Lancaster, Allwine & Rommel
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KNITTING MACHINE

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Fig. 14.

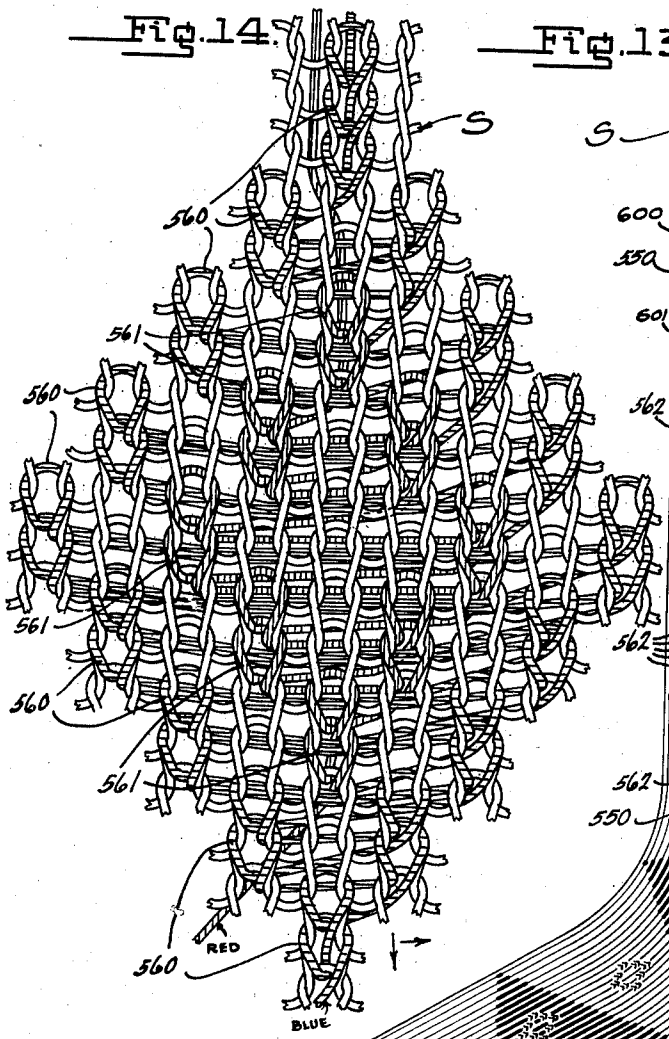


Fig. 13.

INVENTOR.
Harry McAdams

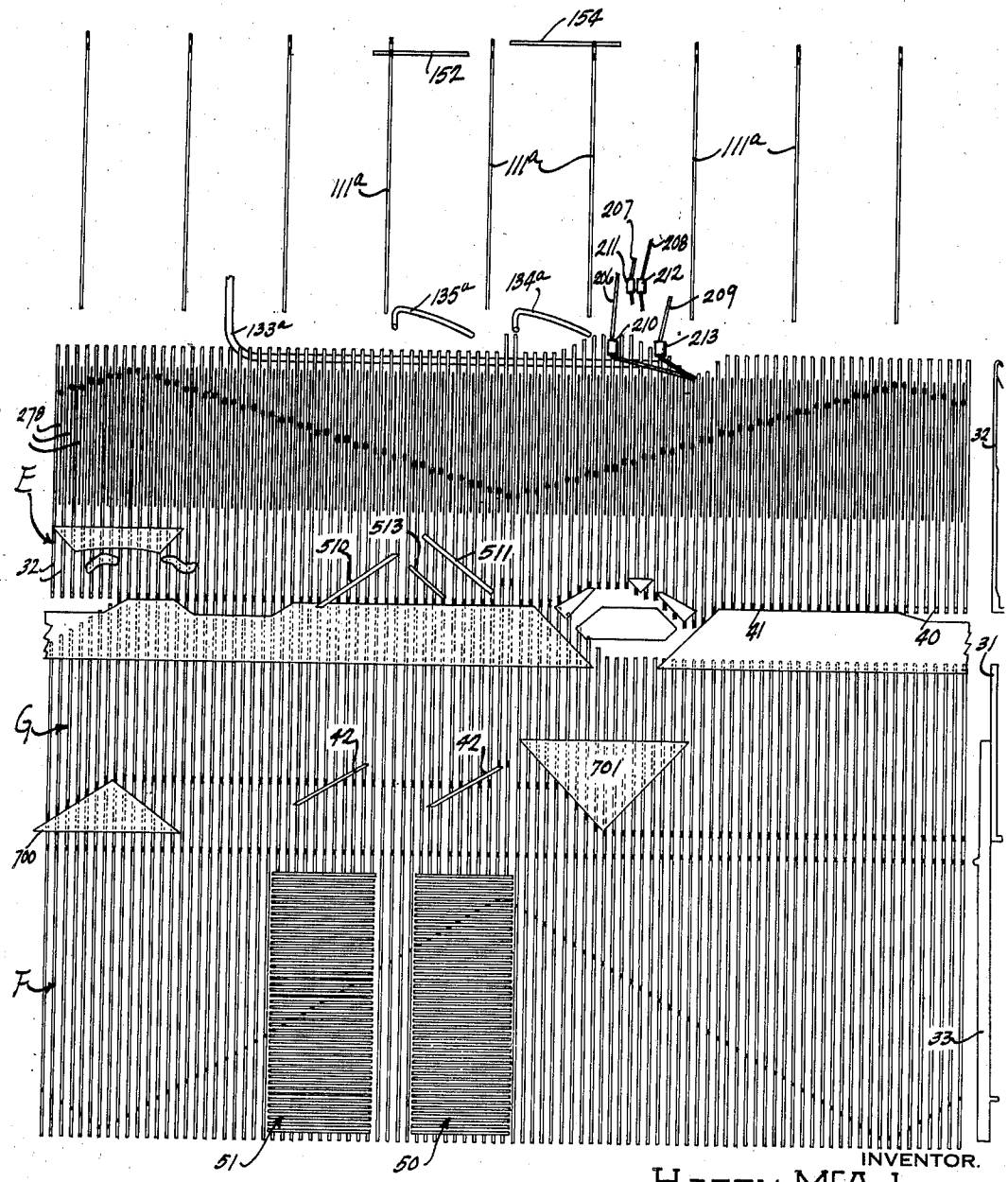
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June 27, 1939. H. McADAMS 2,164,118

KNITTING MACHINE

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Fig. 15.



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KNITTING MACHINE

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Fig. 16.

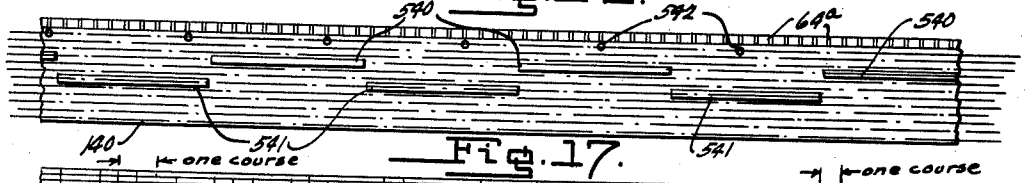


Fig. 17.

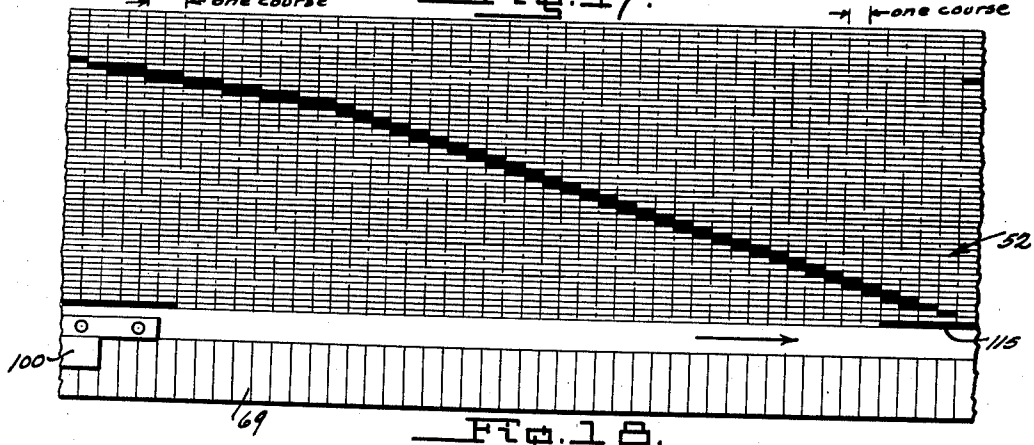


Fig. 18.

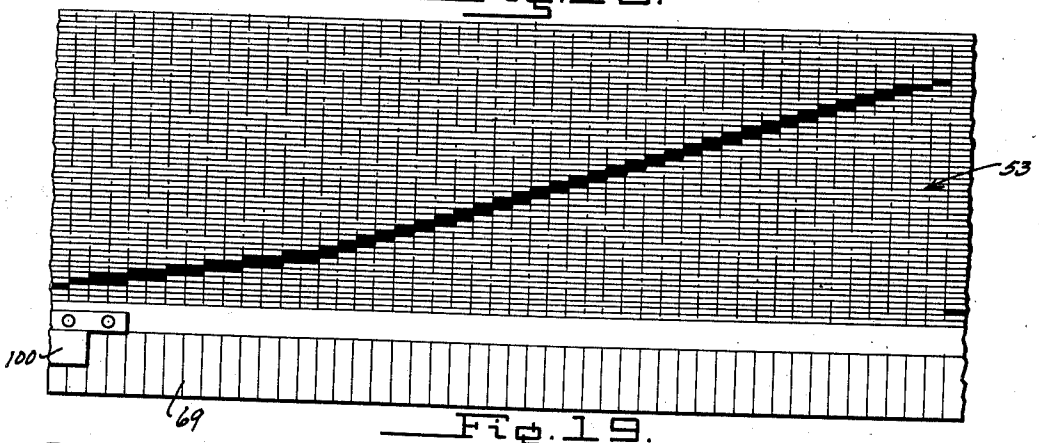
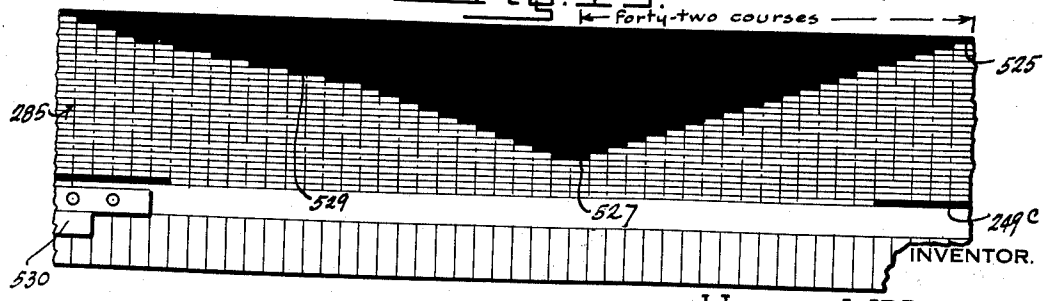


Fig. 19.



INVENTOR.

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BY Lancaster, Allwine & Rommel

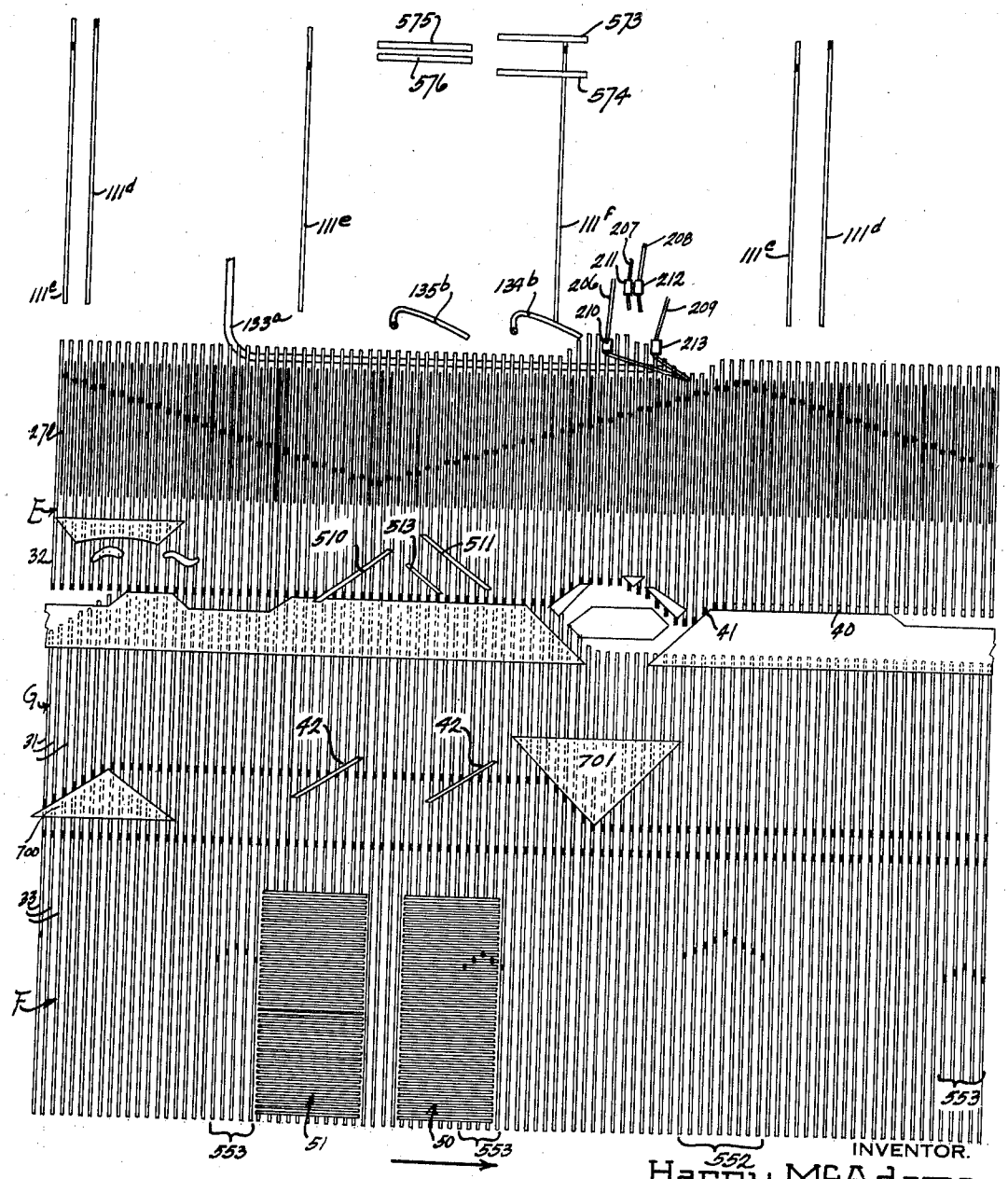
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KNITTING MACHINE

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Fig. 20.



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June 27, 1939. H. McADAMS 2,164,118

KNITTING MACHINE

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Fig. 21.

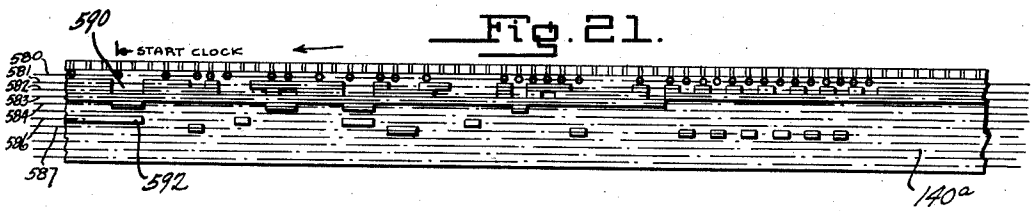


Fig. 22.

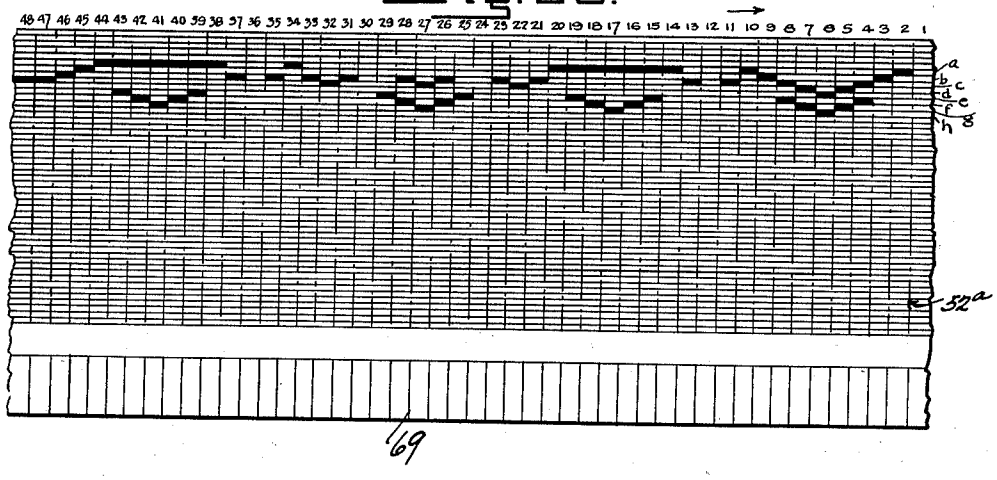
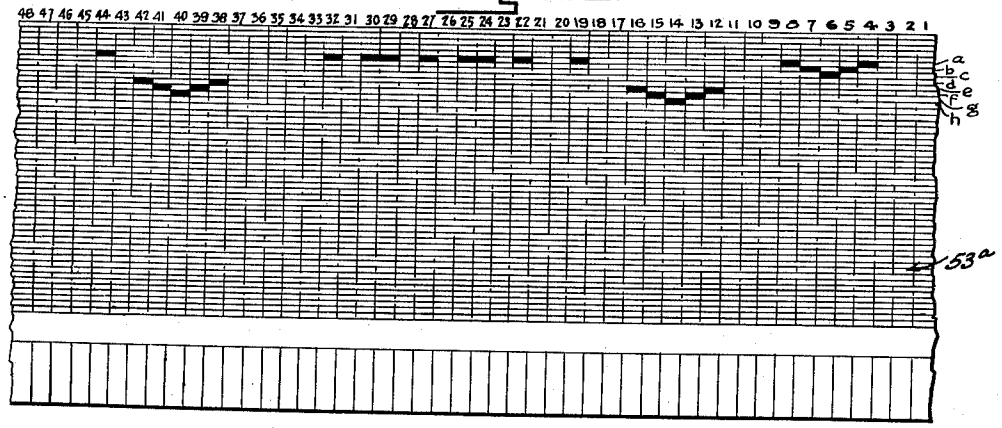


Fig. 23.



INVENTOR.
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BY Lancaster, Allwine and Rommel
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Patented June 27, 1939

2,164,118

UNITED STATES PATENT OFFICE

2,164,118

KNITTING MACHINE

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

Application December 21, 1933, Serial No. 703,483

14 Claims. (Cl. 66—135)

This invention relates to improvements in knitting machines and knitted fabrics produced thereon.

The primary object of the invention is the provision of an improved knitting machine whereon seamless stockings or other tubular fabric may be knitted with incorporated patterned areas knitted therein of the nature set forth in my co-pending application, Serial No. 662,354, filed March 23, 1933, but whereon may be knitted a wider selection of patterns which are more complicated.

A further object of this invention is the provision of an improved knitting machine capable of producing fabric having extremely wide irregularly formed reverse plated patterned areas incorporated therein. Furthermore the invention includes means to associate with the plated patterned areas horizontal striping yarn changes and selective wrap patterned effects.

A further object of this invention is the provision of improved patterning means for selecting desired needles, the improved patterning means being compactly arranged to enable the selection of widely different series of needles for taking patterning yarns.

A further object of this invention is the provision of improved pattern control mechanism for varied needle selection upon a knitting machine, capable of incorporating in seamless knitted fabric a wrap yarn patterned effect embodying the "color within color" principle.

Other objects and advantages of the 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 the upper and lower parts thereof removed, and more particularly showing the cooperative means for the purpose of varied needle selection, in order to take selected needle wrapping yarns, etc.

Figure 2 is a fragmentary side elevation of the improved knitting machine.

Figure 3 is an opposite fragmentary side elevation of the improved knitting machine.

Figure 4 is a fragmentary rear elevation of the improved knitting machine.

Figure 5 is a fragmentary side elevation of the knitting machine, showing the same side as illustrated in Figure 2, but with the needle selecting patterning means and reverse plating attachments removed and parts of the frame of the machine broken away to disclose means for controlling certain yarn feeds and gearing within the frame.

Figure 6 is a vertical cross sectional view taken through the cylinder of the knitting machine, showing the association therewith of needles and their cooperating jack arrangement and a series of selectively operated jack actuating cams, the means for operating the same, and the association of wrap feed fingers with respect to the needles.

Figure 7 is a fragmentary plan view of the knitting machine, with the needle cylinder in cross section, and showing more particularly the association therewith of the needle selecting pattern mechanism, its actuating mechanism, and the means for actuating the pattern drum of the reverse plating attachment.

Figure 8 is a fragmentary plan view of certain portions of the needle selecting pattern mechanism, more particularly illustrating the means for step by step advancement of the pattern drums thereof.

Figure 9 is a vertical cross sectional view taken through the wrapping yarn feed mechanism which is suspended above the cylinder, and showing a cam means for operating the fingers thereof.

Figure 10 is a fragmentary perspective view of a pawl mechanism for advancing the pattern drums of the needle selecting pattern mechanism.

Figure 11 is a side elevation of a piece of tubular fabric knitted upon the machine, showing the full width of the tubular fabric and having incorporated therewith reverse plated pattern areas of diamond-shape formation extending the full width of one side of the fabric and the cooperative association therewith of wrap stripes.

Figure 12 is a view of the inside of the tubular fabric, showing more particularly the arrangement of yarns and patterned areas knitted after the design shown in Figure 11.

Figure 13 is a seamless stocking knitted upon the improved knitting machine, and showing more particularly the wide reverse plated patterned areas and the association therewith of cooperative "color within color" wrapping yarns in clocking arrangement and spotted patterned areas.

Figure 14 is an enlarged fragmentary view of that portion of the seamless knitted fabric of Figure 13 wherein the "color within color" wrap

yarn effect is produced at the top of the knitted clock.

Figure 15 is a view on a developed plane of part of the needle set of the improved knitting machine, showing the cooperating series of jacks in their associated relation, in combination with certain jack pressing cams and a series of cooperating yarn feed and wrapping fingers and the operating cams therefor, for the production of seamless knitted fabric with the patterned effect as shown in Figures 11 and 12.

Figure 16 is a fragmentary view on a developed plane of the pattern drum for actuating wrap yarn feed fingers and associated mechanism of the knitting machine for the production of seamless knitted fabric with the patterned effect as shown in Figures 11 and 12.

Figures 17 and 18 are respective views on developed planes of the pattern lug lay-outs for the right and left pattern drums of the needle selecting pattern mechanism, for the production of seamless knitted fabric with the patterned effect as shown in Figures 11 and 12.

Figure 19 is a view on a developed plane of the pattern drum lay-out for the reverse plating attachment pattern drum, for the production of seamless knitted fabric with the patterned effect as shown in Figures 11 and 12.

Figure 20 is a view on a developed plane of part of the needle set of the knitting machine, showing a different lay-out than that illustrated in Figure 15, for the knitting of tubular fabric with the patterned effects as illustrated in Figures 13 and 14.

Figure 21 is a fragmentary view on a developed plane of the pattern drum for controlling the wrap yarn feed fingers to produce the wrap yarn patterned effects illustrated in Figures 13 and 14.

Figures 22 and 23 respectively are the pattern lug lay-out for the right and left pattern drums of the needle selecting pattern mechanism in order to produce the wrap yarn patterned effects illustrated in the fabric of Figures 13 and 14.

Figures 24 and 25 are modified forms of jack mechanism cooperative in the cylinder of the knitting machine for accomplishing a selected needle elevation in cooperation with presser cams for the jacks such as shown in Figure 6.

In the drawings, wherein for the purpose of illustration is shown the preferred form of the improved knitting machine, and by way of example merely several pieces of patterned fabric which may be knitted thereon, the letter A may generally designate the improved knitting machine, which may include a frame B, cylinder C, means D for operating the cylinder and driving the machine, a set of needles E, a set of rockable patterning jacks F, a second set of jacks G adapted to be actuated by the jacks F responsive to pattern control mechanism H in order to elevate or otherwise actuate certain selected needles of the set E for the reception of needle wrapping yarns, although it is to be distinctly understood that the needles may be actuated by this pattern control mechanism for other purposes than merely the selection of needle wrapping yarns. The yarn controlling device K is provided for wrapping the yarns upon the needles selected by the pattern control device and associated jack mechanism to be subsequently described. Means L is provided for actuating the yarn feed fingers of the needle wrapping yarn mechanism K. A set of web holders or sinkers M is provided with means N comprising an improved reverse plating attachment cooperating therewith in effecting a large selection of wide or narrow irregular or symmetrical reverse plated patterns in the tubular fabric. A horizontal striping attachment P is also provided in cooperative relation with other parts of the improved machine. The sample of fabric R illustrated in Figures 11 and 12 shows the versatility of the machine in its effectiveness to knit tubular fabric with stepped or irregularly formed reverse plated patterned areas tapering about one-half of the circumference of the tubular knitted fabric, in association with horizontal striping yarn change to vary the color of the reverse plated patterned areas along the fabric, and in association with cooperatively disposed wrap yarn striping or patterning. The other sample of fabric illustrated in Figures 13 and 14 shows the incorporation with the large reverse plated areas of "color within color" wrap yarn patterns or designs both spotted on the fabric and in clocking arrangement. This piece of fabric may be generally designated by the letter S.

The knitting machine may generally be of the rotary cylinder type shown in U. S. Patents 933,443, and 1,152,850, or of the well known stationary cylinder type with revolving cam set, since the improved features of the knitting machine shown in this application are adaptable upon either rotary or stationary cylinder types of knitting machines. The frame B has a supporting bed 20 upon which the cylinder C is rotatably mounted. This cylinder C is considerably longer than the ordinary cylinder stocking knitting machines, because of the needle selecting mechanism associated therewith, as shown in Figure 6. The cylinder C has a gear wheel 21 attached at the lower end thereof and resting upon the bed 20 of the machine on a ring-shaped anti-friction bearing 22. This enables a smooth and easy rotation of the cylinder, as can readily be appreciated. The means for rotating and oscillating the cylinder C may be of the usual type, similar to those shown in the patents above mentioned, and more particularly U. S. Patent 933,443. The cylinder C is driven off the main shaft 21^a, which as shown in Figure 4 is provided with the usual gearing and clutch mechanism, and through the pinion 22^a drives a gear wheel 23 known conventionally as the "104" gear.

The cylinder C except for its length may be of usual construction. It is provided with needle and jack grooves 26 wherein the needles of the set E are disposed and the jacks of the sets F and G are arranged.

The needles of the set E may be of any approved type, although latch needles are shown. Any number of needles may be provided dependent upon the type and gauge of tubular fabric being knitted. The needles are divided so that about one-half of them have long butts 40 and the other half have short butts 41; the latter being shown in full black in Figures 15 and 20 of the drawings.

Each slot in the cylinder C is of course provided with one of the needles of the needle set, and is also provided with a jack 31 of the set G disposed immediately beneath the needle 32 and also a pattern jack 33 of the set F disposed in the slot beneath the jack 31 and cooperative therewith.

The jacks 33, as clearly shown in Figure 6 of the drawings, is of strip-like form, preferably of metal and longitudinally rigid to enable it to rock the jacks 31 of the set G. Each of the jacks 33 is provided with a fulcruming lug 35 on the

edge thereof facing the bottom of the cylinder slot, which fulcrums in a depression or seat 36 grooved around the wall of the cylinder C. The jack 33 below the fulcrum lug 35 is of any approved length, and is provided with a plurality of frangible butts 37 which may be finely gauged and quite closely spaced together. They may be broken off in any selected arrangement to cooperate with the presser cams of the pattern mechanism H to be subsequently described. The jack 33 above the fulcrum lug 35 has an extension 38 adapted to lie in the slot of the cylinder behind the lower portion of the cooperative jack 31 of the set G so that when a presser cam presses the lower end of the jack 33 inward the upper end 38 will press the lower end of the jack 31 outwardly to position the butt 39 thereof in operative relation to a jack cam 42, as shown in Figure 6. Normally springs 43 contracted about the cylinder hold the jacks 31 of the set G inoperative, so that the butts 39 will pass by the jack elevating cam 42. It is only when one of the presser cams or plungers actuate against a butt of the respective jack 33 that the jack 31 is thrown at its lower end into position for engagement of its butt with the jack cam during cylinder rotation. Of course it is obvious that elevation of the jack 31 will push the cylinder needle 32 into position for receiving yarn from the wrap yarn feed mechanism, as shown in Figure 6.

A contractable spring 44 is disposed about the cylinder immediately in the plane of the fulcrum extensions 35 so as to permit easy rocking of the fulcrumed pattern jacks 33. The springs 43 of course normally urge the jacks 31 and 33 to the position shown in the left hand slot in Figure 6 of the drawings.

The pattern mechanism H is generally for the purpose of actuating the jacks in order that selected needles may be elevated for the taking of predetermined yarns in wrapped relation thereon, as accomplished by the wrap yarn feed mechanism K. This pattern mechanism H includes two sets 50 and 51 of presser cams or plungers which are spaced about the cylinder, preferably at the front thereof, and are respectively actuated by the pattern lugs upon pattern drums 52 and 53 respectively. Each presser cam set 50 and 51 consists of a frame 54 provided at opposite ends with narrow closely spaced shelves 55, as shown in Figure 6 of the drawings, so as to dispose the presser cams or plungers 56 of each of the sets 50 and 51 in closely spaced parallel superposed relation for rectilinear sliding in a predetermined path. These presser cams are arranged in spacing according to the spacing of the finely divided butts 37 upon the rocker jacks 33, as shown in Figure 6, and it is obvious that upon pressing a cam or plunger 56 inwardly it will operate upon the butt of the jacks 33 in the path thereof, if said butt has not been broken off, in order to rock the jack 33 for the purpose above described. These plungers or presser cams 56 are of the general shape shown in Figure 7 of the drawings. They have a rather pointed end facing the respective pattern wheel or drum and the opposite end is angled as shown at 57. Springs 58 urge the individual presser cams away from the needle cylinder; the movement being limited by abutment of the angled end 57 against the frame 54. The edge of the presser cam facing the cylinder may be divergently sloped with respect to the circumference of the cylinder to enable a gradual rocking of the jack 33. The framework 54 for supporting the presser cams may be readily disassembled as a unit from the bed of the knitting machine, and it may be disassembled to permit removal and replacement of the presser cams. Each presser cam set, upon the top of the frame 54, is provided with one of the cams 42, which may be set in fixed position by means of adjusting screws 60, as shown in Figure 6 of the drawings, for the above described purpose of elevating the jacks 31 whose butts 39 are thrown into position by the aforementioned pattern mechanism H.

Referring to the mounting of the pattern drums or wheels 52 and 53 and the means for step by step advance rotation thereof, it is broadly the purpose in providing said pattern wheels to selectively arrange lugs thereon in convenient manner for the operation of the presser cams above described. Various methods of construction may be adopted, such as the use of vertical strips in the wheel about the circumference thereof provided with frangible butts which may be broken to suit the pattern. Or removable pins may be disposed in the wheel at suitable elevations about the circumference of the wheel. In the example shown, however, each wheel consists of a supporting post 61 removably secured at its lower end in a slidable supporting table 62. This supporting table 62 is slidably mounted upon a stationary bed 63 which is bracketed at 64 upon the bed of the knitting machine, as shown in Figure 6, at the front of the same, so that the table 62 and the pattern wheels therewith may move towards and from their respective presser cam sets. To guide this motion the bed 63 may be provided with suitable guide ribs 65 and the table 62 may be provided with slots to receive the same, as shown in Figure 7. A cylindrical shell 67 may be removably mounted upon each of the posts 61, provided with longitudinal passageways therethrough for receiving clamping bolts 68 by means of which a ratchet wheel 69 may be clamped at the lower end of the wheel. The cylinder portion 67 of the wheel is adapted to receive removable ring discs 70 of the well known type, which are provided with a circumferential row of spaced frangible butts thereon which may be broken off in any selected arrangement. A cap 71 may be provided on top of the wheel removably held thereon by set screws and a clamping nut or screw 72 of well known construction.

The operation of the slide table 62 will be apparent from Figures 1, 3 and 6 of the drawings. A bell crank lever 74 is pivoted at 75 upon a bracket 76 attached to the bed of the machine, and the upper end of the bell crank lever is connected to an extension 77 upon the table 62. The other end of the bell crank lever has a link 78 connected at its lower end with a slide block 80 (shown in Figure 3 of the drawings) which slides in a frame 81 of the machine and is operated by a lug upon a pattern drum 82 of the machine. This mechanism throws the table 62 forward during knitting of the heel and toe of a stocking, so that the pattern control drums or wheels 52 and 53 are out of operating relation to their respective presser cams. A spring 85 normally urges the pattern drum supporting table 62 forward and away from the cylinder.

Referring to the means for step by step advancement of the drums 52 and 53 of the pattern control mechanism H, an oscillating pawl supporting block 90 is provided for each of the drums 52 and 53, preferably below the ratchet wheel 69 thereof, and whereon the pawl mecha-

nisms for the respective drums are mounted. These pawl mechanisms are substantially the same, and best illustrated in Figures 7, 8 and 10 of the drawings. As shown in the latter figure, each drum pawl mechanism consists of an upper pawl 91 and a lower pawl 92, both of which are pivoted intermediate the ends thereof at 93 upon the respective plate 90. Springs 94 normally urge the pawls into engagement with the teeth of the respective ratchet wheel 69. The upper pawl 91 of each pawl mechanism has an extension 95 thereon in a path to engage the lower pawl 92 when the outer end of the upper pawl is swung towards the respective ratchet wheel associated therewith in order that both pawls may be moved out of engagement at their pointed ends with respect to the teeth of the ratchet wheel. The means for accomplishing this action will be subsequently described.

As before mentioned the plate or member 62 which supports the pattern wheels or drums is moved away from the cylinder in order to place the trick lugs out of operating path of the respective plunger or presser cams 56. This takes place when the machine is knitting the heel and toe. When this occurs, in order to bring the pattern drums 52 and 53 to initial starting position, that is, to reset them, the upper pawl section 91 of each pawl mechanism remains operative upon the respective ratchet wheel 62, and the lower pawl section 92 is drawn out of operation with respect to the respective ratchet wheel. As will be noted from the drawings each lower pawl section 92 has an upstanding pin 97. As will be noted from Figure 7 of the drawings the frames of the presser cams are provided with cam extensions 99 forwardly of the respective pins 97 of the lower pawl sections so that as the supporting plate 62 is moved away from the frame of the knitting machine the pins 97 will slide along the cams 99 and move the pointed end of the pawls away from the ratchet wheel 69. This will not, however, move the upper pawl sections 91 out of engagement with the teeth of the ratchet wheels 62, and the step by step advancement of the drums or wheels 52 and 53 will continue until a blank or filler piece in the upper part of two of the teeth of each ratchet wheel 62 rides opposite the pointed end of the pawl section 91, and at which time the pawl sections cannot further advance the ratchet wheel 69. This resets the pattern drums or trick wheels. As will be noted from Figures 17 and 18, showing the developed views of the pattern drums 52 and 53, these blank pieces 100 occur only on the upper half at two of the teeth of the ratchet wheels 69. Thus even during knitting of the heel and toe the pattern drums may be moved in their step by step advancement until their resetting position is obtained, and when the pattern drums are again moved into position for operation upon the presser cams 56 the lower pawl sections 92 will insure a continued rotation of the pattern drums or trick wheels.

Referring to the means for synchronized step by step advancement of the pattern wheels 52 and 53, it will be noted that the right hand pattern drum or wheel 52 has an extension arm 102 on the base 90 which supports the pawl mechanism. A connecting rod 103 is pivoted at 104a on this arm, as shown in Figure 7 of the drawings, and it extends rearwardly where it is pivotally connected to the upper end of an oscillating lever 104; the latter being pivoted at 284a on a bracket at the rear of the machine. This lever 104 at its lower end extends into the operating path of four lugs 105 on one side of a wheel 106, located 90° apart. The wheel is rotatably supported upon the frame of the knitting machine in any approved relation and geared for synchronized rotation with the conventional "104" wheel 23. The wheel 106 is of the same size and gear ratio as the "104" wheel 23.

As will be noted from Figure 7 of the drawings a spring 108 normally urges the lever 103 forward to a position where the operating throw of the lug 105 of the wheel 106 on the pattern wheel advancing mechanism is sufficient to advance the drums the length of two teeth of the ratchet wheel 69. It will be noted that the two pattern drums 52 and 53 have their pawl supporting bases connected for synchronous operation by a connecting bar 110. During normal operation of the pattern mechanism H, however, it is only desirable to have each pattern drum advanced for the distance or length of one tooth. This is accomplished by providing a detent 111, shown in Figure 7, spring actuated at 112 so that the restraining end thereof operates to engage a pin 113 to limit the advancement of the pattern wheels 52 and 53 for the length of one tooth of the ratchet wheel 69, as will be quite apparent. This detent lever is sometimes thrown out when knitting particular designs. For instance, if the machine is knitting a continuous wrap stripe pattern throughout the stocking, the pattern being, say 42 courses in length. If now there are 48 lugs about the circumference of each pattern drum 52 and 53, it can readily be understood that there are six extra spaces in the forty-eight divisions which must be accounted for in order to continue without course spacing the successive wrap patterns. This regulation is effected by providing a line of lugs 115 along twelve divisions of the pattern drum, as shown in the developed view Figure 17, which throw the detent 111 out of operation in order that during this interval the advancing mechanism may advance each pattern drum 52 and 53 for the length of two teeth of the ratchet wheel 69, every time a lug 105 of the wheel 106 actuates the advancing mechanism. With this arrangement it is perfectly obvious that wrap patterns may vary as to the number of courses which they cover and such patterns may continuously appear one after the other without or with any desired spacing, since with the mechanism illustrated and described for advancing the pattern wheels, each advancement may be for the length of one tooth or more than one tooth as required.

Means is provided to stop the advancement of the pattern wheels 52 and 53 while knitting the heel of the stocking in order to hold the pattern controlling lugs or butts of the trick wheels in proper place, so that the pattern may be properly completed when knitting upon the upper foot portion is resumed. Additional means is also provided to selectively throw one or other of the pattern wheels 52 and 53 out of operation while the other remains operative. These means, as shown particularly in Figures 7 and 8 of the drawings, consists in the provision of pawl throw-out levers 120 and 121 for the pawls of the drums 52 and 53 respectively, pivoted at 122, which are normally inoperative, but which may be moved together or selectively into engagement with upstanding pins 123 on the uppermost pawl section of each pawl assemblage. Operation of these throw-out levers against the pins 123 will of course throw both pawl sections 91 and 92 out of op-

eration due to the extension 95 (see Figure 10). Bell crank levers 125 and 126 are pivoted at 127 on the frame of the machine. At similar ends thereof they are respectively connected by links 128 and 129 with the free ends of the pawl throw-out levers 120 and 121, as shown in Figure 7. At the rear part of the frame of the machine, as shown in Figures 2, 5 and 7 of the drawings there are provided a pair of bell crank levers 130, pivoted at 131, the upper ends of which are connected by rods 132 with the bell crank levers 125 and 126. The other ends of the bell crank levers 130, as more particularly illustrated in Figures 4 and 7 of the drawings, are connected by rods 135 with certain levers 137 pivoted at 138 on the frame of the machine. These levers 137 at their free ends operate upon a pattern wheel or drum 140 such as has been described in my above mentioned co-pending application. Lugs on this pattern wheel actuate the throw-out levers 120 and 121 through the connecting mechanism above described. The levers 137 are illustrated in side elevation in Figure 3 of the drawings, but to avoid confusion that view does not show the connecting links 135. Many of these levers 137 may be provided for controlling various parts of the knitting machine, and they are particularly used in the present invention for controlling the yarn feed fingers of the wrap yarn feed mechanism. Through control of the throw-off levers 120 and 121 individually off the pattern control drum 140, the pattern control wheels or trick wheels may be selectively thrown into or out of operation, as desired.

As above mentioned, in order to hold the wheels 52 and 53 until after knitting of the heel, when it is desired to resume a wrap pattern on the foot portion of the stocking, the throw-out levers 120 and 121 may be operated in a different manner than that above described, and simultaneously. Such arrangement is shown in Figures 1 and 7 of the drawings, by employment of a bell crank lever 150, pivoted at 151 on the frame of the machine. Its upper end is provided with a pair of pins 151 which operate in the slotted ends of a pair of levers 153 and 154 which are respectively connected with the bell crank levers 125 and 126. The other end of the bell crank lever 150 is connected to suitable mechanism 155 operated by lug control off a pattern drum 157, as shown in Figure 1 of the drawings. It will be noted that with this means both the throw-off levers may be simultaneously operated to hold the pattern control wheels or drums 52 and 53 in proper position, or through the first means above described these trick wheels 52 and 53 may be selectively and independently actuated off the control drum 140.

Referring to the yarn wrapping attachment K and its operating means L, the same are used to selectively control the wrapping of various contrasting yarns upon selectively arranged predetermined groups of needles, in accordance with the teaching in my co-pending applications Serial Nos. 591,689 filed February 8, 1932, and 662,354 filed March 23, 1933. A bracket 90a is provided as part of the frame of the machine rotatably supporting a suitable bobbin stand and drive gearing thereon (shown in the co-pending applications above referred to). The bobbin stand includes a rotary spindle 91a supported by the portion 92a of the standard 90a. This spindle 91a axially aligns with the cylinder C and has keyed thereto the platform of the bobbin stand (not shown). The bobbins in any approved number are used and the threads extend therefrom downwardly through suitable tensioning devices which are specifically old in the art and thence downwardly through a suitable concentrating guide from whence they converge into the wrapping attachment K.

The yarn wrapping attachment K includes a yarn feed finger head 102a, specifically described in my above identified co-pending application, which is keyed to the shaft 91a. In the peripheral slot vertically provided in the head 102a yarn feed fingers 111a are provided which are fulcrumed at 112a. Normally they are in inoperative position, maintained in such relation by a circumferential spring 113a and individual springs 114. The threads extend downwardly through the head and are threaded through the lower ends of these yarn feed fingers, which are suspended just above the needle cylinder so that they may be swung from inside of the needle line to outside of the needle line in order to wrap yarn on selected groups of needles in accordance with the description in my above identified co-pending applications. Each of these yarn feed fingers may contain a plurality of frangible butts which may be broken off as desired so as to leave certain other butts at selected levels for operation by selected presser cams in accordance with that feature of my invention described in my above identified co-pending applications.

In order to control the wrapping yarns so that they may be wrapped at the desired locations upon one or more needles, the means employed is substantially the same as described in my above identified applications. That is, the latch ring 130a, which is of usual construction, has a plurality of yarn guide wires or members 134a and 135a, for the needles which are respectively elevated by jack mechanism off of the drums 52 and 53. Each of these yarn guide wires or bars is mounted upon a plunger 136a slidable in a suitable bearing on the latch ring and spring urged to normally a retracted position. Briefly the yarn which is thrown into operative relation by a yarn finger catches upon the intended yarn guide member 134a or 135a and is held in such position so that it will catch upon the predetermined number of elevated needles which are brought into position by pattern drums 52 or 53, as the case may be, only sliding off of the yarn guide wire or member 134a or 135a when the warn feed finger 111a is retracted, as has been specifically described in my co-pending applications above mentioned. A curved wire or bar 133a is provided along the inside of the line of needles at a location adjacent the hook ends thereof when lowered, to prevent yarns from the yarn wrapping feed fingers 111a becoming entangled with the web holders and needles other than those intended. The yarn guide members 134a and 135a are simultaneously operative into or out of yarn retaining relation with the yarn feed mechanism of the wrapping attachment in a manner which need not be specifically described here but has been set forth in my above identified co-pending applications.

The means L for actuating the yarn feed fingers of the needle wrapping yarn mechanism K contemplates the disposition of a pair of cam supporting blocks 143 and 144 upon a pivoted supporting arm 145 as fully described in my co-pending application Serial No. 662,354 filed March 23, 1933. These blocks each support four cams, although the number may vary as desired. The cams are of the presser type and actuated to en-

gage the butts placed at various levels on the fingers 111ª of the wrapping attachment K in order to selectively swing the fingers 111ª at two different points for selective contral of yarns having various characteristics.

For the knitting of the pattern shown in Figures 11 and 12 of the drawings, the topmost presser cam of the block 144 is used, and the second presser cam from the bottom in the block 143 is used. These cams are respectively designated at 154 and 152 in Figure 15 of the drawings. The cams in the block 143 are actuated by levers 158 pivoted at 159, as shown in my above identified applications and also in Figure 1, and the cams of the block 144 are actuated by levers 160 pivoted at 161, as shown in Figure 1. All of these operating levers have connecting rods 165, shown in Figure 3, pivotally connected therewith and slidable through a suitable guide block 166 mounted upon the bracket 90ª of the machine. Bell crank levers 167 are pivoted on a similar bracket at 168 with which the rods 165 are operatively associated as indicated in my above identified applications. The other ends of the bell crank levers have connecting rods 170 connecting them with suitable plungers 172 mounted within an eccentrically pivoted supporting block 173, as shown in Figure 3. The block 173 is mounted to turn upon a horizontal axis at 174 and the plungers 172 are connected by links 175 with the rear ends of certain of the pattern drum operating levers 137 above described. It is obvious that lug actuation of the plungers 172 through the levers 137 and 175 will, through the connecting linkage, operate the cams in the blocks 143 and 144 for moving the yarn fingers 111ª into operative relation with the predetermined elevated groups of needles, in accordance with the arrangement described in my above identified co-pending applications.

In order to cut out the feed of patterning yarns, means is provided to prevent operation of the cams in the blocks 143 and 144. This means consists of a lever 184 pivoted between its ends at 185, as shown in Figure 3 of the drawings, connected slidably by a pin and slot connection with the outer end of an arm 186 which is keyed to the shaft on which the block 173 is eccentrically pivoted. A lever 187 operative by means of a lug upon the pattern drum 82 through a connecting rod 188 actuates the eccentric block 173 in a manner which has been described in my above mentioned applications.

The pattern drum 140 is advanced step by step off of the cylinder driving mechanism of the machine. This drum has a ratchet wheel 64ª with sixty teeth about its circumference. Since it is intended to advance the drum 140 the length of one tooth for each two revolutions of the cylinder C the "104" wheel 23 is provided with diametrically opposed lugs 65ª on the right hand side thereof, facing the front of the machine, as shown in Figure 5 of the drawings, which operates a lever arm 66ª, shown in Figure 2 of the drawings, for turning a shaft 67ª to which said lever arm 66ª is keyed. This shaft 67ª has an arm 68ª keyed therewith, as shown in Figure 3, and said arm is provided with a pawl 69ª freely pivoted thereon resting upon the teeth of the ratchet wheel 64. A spring 70ª urges the shaft 67ª into such position that the lugs 65ª on the gear wheel 23 will properly operate the pawl 69ª for step by step advancement of the pattern wheel 140. All of this mechanism is described in my above identified co-pending applications.

In order to cut out of operation the drum 140 means is provided to trip and hold the pawl advancing lever 69ª out of operation, and this means is tripped in predetermined manner by a lug 77ª upon a pattern chain 78ª, as has been described in my above identified applications, and as specifically claimed in my co-pending application, Serial No. 666,914 filed April 19, 1933.

Referring to the operation of the horizontal yarn striping attachment P, the same is used during the knitting of plated fabric in order to change the horizontal striping yarns. A large number of yarn changes may be provided, but in the sample of fabric R only two yarn changes are shown. This horizontal striping mechanism has been detailed in my co-pending application Serial No. 662,354, filed March 23, 1933, and briefly consists of yarn guide fingers 212 and 213, which are pivoted upon the latch ring in the usual manner and normally urged by springs into yarn feeding position, as will be well understood by anyone skilled in this art. As many of the yarn guide fingers for the horizontal striping mechanism may be provided as desired. In the present invention only two of the yarn guides 212 and 213 are provided for the knitting of the fabric R.

For knitting a stocking on the knitting machine A with the pattern of the fabric R, a body yarn 206 is fed from a finger 210 (similar to the feed fingers 212 and 213 above mentioned). This body yarn 206 is fed to the leg of the stocking throughout its length. A heel and toe yarn 207 is likewise fed from a yarn feed finger or guide 211, and brown and green striping yarns 208 and 209 are respectively fed from the fingers 212 and 213. Of course the yarns 208 and 209 are alternately plated with the body yarn 206. Through tensioning means well understood in this art the yarns 208 and 209 may be plated on the outside of the fabric to produce alternate horizontal striping effects, and the yarn 206 may be used as a lining yarn. In the fabric R the body yarn 206 appears on the outside of the tubular fabric and the horizontal striping yarns are used as lining yarns, but they are reverse plated in certain areas to produce the alternate contrasting reverse plated effects shown throughout the leg in Figure 11 of the drawings.

The operating means of the horizontal striping attachment P includes connecting wires 216 which operate the yarn feed fingers 210 to 213 inclusive in a manner well understood in this art and specifically shown in my co-pending application, Serial No. 662,354 filed March 23, 1933. They extend downwardly through the machine and at their lower ends are connected operatively with the usual levers 217. The latter ride upon suitable cams of a conventional drum 218 at the front of the machine, shown in Figure 1 of the drawings. Since any number of yarn fingers may be provided on the latch ring, for the knitting of the above described yarns, and also additional yarns such as for the foot, reinforcing and other splicing. The horizontal striping attachment P additionally includes levers 220, shown in Figure 5 of the drawings, pivoted intermediate their ends at 221 and at their forward ends engaging the respective wires 216 for pulling the wires which are respectively associated with the horizontal striping yarn feeds 212 and 213 into yarn feeding position alternately. The opposite ends of the levers 220 are controlled by a pattern drum 223, best shown in Figure 4 pivotally mounted upon a shaft 221 on the rear of the machine. This pattern control mechanism has been de-

scribed, as to operation, in my above identified co-pending application, Serial No. 662,354, filed March 23, 1933. Briefly, lugs are provided on the pattern drum 223 for alternately operating the levers 220, and for the particular fabric R the green striping yarn 209 is fed to the needles of the machine for eighty-four courses, designated by the space "a" in Figure 12 of the drawings. Thereafter the lug arrangement on the drum 223 throws the green striping yarn 209 out of operating relation to the needles and the feed finger 212 throws the brown striping yarn 208 into operating relation to the needles of the knitting machine, and for the next eighty-four courses, designated by the space "b" in Figure 12 of the drawings, the brown striping yarn is knitted into fabric with the body yarn 206. Of course it is to be understood that the lug arrangement on the drum 223 may change as desired. It should be briefly remarked that the lugs coming into engagement with the levers 220 will rock the same for depressing the forward ends thereof. This pulls down upon the wires 216 to throw the yarn feed fingers out of operation. Normally they are spring urged into feed position.

The means for advancing the drum 223 includes a ratchet wheel 224 upon the shaft 221. A lever 225, shown in Figures 4 and 5 of the drawings, pivoted upon the frame of the machine, has a pawl 226 spring urged against the teeth of the ratchet wheel 224. The gear wheel 23 has a lug or roller 230 thereon which engages the lever 225 to swing it into position for advancing the ratchet wheel 224 thru the pawl 226 to an angle equivalent to the pitch of one tooth upon the ratchet wheel. Twelve teeth are provided upon the ratchet wheel. The lugs are so placed upon the drum 223 that each lever 220 will be operated at every alternate advance of the ratchet wheel by the pawl 226. Since the gear wheel 23 rotates once for every four revolutions of the knitting cylinder it is quite apparent that the ratchet wheel 224 will be advanced for the length of one tooth at every four revolution of the cylinder. If desired more than one of the lugs 230 may be placed upon the gear wheel 23.

For selectively controlling advancement of the drum 223 a bell crank detent lever 231 is pivoted, as shown in Figure 2 of the drawings, at 232 upon the frame of the machine. It has a shoulder 233 positioned to engage an extension upon the pawl lever 225 in order to hold the pawl 226 of said lever 225 inoperative with respect to the ratchet wheel 224, as shown in Figure 2 of the drawings.

Referring to Figure 5 the cam shaft 240 upon which the cam drum 218 is mounted has a ratchet wheel 241 advanced intermittently by a pawl 242. The latter is pivoted at 243 upon the conventional oscillating segment 244. In this manner the usual pattern chain 78 is advanced. As mentioned in my above identified co-pending application a second pattern chain 246 is provided, trained over a sprocket wheel 247 upon a shaft 248 of the machine. This chain is used to control the tripping of the detent lever 231 for intermittently changing the horizontal striping yarns.

For rotating the shaft 248 of the sprocket wheel for the second chain, the supporting arm 250, shown in Figure 2 of the drawings, is swivelled upon the shaft 248. It has a pawl 251 adapted to act upon the teeth of a ratchet wheel 253 which is keyed on the shaft 248. Referring to Figure 5 an arm 254 is keyed upon the oscillating shaft 245 of the segment 244. It has a roller 255 thereon adapted to act against the pawl supporting arm 250. A spring 256 normally under tension urges the pawl supporting arm to a retracted position as permitted by the lug 255. Thus the ratchet wheel 241 and 253 are advanced in the same manner and for the same distance for cooperative movement of the pattern chains 78 and 246. The latter is trained over suitable idle brackets and operates in the manner described in my above identified co-pending applications.

In order to trip the detent lever 231 a lever 260, shown in Figure 2 of the drawings, is pivoted intermediate its ends upon the frame of the machine and provided with a spring 262 urging it into engagement with the pattern chain 246. Its opposite end has a connecting rod 263 with a pin and slot connection with the detent 231. Lugs upon the chain 246, indicated at 265^a, engage the lever 260 at predetermined times for pulling the detent 231 in order to trip the lever 236 and permit the "104" wheel 23 to operate the pattern drum 223 through the mechanism above described.

A bell crank shaped latch lever 265 is pivoted upon the frame of the machine. One end has a notch 268 for engagement with a pin 269 on the lever 231 in order to hold the latter inoperative after it has been tripped as above described. The lever 265^a is in turn tripped by any of a plurality of lugs 270 upon a drum 271 keyed upon a shaft 221. These lugs are removable. One of them or all of them or any desired number may be used in accordance with the number of plating yarns used and the number of courses with which it is desired that the plating yarn shall individually appear throughout the fabric being knitted. It is to be noted that the trip lug 270 will trip the lever 265^a so as to permit the detent 231 to swing into position while the lug 230 is in advance of the lever 225. This insures rotation of the shaft 221 and the pattern drum thereon.

The reverse plating attachment N is an improvement over prior reverse plating attachments in that with the same as used upon this improved machine it is possible to reverse plate very large patterns upon the tubular fabric. Particularly is that true in such fabric R wherein diamonds are reverse plated, each extending through substantially eighty-four courses and the entire width of the stocking. The web holders M are of usual construction and have butts or tails on them acted upon by suitable cams provided upon the cam ring 276, as shown in Figure 6 of the drawings. 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 reverse plating jacks 278 are provided in each groove for the respective web holders in order to control the latter and relative tensioning of the plating and body yarns for the purpose of effecting normal and reverse plating.

In contradistinction to prior practice these jacks 278 have vertical butt portions which are extremely long, so that in the example shown twenty-four butts may be provided thereon, which may be selectively disposed for the knitting of very deep and wide reverse plated patterns. These jacks are provided with the usual top butts 279 and the selective butts 280^a for controlling their sliding actuation. The plating jack butts are of course acted upon in the usual manner by cams of the cam ring 276 and by a selective cam device consisting of a plurality of longitudinally slidable cams 280, shown in Figure 1 of the

drawings, any desired number of which may be provided. For the pattern R illustrated in Figures 11 and 12 twenty-one of them are utilized. They are slidable in suitable blocks 281 and actuate against the butts 280a at the different elevations thereof. The sliding cams 280 are pressed into operative relation to the butts of the reverse plating jacks 278 by means of lugs upon a rotary pattern drum 285.

The pattern drum 285 may be of any approved nature, but as illustrated may consist of a base 288, which is eccentrically pivoted (not shown) so that the drum may be moved to place the lugs thereof into or out of active cooperation with the presser cams 280 during knitting of the heel and toe, and part way out during knitting of the sole. These are conventional features of a reverse plating attachment of this type and will be only briefly described. The base 288 carries a spindle upon which discs of circular form are superposed. These discs have a peripheral arrangement of frangible lugs or butts which may be selectively broken off in order to lay out the pattern upon the drum as will be understood by those skilled in the art.

The drum 285 is intermittently advanced by a pawl and ratchet arrangement comprising a ratchet wheel 290 upon the drum, best shown in Figure 7 of the drawings. A split pawl device 296 is used for advancing the pattern drum 285, much in the same manner as above described for the needle wrapping yarn controlling drums, consisting of an upper pawl part and a lower pawl part. They are pivotally mounted on the same axis upon an oscillating member 287 and are spring urged at 291 against the teeth of the ratchet wheel.

The gear wheel 106 is provided with diametrically disposed lugs 282 which are adapted to actuate a lever 284 pivoted at 284a upon the machine. This lever at the opposite side of the pivot from that adapted to be engaged by the lugs on the gear wheel 106 has a link connection 284b with a lever 284c which is pivoted at 284d upon the machine frame, as shown in Figure 2. The lever 284c has a loosely pivoted connection at its upper end with a link 284e connected with the pawl support 287. It is quite obvious that contact of one of the lugs 282 with the lever 284 will move the pawl device 296 into advancing relation with the ratchet wheel 285.

The eccentrically pivoted base 288 is actuated to move the pattern drum 285 into or out of operating relation with the presser cams by a bell crank lever 236 having an operating connection 237 with the said base 288. A connecting rod 238 connects the bell crank lever 236 with a pivoted lever 239, shown in Figure 2 of the drawings, which operates off lug means on the drum 157 to move the pattern wheel 285 into or out of operating relation to the presser cams. Of course the drum 285 may be thus moved entirely out of operating engagement with the presser cams, or part way so as only to actuate upon the longer butts of the jacks controlling the sinkers when it is desired to reverse plate around only part of a stocking, such for instance as when it is desired to cut out reverse plating from the sole.

A detent 249 is pivoted at 249b on the frame of the machine and has a hooked end cooperating with a pin 259 fixed on the pawl supporting base 287 to limit the advancing movement of the pawl assembly to the throw of one tooth. This detent 249 is spring urged into the position shown in Figure 7. It has an extension 249a thereon which may be tripped, as by certain lugs 249c, shown on the developed view of the pattern drum in Figure 19, in order to throw the pawl 249 out of operating relation to the pin 259. The lugs on the pattern drum operate this lever obviously for the purpose of permitting the pawl mechanism 296 to advance the pattern drum two teeth instead of one. This enables proper circumferential advancement of the pattern drum for resetting the pattern, as has been above described for the pattern drum arrangement for controlling the wrapping yarns.

A lever 500 is pivoted on the frame of the machine, preferably also at the pivot 249b which actuates against a pin 501 on the upper pawl 296 in order to throw that pawl out of operation during knitting of the heel. This lever 500, shown in Figure 7, is actuated off a lever 502, shown in Figure 2 of the drawings, through a suitable link connecting mechanism illustrated in that drawing. The lever 502 is actuated off a lug arrangement upon a pattern drum 503.

Referring again to further explanation of the lug arrangements on the pattern drum 157, the lug 506 thereon actuates the lever 239 in order to throw the lugs of the reverse plating drum 285 out of actuating relation upon the presser cams during knitting of the heel. The lower lug 507 thereon is used to cut out those sinker jacks having short butts. It comes into play before starting the leg portion of the new stocking. The lug 508 is used in the same manner for cutting out short butts of those jacks controlling sinkers just before the start of the heel of the stocking. The lug 509 is used during knitting of the toe. The cam for actuating the lever 155 lies back of the cam or lug 506, and as before mentioned will throw all four ratchets of the two wrap yarn pattern control drums out of operation during knitting of the heel of the stocking only.

As illustrated in Figures 1 and 15 of the drawings a cam 510 is provided which is actuated off the pattern drum 82 for the purpose of elevating the long butt needles during knitting of the heel and toe of the stocking. Another cam 511 also shown in Figures 1 and 15 of the drawings is likewise actuated by a lug arrangement off the drum 82 for lowering the long butt needles with the knitting of the heel and toe. If desired this cam may be placed otherwise than shown, for instance, between the cam 510 and the knock-over point, in order that the first course after coming off the heel can be knitted properly with a reverse plate or wrap stripe pattern. The cam 513, likewise shown in Figures 1 and 15 of the drawings, is disposed between the needle elevating points of the pattern control drums 52 and 53, and as set forth in my above mentioned application is for the purpose of lowering the needles which have been elevated off the jack control of the pattern drum 53, subsequent to wrapping of the yarn thereon, in order to place those same needles or other needles in the pattern group in retracted position where they may be acted upon the jack control arrangement off the pattern drum 52, for the purpose of knitting complicated "color within color" patterns.

Referring further to the tubular knitted fabric R, which is intended to represent part of the leg of a stocking, but which may be any kind of tubular fabric, the developed needle, sinker, warp yarn feed finger and other cam and pattern control layout is shown in the developed view

Figure 15. That view does not, however, show a full complement of needles. Figure 16 designates the developed pattern layout for controlling the yarn feed fingers; Figures 17 and 18 designate respectively the right and left wrap yarn pattern control drums looking towards the front of the machine, and Figure 19 represents the developed layout for the reverse plating pattern drum.

As previously mentioned the body yarn **206** is plated with alternately horizontal striping yarns **209** (green) and **208** (brown); the striping yarns in this pattern being the lining yarn and reverse plated to provide diamonds which extend through eighty-four courses and the entire width of the flattened stocking. So far as the reverse plating is concerned the lug layout is shown upon the plating drum **285**, shown in Figure 19 of the drawings. The direction of rotation is that indicated by the arrow in the drawings and the knitting of the tubular fabric R proceeds in the direction indicated by the arrows in Figures 11 and 12 of the drawings. Figure 19 shows the lug **525**. It actuates a presser cam and through it one of the sinkers in order to reverse plate one of the diamond patterns beginning at **526** (see Figure 11). The timing is set so that the fabric will be knitted through two courses while the lug **525** is active. The reverse plated diamond formed by the body yarn and the green yarn proceeds in a manner which will be well understood in the art, the lugs on the pattern drum **285**, designated in full black, increasing in stepped relation the width of the pattern until its fullest width is attained, at which time the series of lugs at the point **527** (Figure 19) are actuating the presser cams and sinkers, and thereafter the reverse plating is stepped to narrow the diamond. As before mentioned the lugs **249**^{c} will actuate the detent **249** (see Figure 7 of the drawings) in order to release the pin **259** permitting an increased throw of the intermittent advancing mechanism for the reverse plating pattern drum. For this the number of steps about the circumference of the pattern drum is just doubled, as indicated by the double length lugs **529** at the left hand part of Figure 19 of the drawings.

As above mentioned the advancing pawl for the pattern drum **285** is split for the reason that the lower pawl is away from the ratchet wheel when the base block moves the pattern drum away from the presser cams. The upper pawl remains in operation and continues to advance the pattern drum until it reaches the blank piece **530** which lies across two teeth of the ratchet wheel, as shown in Figure 19. The drum stops in order to reset the same for a start of a new pattern (reverse plated). The butt layout upon the jacks for the web holders is shown in Figure 15, for knitting the diamond plated pattern of fabric R, although distinction is not made in this figure as to short and long butts.

The pattern layout upon the right and left hand drums **52** and **53** for controlling the wrapping yarns is designated in Figures 17 and 18 respectively. It is intended to knit diagonal stripes, intersecting the reverse plated diamonds, as indicated at **535** in Figures 11 and 12 of the drawings. These diagonally crossing stripes really form diamond designs in the tubular knitted article. The diamond designs are shown as intersecting the reverse plated pattern, but they may be used to border the reverse plated pattern, since that can easily be regulated. The drum **52** designated in Figure 17 of the drawings is used to knit the lower half of the wrap diamond, that is, the portion designated in the horizontal section "*e*" in Figure 11 of the drawings, and the other pattern drum **53** is used during the knitting of the upper half of the needle wrapped pattern, such as the portion designated at "*d*" in Figure 11 of the drawings. As to the feed of the wrapping yarns to the needles elevated through the pattern drums **52** and **53**, fingers **111**^{a} are placed about the cylinders, say for every ten needles, and each of these fingers preferably has a pair of the butts at the upper end thereof, the upper butt adapted to be actuated by the cam **154** and the lower butt by the cam **152**. These cams **152** and **154** are actuated in a manner described in my above identified co-pending application, and the lug layout for actuating them is designated on the pattern drum **140** illustrated in Figure 16 of the drawings. A line of lugs **540** actuate the cam **154** and the line of lugs **541** actuate the cam **152**. This is accomplished through intermediate linkage well understood from the description in my co-pending application above identified. Opposite each of the lugs **540** and **541** there is a pin **542** on the drum which holds the drum advancing pawl inoperative until tripped by the pattern chain, as described in my above mentioned co-pending applications, so that each lug **540** and **541** remains active as to its respective cam **154** or **152** throughout the knitting of forty-two courses of the fabric R. The wrapping yarns cooperate with the yarn guides **134**^{a} and **135**^{a} in order to properly wrap the needles elevated by the pattern drums **52** and **53**.

Referring to the seamless knit stocking S illustrated in Figure 13, in this pattern there is merely used a body yarn which may be white, and a lining yarn, which may be brown; the latter being reverse plated in diamond areas at each side of the stocking, similar to the reverse plated diamonds of the fabric R. Of course horizontal yarn changes may be used if desired. Each of these diamonds is eighty-four courses measured along the clocking length of the stocking, and extends the full width of the stocking. Wrap yarn knitted clocks are provided, and for such purpose blue yarn may be provided for the major portion of the clock with red yarn for the "within color" portions at the top and intermediate portions of the clocks. Similarly red yarn may be provided for knitting the small lateral patterns of diamond shaped area designated at **550** in Figure 13 of the drawings. Inasmuch as the reverse plated diamonds are provided with the body and plating yarns much in the same manner as that above described for the fabric R the reverse plating operation will not be further described.

Referring to the developed layout of the needle and jack arrangement for knitting the fabric S, a group of jacks **552** is provided for each clocking area, and lateral groups of jacks **553** are provided for manipulating needles in order to knit diamonds **550**. These groups of jacks are selectively manipulated by the pattern drums **52**^{a} and **53**^{a} in order to knit the "color within color" clock and also the patterns **550**. Inasmuch as the full complement of needles and jacks is not shown in Figure 20, the second group of jacks **552** is not illustrated. It will be noted from Figure 14, which illustrates (in inverted position, or the state in which the same is knitted) the top of the clock, that the same consists of an enclosed wrap stripe boundary (knitted with blue yarn) as designated by stitches **560**, which of course are knit-

ted in with the knitted stitches of the plated body and reverse plated yarns. The body yarn is not illustrated, and the stitches shown in blank are of the reverse plated brown yarn, in which the top of the diamond is knitted, as shown in Figure 13. Within the enclosed wrap stitch boundary formed by the blue yarn stitches **560** there is a diamond-shaped pattern formed of red yarn stitches **561**. On the inside of the fabric the blue yarn is floated between spaced stitches in the courses in which the same is knitted, and from course to course, and that is also true of the red yarn, in accordance with the "color within color" method of knitting described in my above identified co-pending applications.

The rest of the clock is knitted of the blue yarn except for the pattern dots indicated at **562** in Figure 13 of the drawings.

As shown in Figure 20 of the drawings a yarn finger **111c**, which controls the feed of a red yarn, and the yarn finger **111d**, which controls the feed of a blue wrap yarn, are provided for the clocking group of needles **552** in order to knit the "color within color" pattern at the top of the clock as illustrated in the enlarged view, Figure 14. Wrap yarn guides **134b** and **135b** are provided respectively for the wrap yarn pattern control drums **52** and **53** in holding the respective yarns for deployment upon the selected group of needles as elevated by the pattern control drums and presser cams. Wrap yarn finger swinging cams **573** and **574** are provided for cooperating with those fingers which are intended to feed yarn to the needles elevated off the right hand pattern drum control **53**, and cams **575** and **576** are similarly employed in cooperation with the yarn guide **135b** for swinging the fingers controlling the wrap yarns into cooperation with those needles raised off the jacks and presser cam controlled left hand drum **54**, as will be quite apparent.

Inasmuch as the variety and complicated arrangement of wrap strips patterns is practically unlimited, not only as to arrangement of patterns but as to selection of "color within color" yarns, it is believed that it will suffice to explain only part of the lug arrangement on the pattern drums **52a**, **53a**, and **140a**. It should be borne in mind that by means of the levers **120** and **121**, shown in Figure 7 of the drawings, the wrap stripe pattern control drums **52** and **53** may be independently controlled off a lug arrangement on the drum **140**. In knitting the pattern S the pattern drums **52a** and **53a** are so rotated that sometimes one of them is inoperative while the other rotates to effect needle displacement, and vice versa.

In the drum **140a** illustrated in Figure 21 the line of stop pins intersected by the dot and dash line **580** are used to hold the drum **140a** against step by step advance until tripped by the pattern chain, as has been described in detail in my above identified co-pending applications. The line of lugs intersected by the dot and dash line **581** controls the operation of the left hand drum **53a**. The line of lugs intersected by the dot and dash line **582** controls the operation of the right hand drum **52a**. The line of lugs intersected by the dot and dash lines **583** controls the operation of the yarn finger swinging cams **573** for the purpose of regulating feed of the blue wrapping yarn onto the needles elevated off the pattern drum **52a**. The line of lugs intersected by the dot and dash lines **584** controls the cam **574** (see Figure 20) for swinging of the yarn feed fingers **111e** which feeds red yarn to needles elevated off the pattern drum **52a** to certain groups of the needles controlled by the group of jacks **553**. The lugs intersected by the dot and dash line **586** control the cam **576** for actuating the yarn feed fingers **111c** in order to control the feed of red wrapping yarns to certain intermediate needles operated on the group of jacks **552**, as shown in Figure 20, for the knitting of the red pattern in the portion of the clock illustrated in Figure 14. The line of lugs intersected by the dot and dash line **587** actuate the cam **575** for controlling yarn feed fingers **111f** by means of which red wrapping yarns are fed to groups of needles actuated off a jack group **553** for the knitting of certain of the red wrap stripe pattern areas **550**.

The drum **140a** rotates in the direction illustrated in Figure 21 of the drawings and in that figure is indicated the position of the drum in relation to the wrapping yarn control drums **52a** and **53a** for start of knitting of the clock. Of course the "color within color" head of the clock is knitted first, and at this time the drums **52a** and **53a** are being advanced step by step. The levers **137** (see Figures 3 and 4 of the drawings) in this position drop at their free ends into the depressions **590** between the lugs in the lines **581** and **582**. At this time, referring to Figure 22, the lugs on the pattern drum **52a** designated at the intersection of blocks **2** to **10** inclusive with blocks "*a*" to "*e*" inclusive insure the elevation of the group of needles controlled off the jack groups **552** for taking the blue yarn fed by the finger **111d** off the cam **573** in order to knit the wrap yarn stitches **560** comprising the outer blue border portion of the head of the clock. The cam **573** of course is moved into position at this time since it operates off the lug intersected by the line **583**. The wrap yarn pattern control drum **53a** operates the five intermediate needles controlled off the jack group **552**, so far as elevation is concerned, in order to take the red yarn fed thereto by the yarn finger **111c** controlled off the cam **576**. This cam **576** is controlled off the lug **592**, at this time. The lugs on the pattern drum **53a** which actuate the five central needles controlled off the five central jacks of the group **552** at this time are designated in solid black in the intersecting spaces **4** to **8** inclusive and "*a*", "*b*" and "*c*", to insure the knitting of the stitches **561** in the pattern shown in Figure 14.

At the same time that this head end of the clock is being knitted the side patterned areas **550** in the same courses therewith are knitted off needles controlled off the drum **52a** by the lugs designated in the intersecting spaces **4** to **8** inclusive with "*f*", "*g*", and "*h*", and the cam **574** is thrown into operation at this time with the fingers **111e** in order to wrap the red yarn controlled thereby upon the groups of needles controlled off a jack group **553**, in a manner which is perfectly apparent. After the "color within color" head portion designated at **600** in Figure 13 of the drawings has been knitted, the blue wrapping yarn may be knitted to provide a narrow clock portion **601** extending over one or more wales. During the knitting of this portion **601** of the clock, the drum **52a** may be stopped with the lug at the intersection of pattern spaces *a*—**10** on the presser cam actuating the central needle operated off the central jack of each group **552**. The drum may be stopped at this time for the desired number of courses knitted in the leg of the stocking. This stopping of the drum **52** is of course regulated off lugs of the drum **140a** in the line **582**. Inasmuch as any "color within

color" clocking and other patterned areas may be provided in the seamless knitted article after the wrap stripe method, it is thought the above description need not be continued, but the lug arrangement on the drums 52a and 53a and 140a illustrated in Figures 21, 22, and 23 of the drawings, are correct for the knitting of the "color within color" wrap yarn clock shown in Figures 13 and 14 of the drawings. It is of course to be understood that both sides of the seamless stocking shown in Figure 13 are provided with similar patterned and clocked areas both so far as wrapping yarns and reverse plating are concerned.

It is to be noted for the drums 52a and 53a, as shown in Figures 22 and 23, that no pawl stopping blanks such as employed at 100 in Figures 17 and 18 of the drawings are provided. This is so because the resetting of the drums 52a and 53a in knitting of the pattern S is accomplished off the back drum 140a.

Referring to Figures 24 and 25 of the drawings, therein are shown modified means for actuating jacks off the presser cams 56 in order to elevate the needles for the reception of wrapping yarns. In Figure 24 the lower or main rocker jack 650 is fulcrumed at 651 and spring urged at 652 into position for throwing the upper end of the jack 650 outwardly. The extent of such outward movement of the upper end of the jack is regulated by the lower end 654 of the jack 650. An intermediate rocking and sliding jack 655 is provided, having a fulcrum lug 656. A portion of the jack 655 below the fulcrum point 656 is actuated by inward and outward movement of the upper end of the jack 650, and the upper end of the jack 655 of course actuates against the lower end of the needle 32 during upward movement in order to elevate the needle. Rocking of the jack 655 outwardly at the upper end thereof above the fulcrum point 656 places the butt 657 thereof into position so that the elevating cam 42a may engage it for causing upward sliding of the jack 655. Springs 658 normally urge the upper end of the jack 655 inwardly so that the butt 657 is retracted with respect to the cam 42a.

In Figure 25 the main jack 660 is fulcrumed at 661 so that it may not slide upwardly and downwardly in the slot of the cylinder. The upper end of the jack 660 above the fulcrum 661 is vertically slotted at 662 for slidably receiving therein an elevating jack 663 which preferably does not rock directly upon the cylinder. Springs 664 normally retract the upper end of the jack 660 in the slot and the jack 663 therewith so that the butt 665 of the jack 663 lies normally out of the path of contact with the elevating cam 42b. A presser cam 56 operating against a butt of the jack 660 swings the upper end of the latter outwardly so that the complementary needle elevating jack 663 will move into position so that the butt 665 will contact the cam 42b and slide the jack 663 upwardly for needle elevating purposes, as is quite obvious.

It will of course be understood from the foregoing that the patterns R and S are merely typical of the variety of work which the improved knitting machine may accomplish in the knitting of the tubular fabric. The machine is very compactly arranged for the knitting of either small or large reverse plated areas in combination with practically unlimited horizontal yarn changes, and in association with improved means by which the needles may be finely divided in groups for the purpose of knitting extremely complicated "color within color" patterns and wrap yarn patterned areas of extremely complicated nature. The usual knitting machine mechanism necessary to handle the different plating and striping yarns is provided, such as the binder mechanism 680 designated in Figures 3 and 4 of the drawings which is actuated in a manner well known to those skilled in the art, and the usual knitting cams and picks are provided, as shown in Figures 15 and 20 of the drawings, and elsewhere. In addition a cam 700 is provided to initially elevate the jacks of the set G in advance of the drums 52 and 53, and another cam 701 is provided succeeding the right hand drum 52 and just below the knitting cam set in order to lower the jacks of the set G after they have accomplished their purpose of moving the proper needles into elevated relation to take wrapping yarns.

Various changes in the shape, size, and arrangement of parts, and method of knitting the improved fabric and pattern areas, 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. A circular knitting machine having a needle cylinder with slots therein, a circle of knitting needles in the slots, jacks in the slots for the needles, said jacks having butts thereon, a cam for elevating said jacks through said butts in order to elevate the needles, spring means normally maintaining said jack butts out of operation with said cam, pattern jacks in the slots below said first mentioned jacks transversely movable at the upper ends thereof so as to move the first mentioned jacks respectively associated therewith transversely into operative relation with said cam, said last mentioned jack having butts thereon and individually movable pattern controlled presser cams for selectively operating said pattern jacks.

2. A circular knitting machine having a slotted needle cylinder and a circle of knitting needles therefor, a set of pattern jacks fulcrumed on the cylinder in the slots thereof having lower butt portions adapted to project from the cylinder slots and having upper portions rockable transversely in the slots, pattern means for selectively actuating against the butts of said jacks, and a second set of jacks individually related to the needles and first mentioned jacks transversely movable and longitudinally slidable within the slots of said cylinder, a selectively movable cam for longitudinal sliding of said last mentioned jacks, spring means normally retaining said sliding jacks out of operating relation to said cam, said last mentioned jacks at their lower ends bearing against the fore part of the upper end of said pattern jacks so that the transverse movement of the latter will move the last mentioned jacks transversely into operative relation to the cam.

3. A circular knitting machine having a needle cylinder with slots and a circle of knitting needles independently slidable in the slots, a set of needle actuating jacks fulcrumed on the cylinder in the individual slots directly beneath the needles thereof for both longitudinal and transverse movement, each jack above its fulcrum point having a butt thereon, a cam for operation against said butts in order to slide the jacks in the slots and elevate the needles, spring means normally urging the upper ends of said jacks above their fulcrum points into position with their butts out of operating relation with respect to

said cam, a set of pattern jacks in the slots rockable transversely therein having their upper ends movable forwardly against the lower part of the respective jacks of said first mentioned set below the fulcrum points of the latter, and means for selectively actuating the pattern jacks for moving the upper ends thereof radially inward for the purpose of throwing the upper ends of the jacks of the first mentioned set outwardly into butt operative relation to said cam.

4. A circular knitting machine having a needle cylinder and a circle of knitting needles slidable therein, main pattern jacks fulcrumed on the cylinder for each needle, means below the fulcrum points for selectively rocking said main jacks, complementary needle elevating jacks slidably carried by the upper ends of the main jacks above the fulcrum points thereof and extensible with respect to the respective main jacks and rockable transversely therewith, means normally urging the upper ends of the said main jacks above the fulcrum points thereof inwardly for maintaining the complementary needle elevating jacks radially inward, and cam means for moving the needle elevating jacks into needle elevating position and related to said needle elevating jacks so as to normally be out of operating relation thereto until the portions of the main pattern jacks below the fulcrum points thereof are moved inwardly.

5. In a knitting machine, a slotted needle bed, a set of needles in the slots of the bed, a needle cam set including a knitting cam, transversely movable jacks co-acting with said individual needles, a cam for moving said jacks longitudinally into needle elevating position, means normally maintaining said jacks inoperative with respect to said cam, patterning means for transversely moving said jacks selectively for elevating the needles into yarn receiving position in advance of the knitting cam, means to feed yarn to said elevated needles, cam means to lower said needles after receiving the yarn aforesaid, other patterning means for transversely moving selected jacks into elevating relation to the cam for elevating selected needles between the lowering cam and the knitting cam, and means to feed yarn to said last mentioned elevated needles.

6. In a knitting machine the combination of a series of needles, a cam set for the needles including a knitting cam, a series of jacks for elevating said needles into yarn receiving position, a jack cam, means for moving the jacks into and out of operative relation to said cam including a series of pattern jacks having closely spaced butts at different locations therealong, a series of presser cams movable into and out of pressing relation against said butts, means to selectively operate said presser cams, means to selectively wrap different yarns upon the selected needles elevated by said first mentioned jack cam, cam means to lower the elevated needles after receiving the wrap yarns and in advance of the knitting cam, a second jack actuating cam, a second series of presser cams for the pattern jacks located between said last mentioned series of presser cams, and the knitting cam and operable to move the first mentioned jacks into operative relation to the second jack cam in order to elevate the needles, means to selectively operate said second series of presser cams, and means to selectively wrap different yarns upon the selected needles elevated by the second mentioned jack cam.

7. In an independent needle knitting machine a cylinder, a series of needles therefor, needle cams, a series of jacks for elevating the needles into predetermined yarn receiving position, a jack cam, yieldable means normally maintaining said jacks out of operation relation to said jack cam, means for moving the jacks into operating relation to said cam including a series of pattern jacks each operative upon a jack of the above mentioned series of jacks, said pattern jacks having butts at different levels along their length, a series of presser cams for the pattern jacks at different levels of the butts thereon, yieldable means normally maintaining said pattern jacks in position so that the respective needle elevating jacks may assume their normal position with respect to the jack cam, and pattern means for selectively operating said pattern jacks.

8. In a knitting machine the combination of a series of needles, a cam set for the needles including a knitting cam, a series of jacks for elevating said needles into yarn receiving position, a jack cam, means for moving the jacks into and out of operative relation to said cam including a series of pattern jacks having closely spaced butts at different locations therealong, a series of presser cams movable into and out of pressing relation against said butts, means to selectively operate said presser cams, means to selectively wrap different yarns upon the selected needles elevated by said first mentioned jack cam, cam means to lower said elevated needles after receiving the wrap yarns and in advance of the knitting cam, a second jack actuating cam, a second series of presser cams for the pattern jacks located between said first mentioned series of presser cams and the knitting cam operable to move the first mentioned jacks into operative relation to the second jack cam in order to elevate the needles, means to selectively operate said second series of presser cams, means to selectively wrap different yarns upon the selective needles elevated by the second mentioned jack cam, and means to selectively throw both or either of the means for selective operation of said presser cams into or out of operating relation to the respective presser cams.

9. In a knitting machine for knitting seamless stockings the combination of a cylinder, needles for the cylinder, means to feed body and plating yarns to the needles, a cam set for actuating the needles in order to knit seamless tubular stockings upon the machine, means for controlling the body and plating yarns whereby to knit in the stocking reverse plated patterned diamonds which individually extend throughout substantially one half the circumference of the stocking, horizontal stripping means for changing said plating yarns, and means cooperatively related to and co-acting with the reverse plating means for interknitting with the body and plating yarns other patterning yarns with "wrap within wrap" patterned effects.

10. In a knitting machine the combination of a cylinder, a set of needles for the cylinder, a set of cams for actuating the needles, jacks for controlling actuation of the needles, and patterning means for regulating the selection of said jacks including a supporting bed movable towards and away from the cylinder, pattern selecting drums rotatably mounted upon said bed, means for controlling the movement of the bed towards and away from the cylinder into and out of jack actuating relation with respect to said drums, means for step by step synchronous advancement of said drums, means for varying the step advance of said drums, and means for selectively stopping

the rotation of said pattern drums or either of them.

11. In a knitting machine the combination of a cylinder, needles in the cylinder, means for feeding a body yarn or yarns to the needles, cam means for actuating said needles, means for selective feeding of wrap yarns upon said needles at two different points about the cylinder, means for selectively elevating the needles at said two different points to take said wrap yarns, means to lower the needles at a location between said wrapping points, said means for elevating the needles at each of said wrapping points including transversely movable jacks with closely spaced uniform length butts thereon at different levels, movable presser cams at said different levels movable into and out of actuating relation with said butts in order to transversely move the jacks, and rotary patterning drums at each of said wrapping points, each having a selected pattern arrangement of lugs thereon for moving said presser cams.

12. In a knitting machine the combination of a cylinder, needles in the cylinder, means for feeding a body yarn or yarns to the needles, cam means for actuating said needles, means for selective feeding of wrap yarns upon said needles at two different points about the cylinder, means for selectively elevating the needles at said two different points to take said wrap yarns, means to lower the needles at a location between said wrapping points, said means for elevating the needles at said wrapping point including jacks for the needles having butts thereon at different levels, movable presser cams at said different levels movable into and out of actuating relation with said butts, rotary patterning drums directly actuable at said presser cams having a selected arrangement of lugs thereon for such purpose, means for synchronized step by step advance of said drum, and means for moving said drums into and out of actuating relation with the presser cams at different stages during the knitting of an article upon said machine.

13. A circular knitting machine having a needle cylinder, needles slidable in said cylinder, jacks for the needles, said jacks having butts thereon, cam means for elevating both the needles and said jacks, means for selected wrapping of yarns upon the needles thus elevated, means normally maintaining the jack butts out of operation with their cam means, pattern jacks coacting with the first mentioned jacks and transversely movable for moving the jacks first mentioned into operating relation with their cam means, presser cams movable at different levels for actuating selected pattern jacks, and a rotary pattern drum having means thereon for selective actuation of said presser cams.

14. In a knitting machine the combination of a cylinder, a set of needles for the cylinder, a pair of trick drums, means rotatably mounting the drums for simultaneous movement towards and away from the cylinder, means between the drums and cylinder for selectively actuating the needles, means for simultaneously moving the drums into and out of action with the last mentioned means, means for selectively controlling the actuating of said drums, means for feeding plating yarns to the needles, means for selectively reverse plating said yarns including a third trick drum, and means for selectively throwing said third drum into or out of plating actuating relation.

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