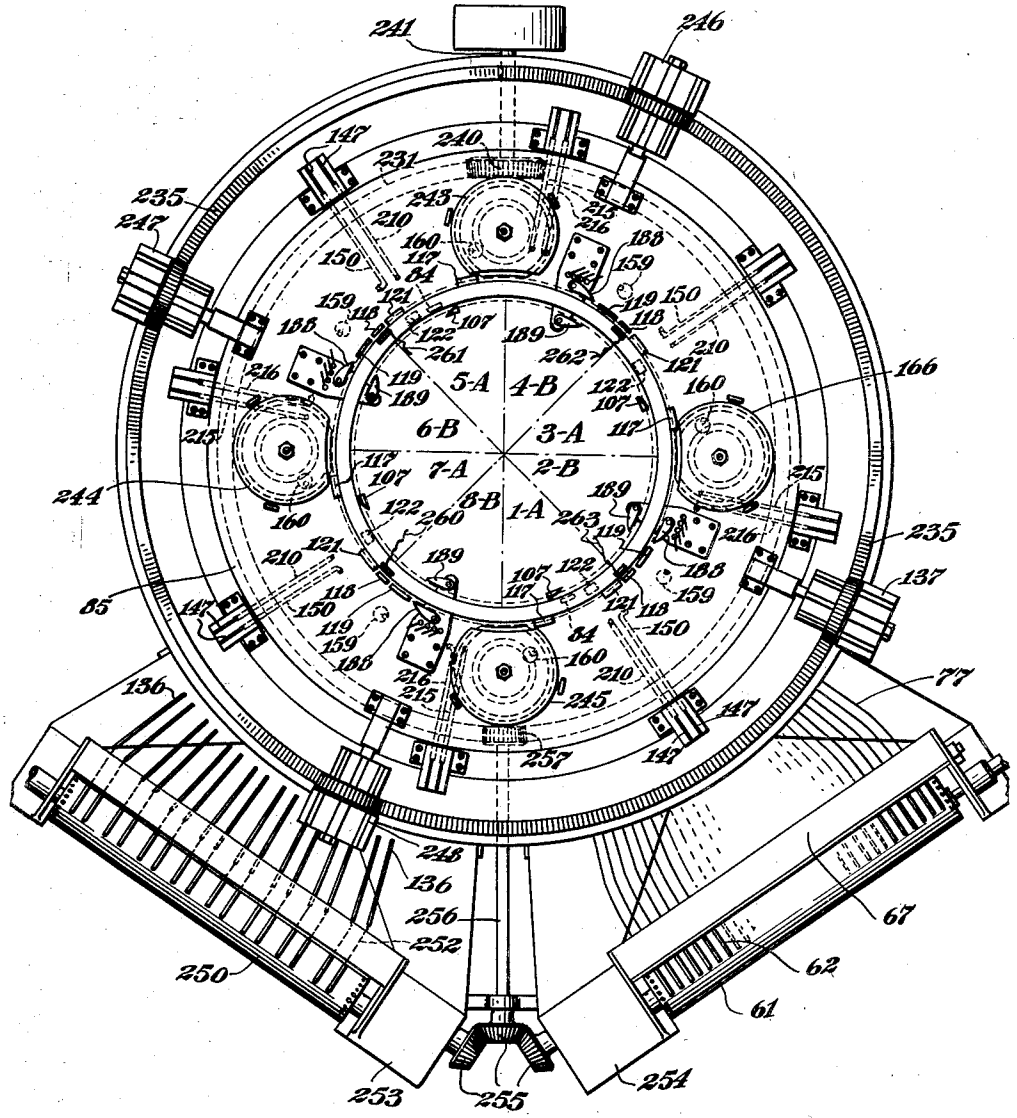
July 12, 1932. V. LOMBARDI 1,866,945

KNITTING MACHINE

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Fig. 1



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KNITTING MACHINE

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Fig. 2

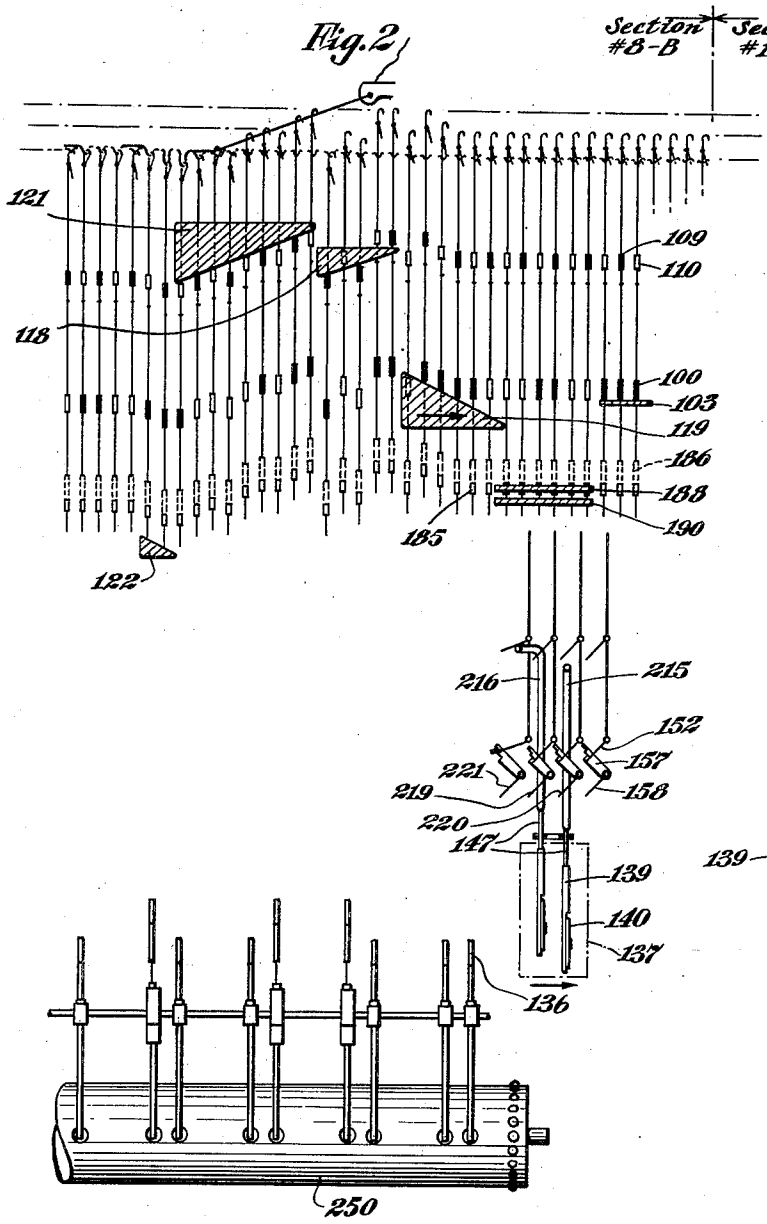
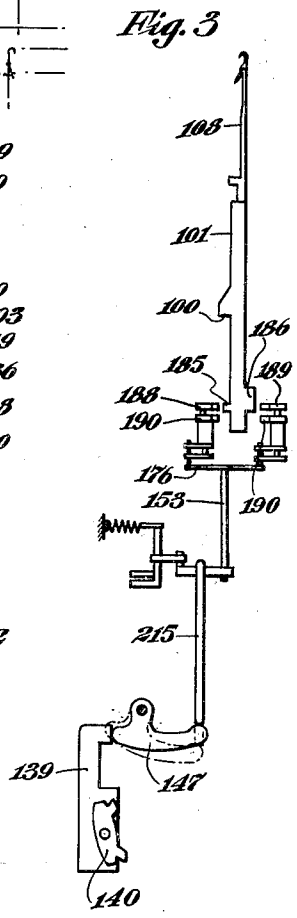


Fig. 3



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KNITTING MACHINE

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Fig. 4

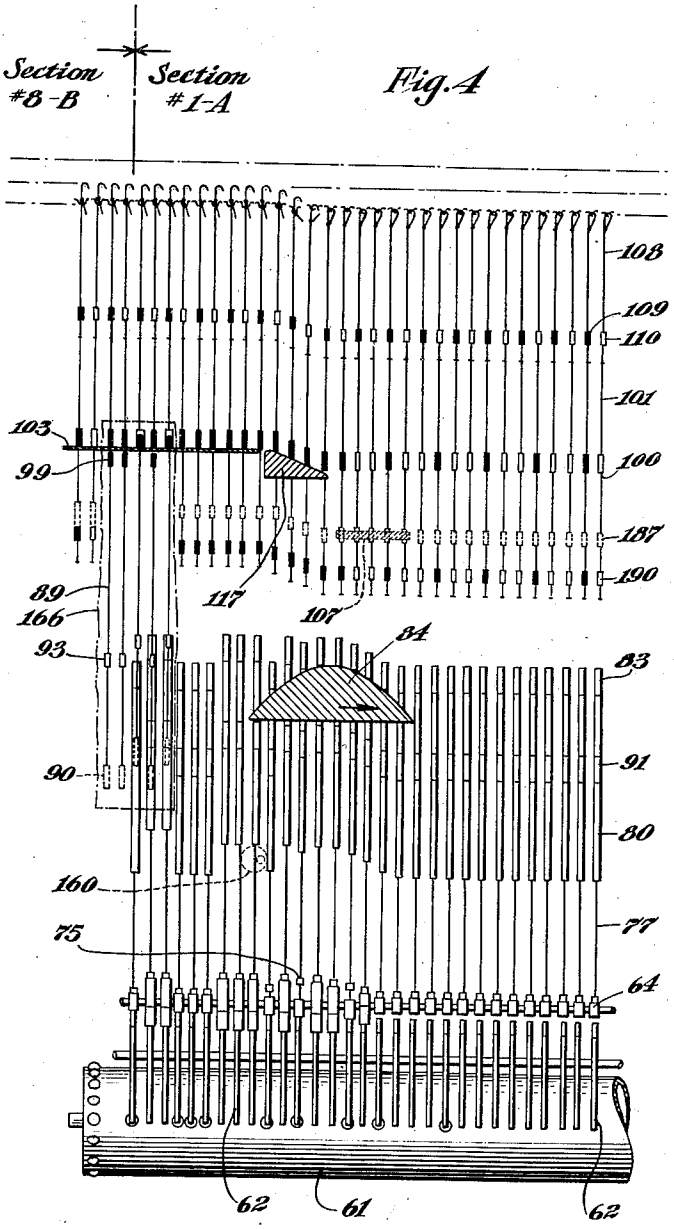
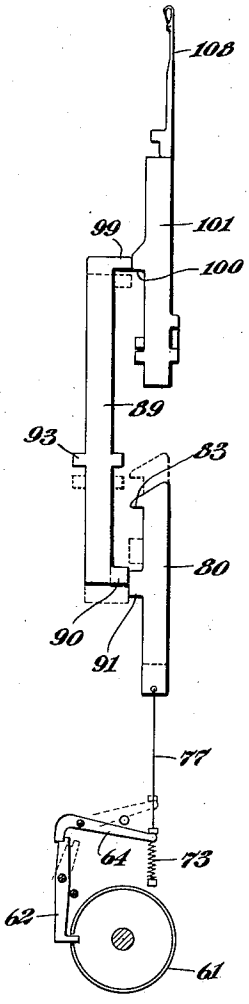


Fig. 5



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KNITTING MACHINE

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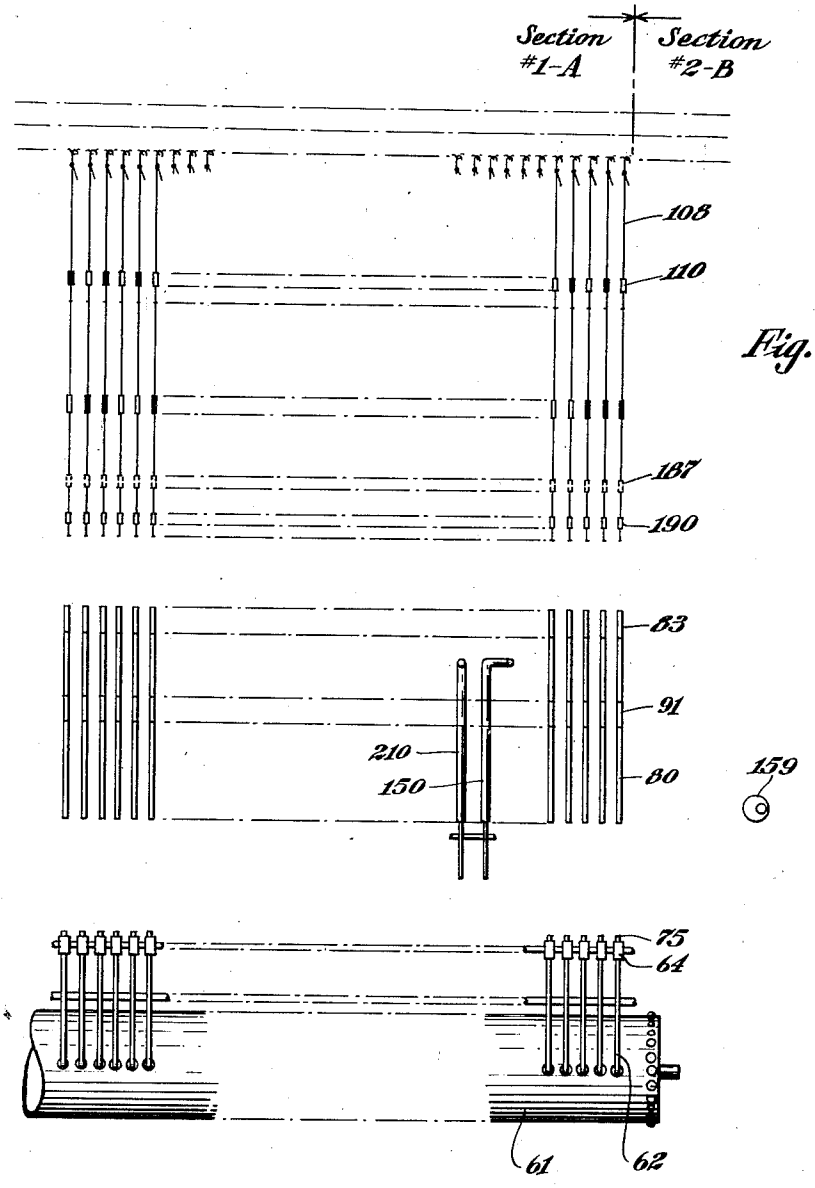


Fig. 6

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KNITTING MACHINE

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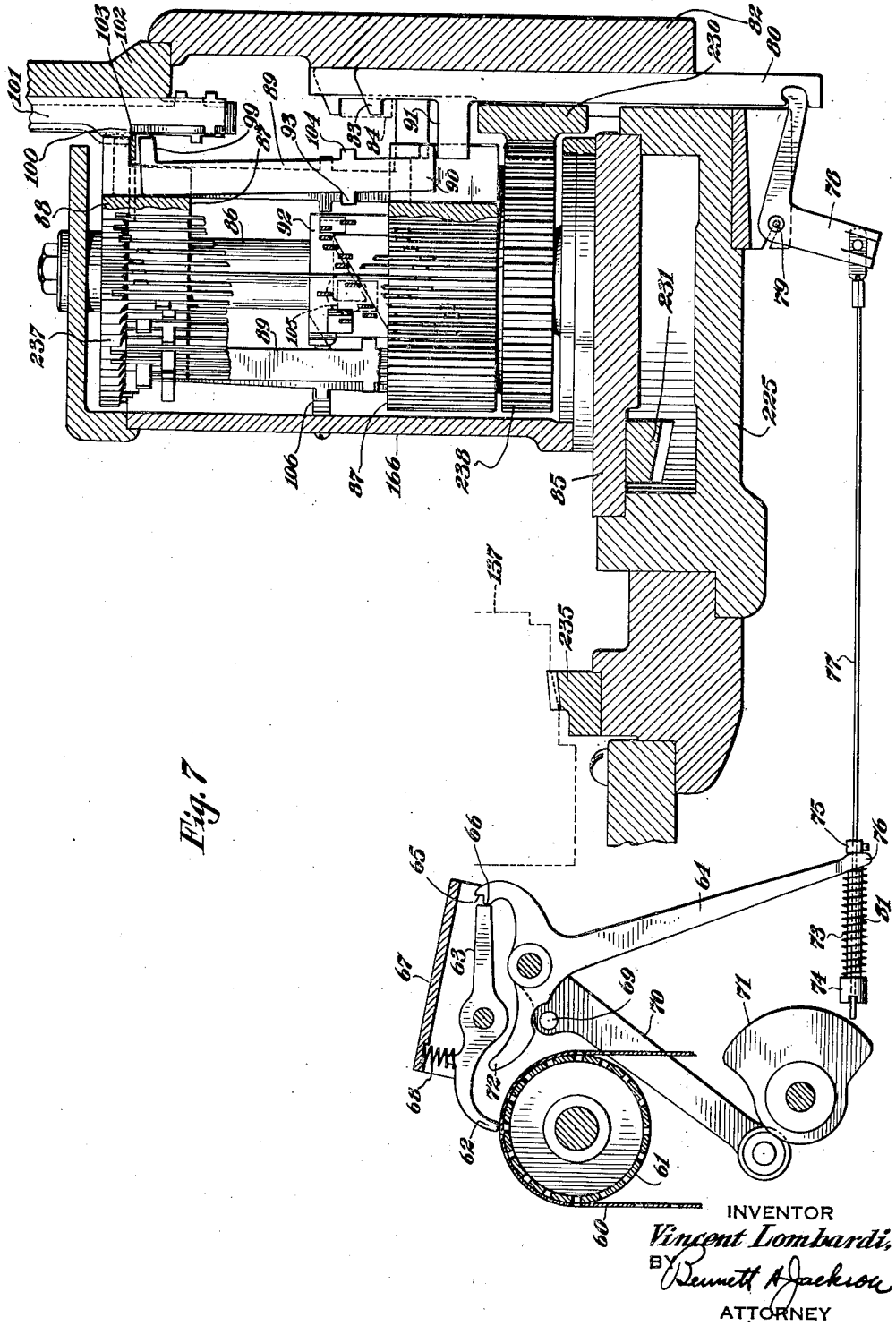


Fig. 7

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KNITTING MACHINE

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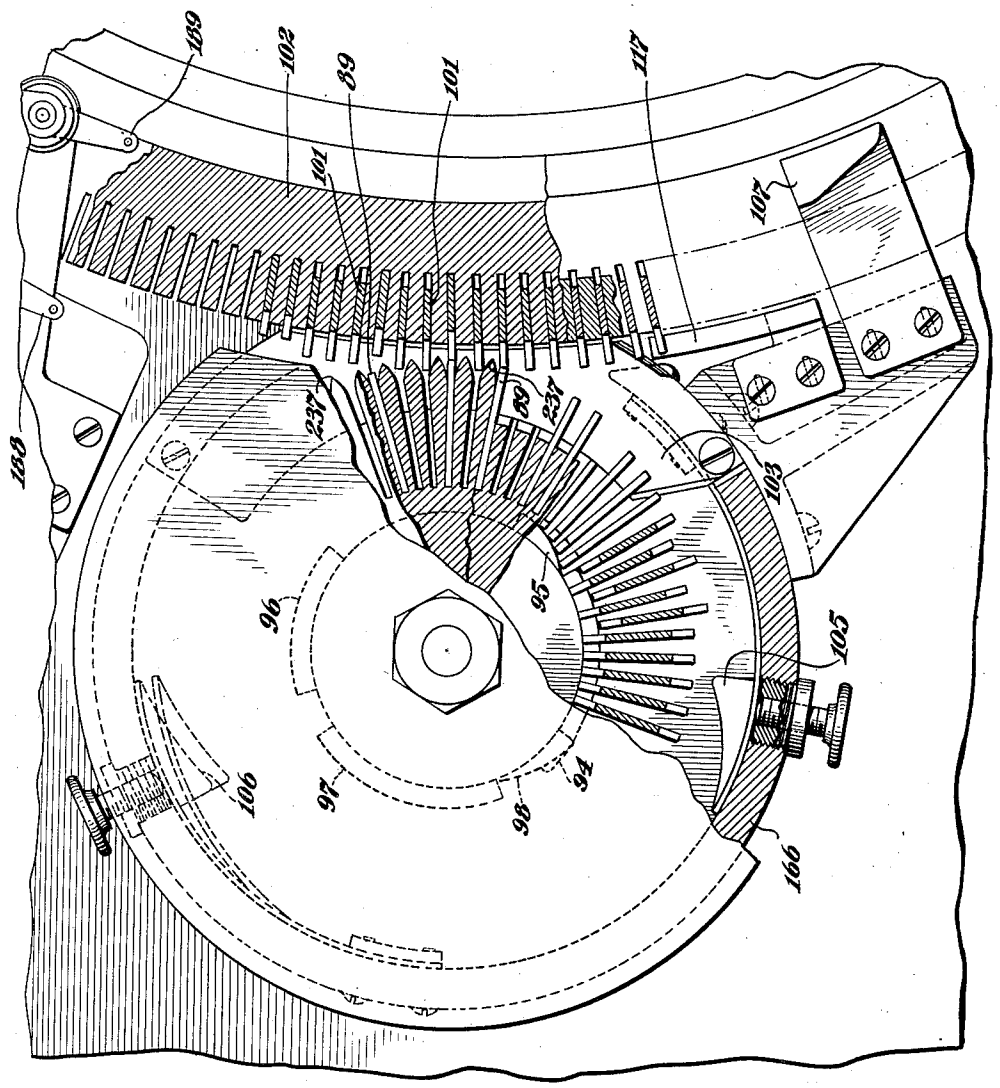


Fig. 8

INVENTOR
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KNITTING MACHINE

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Fig. 9

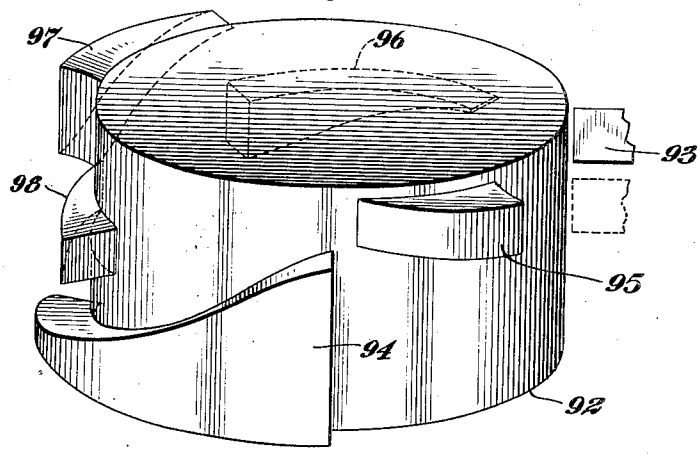


Fig. 10

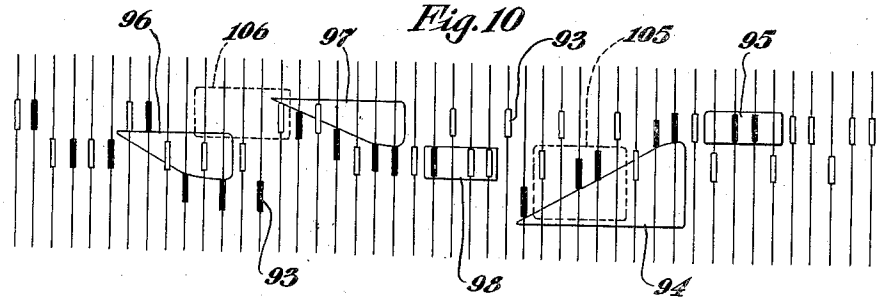


Fig. 15

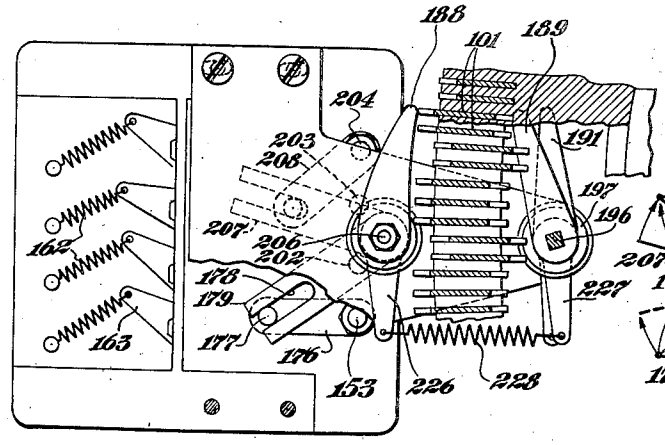
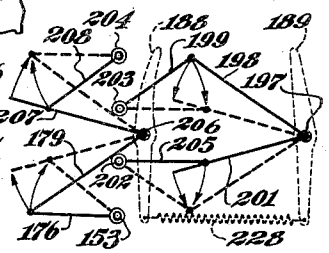


Fig. 16



INVENTOR
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KNITTING MACHINE

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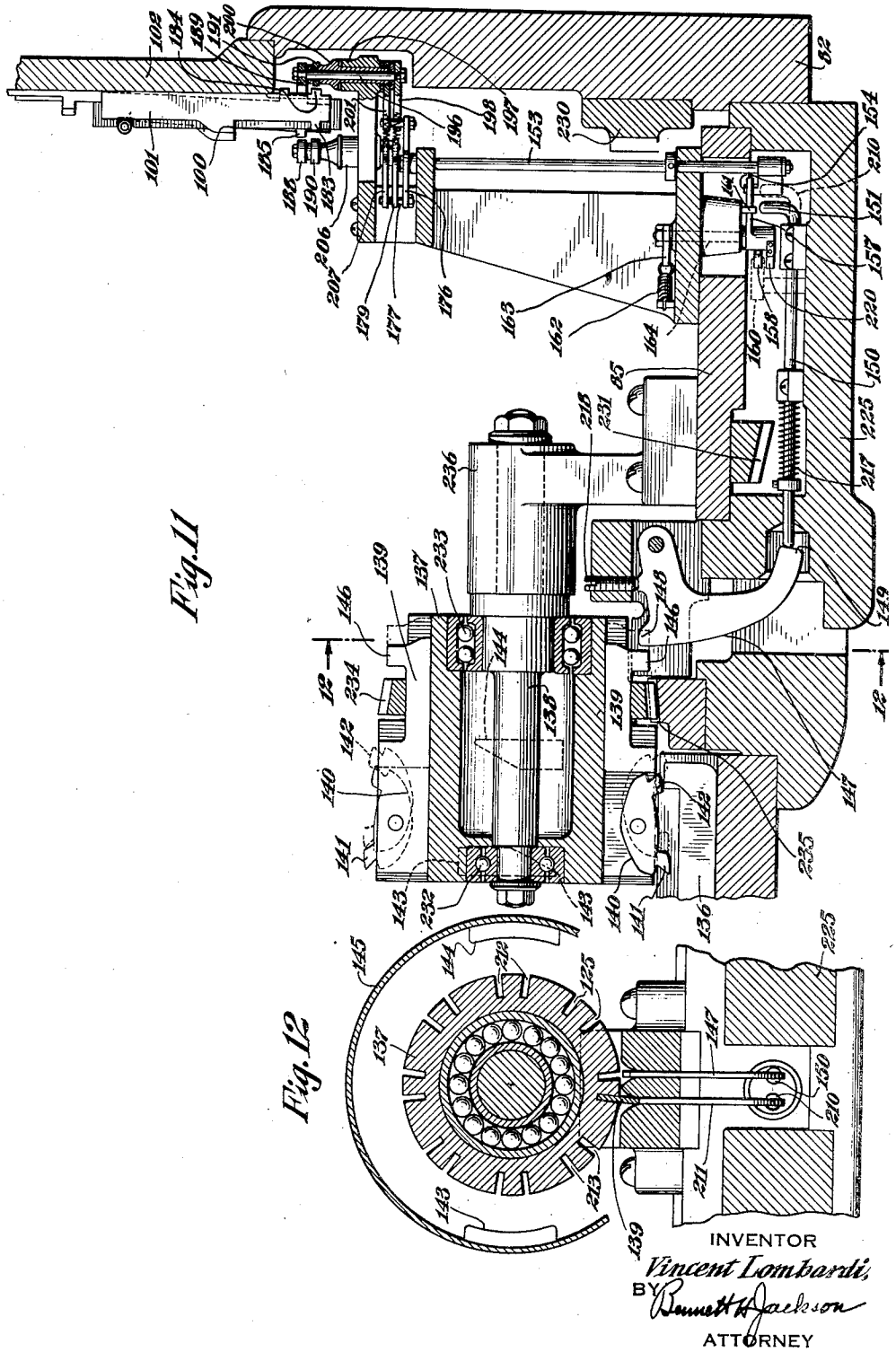


Fig. 11

Fig. 12

INVENTOR
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KNITTING MACHINE

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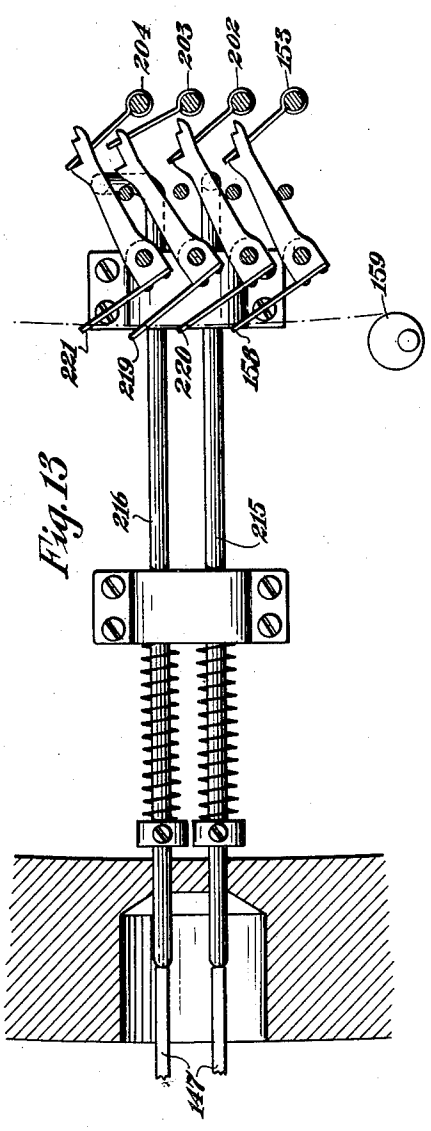


Fig. 13

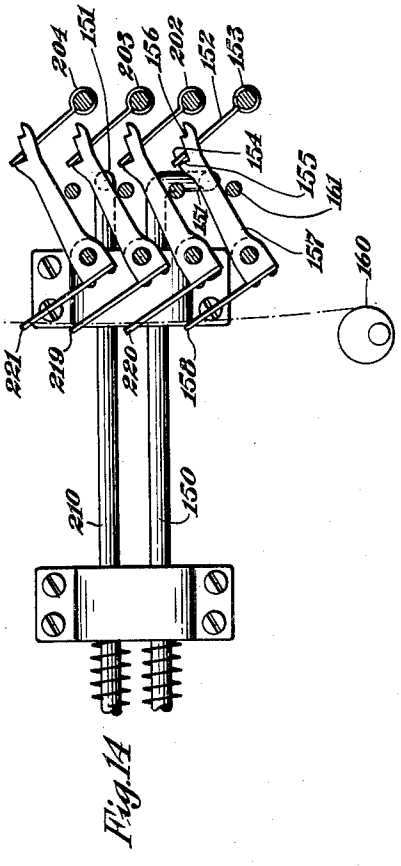


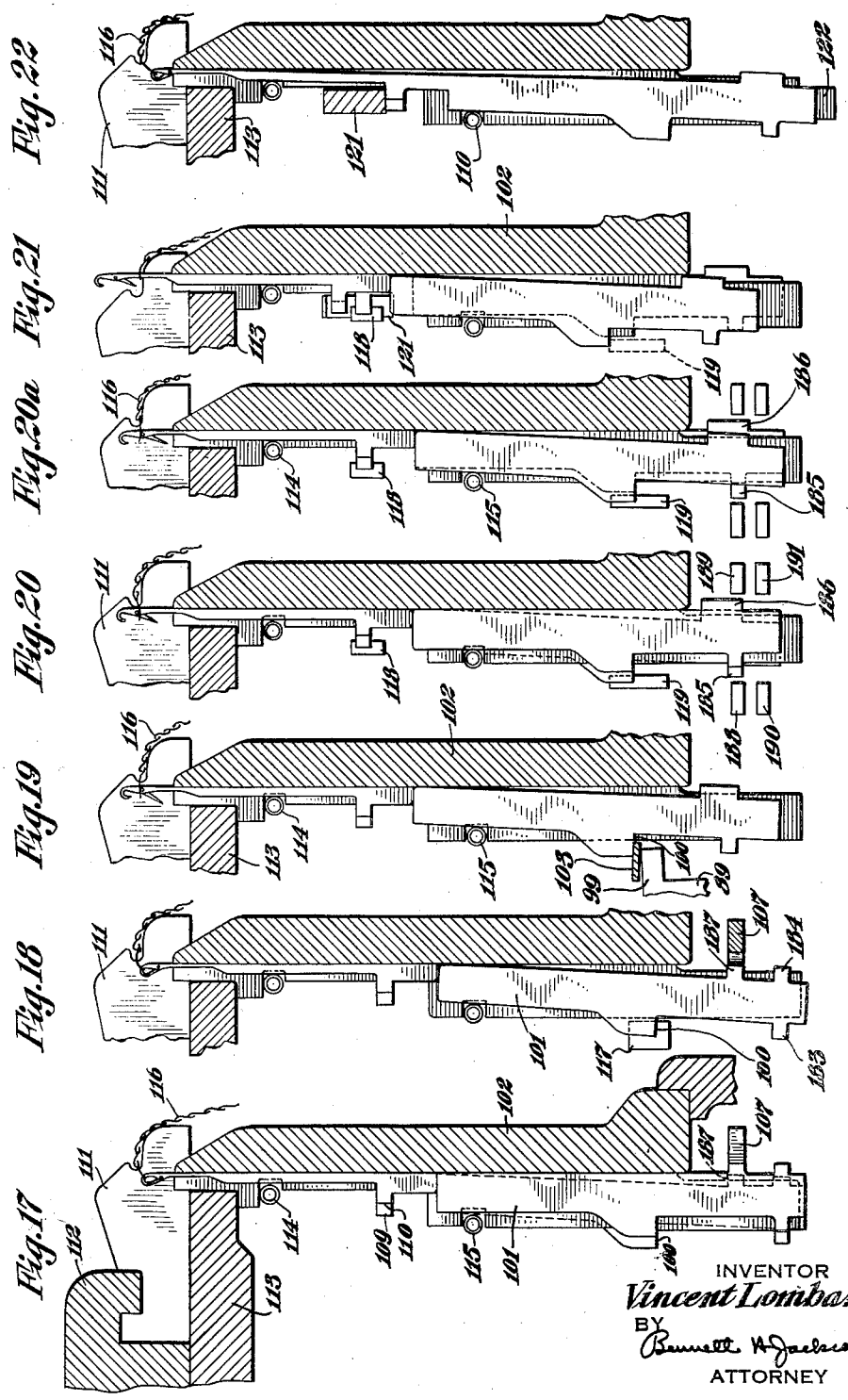
Fig. 14

INVENTOR
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July 12, 1932. V. LOMBARDI 1,866,945

KNITTING MACHINE

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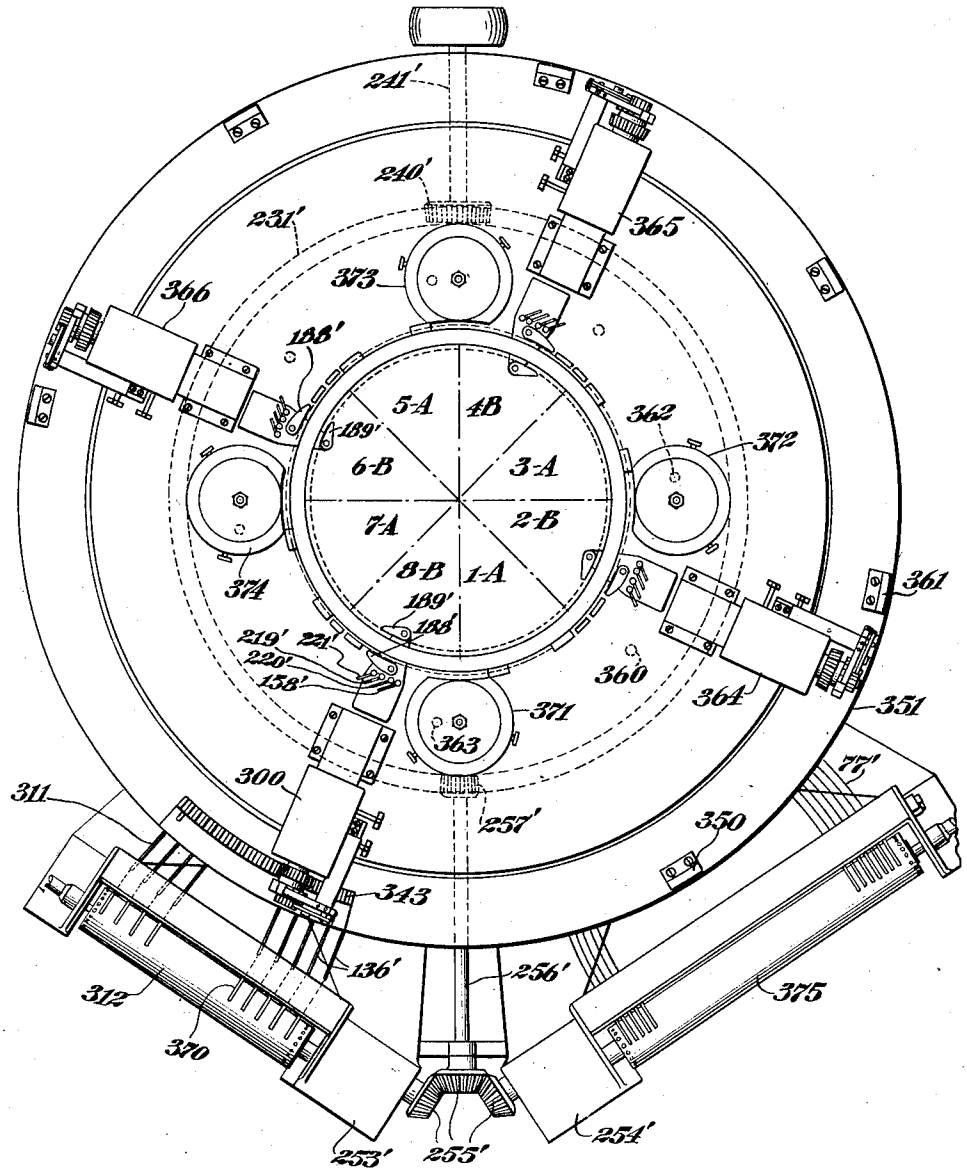
INVENTOR
Vincent Lombardi,
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ATTORNEY

July 12, 1932. V. LOMBARDI 1,866,945

KNITTING MACHINE

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Fig. 23



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KNITTING MACHINE

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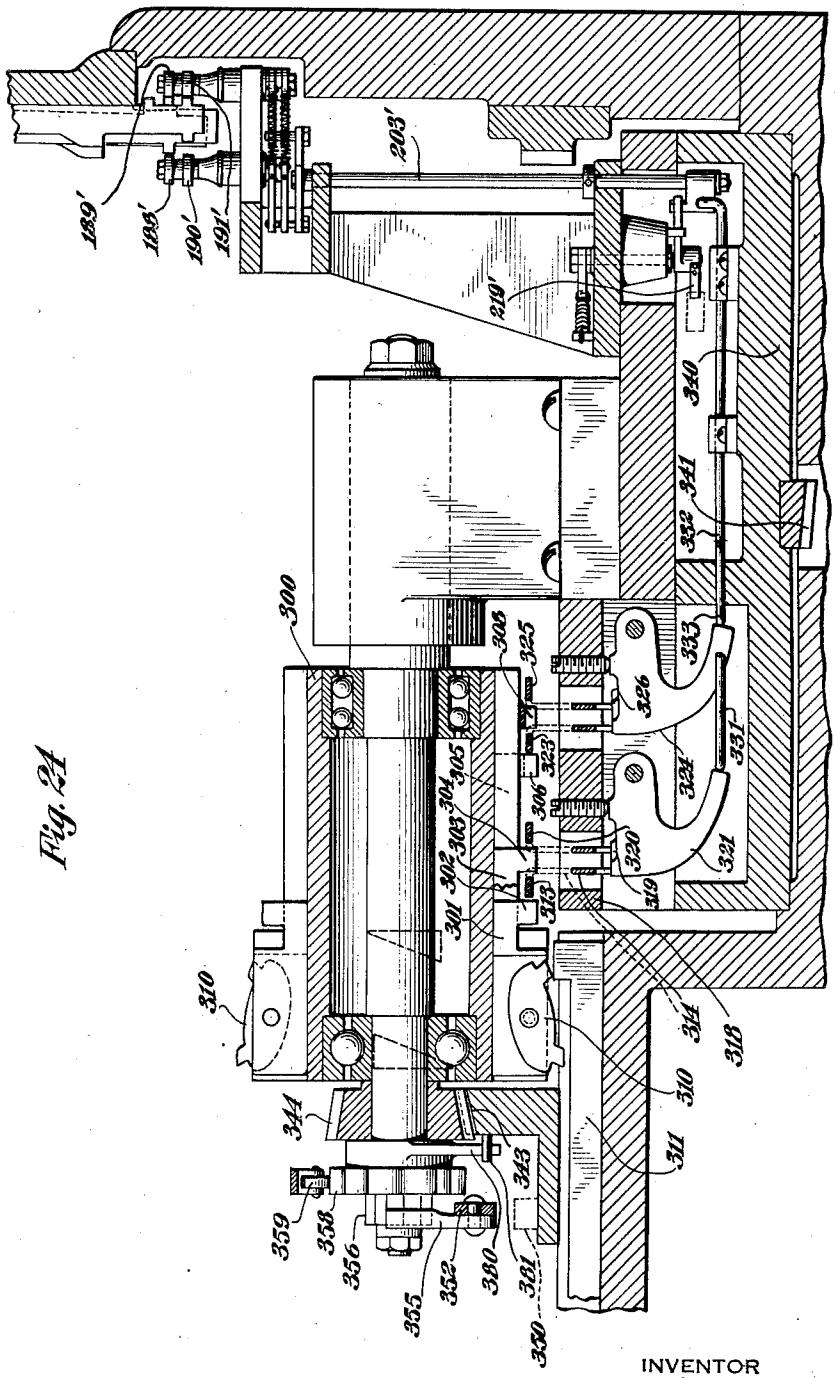


Fig. 24

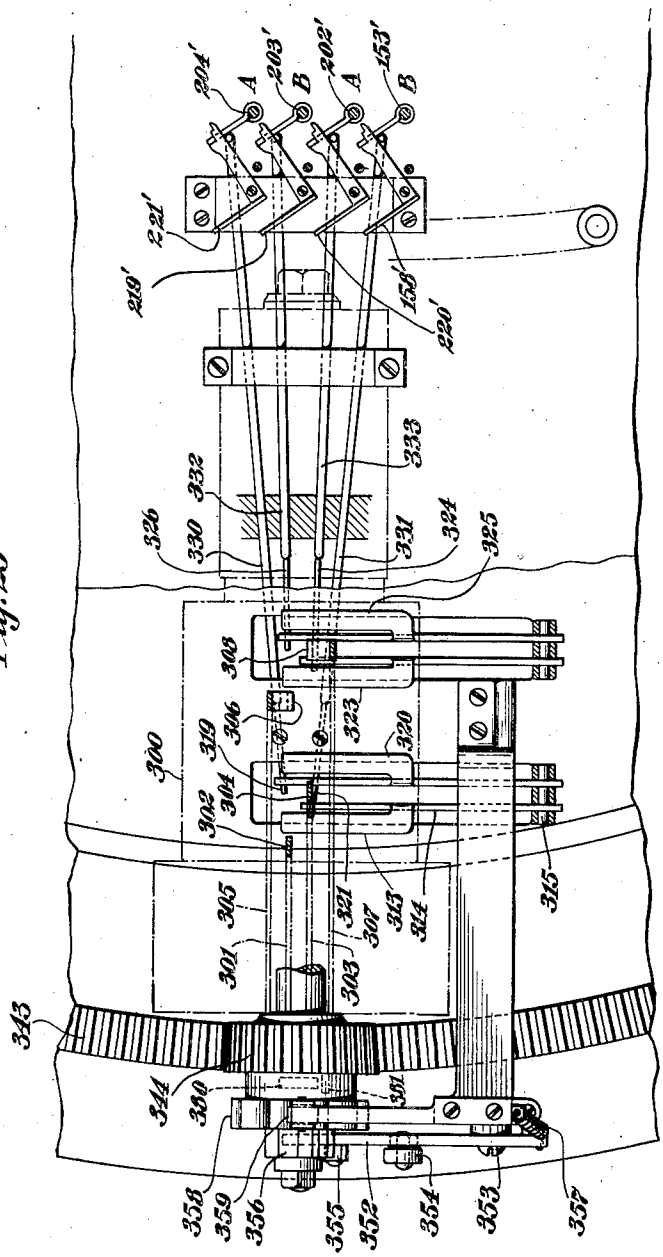
INVENTOR
Vincent Lombardi,
BY Bennett H. Jackson
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July 12, 1932. V. LOMBARDI 1,866,945

KNITTING MACHINE

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Fig. 25



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July 12, 1932. V. LOMBARDI 1,866,945

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Fig. 26

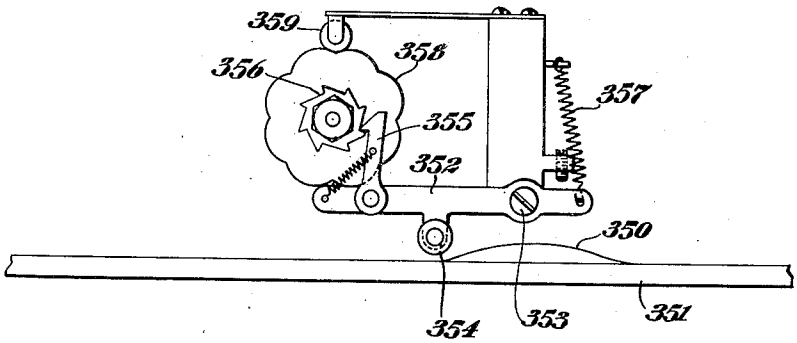


Fig. 27

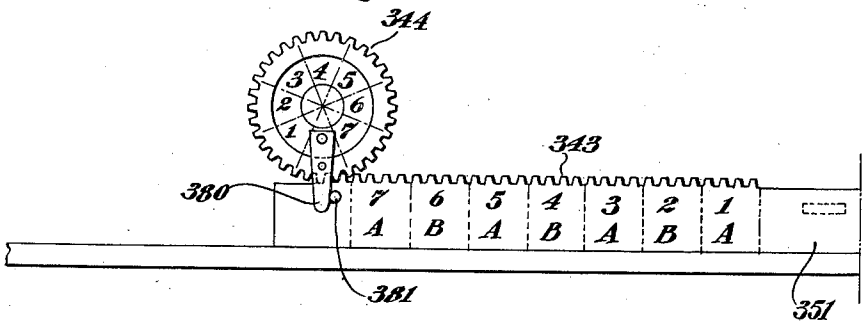
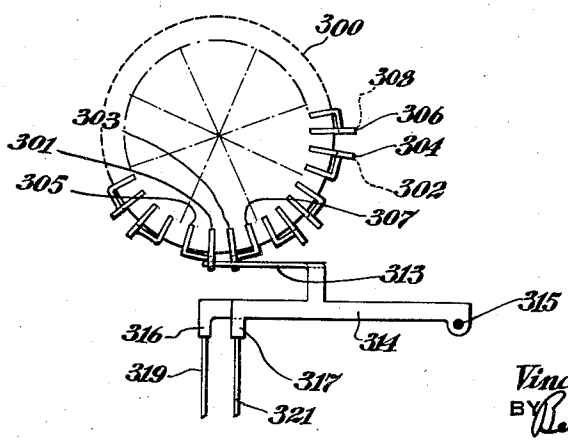


Fig. 28



INVENTOR
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KNITTING MACHINE

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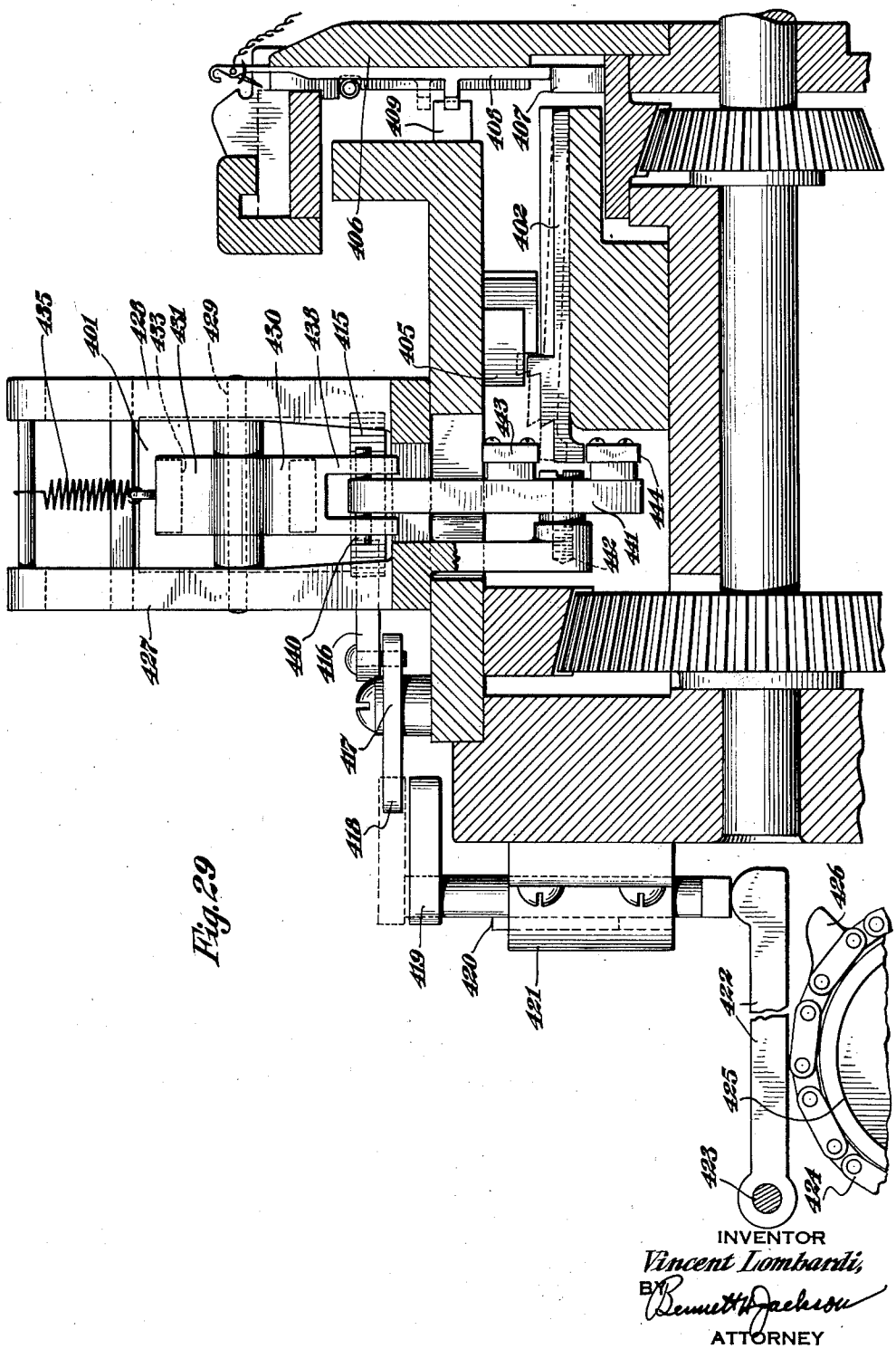


Fig. 29

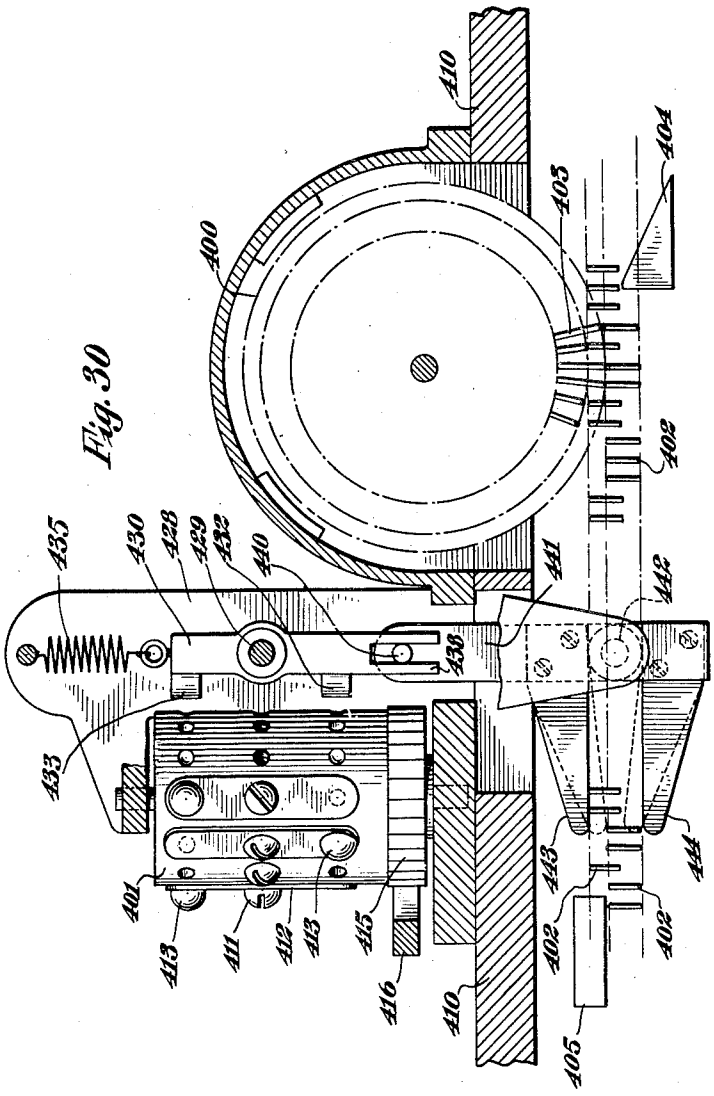
INVENTOR
Vincent Lombardi,
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July 12, 1932. V. LOMBARDI 1,866,945

KNITTING MACHINE

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Fig. 30



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Fig. 31

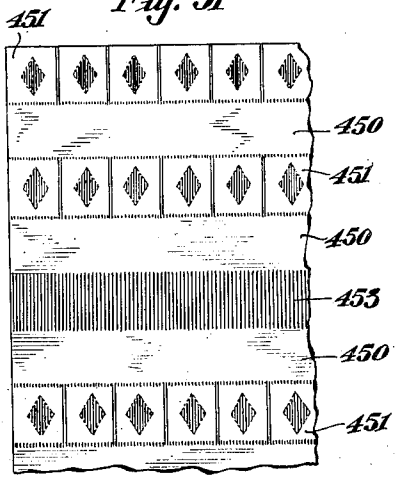


Fig. 32

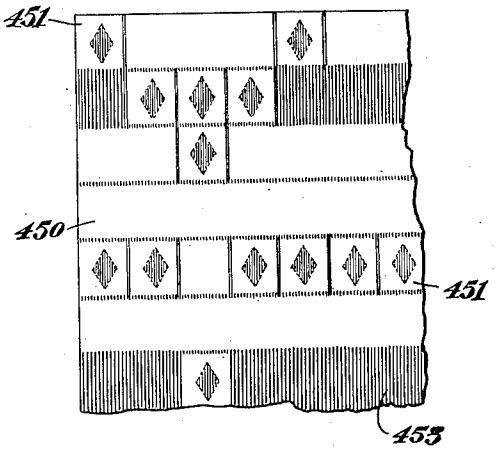
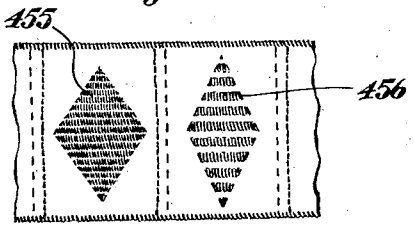


Fig. 33



INVENTOR
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Patented July 12, 1932

1,866,945

UNITED STATES PATENT OFFICE

VINCENT LOMBARDI, OF BROOKLYN, NEW YORK

KNITTING MACHINE

Application filed August 5, 1930. Serial No. 473,212.

This invention relates to knitting machines and includes certain correlated inventions and discoveries appertaining thereto.

An object of the invention is to provide a knitting machine whereby a large number of varied pattern effects may be readily and economically incorporated into a knitted fabric.

In its more specific aspects, the invention has for an object the provision in a knitting machine of improved pattern-control mechanism arranged to be periodically set in accordance with the configurations presented thereto by a pattern-determining medium, and in response to said setting to impart pattern-controlling actuations to a series of needles.

An additional object is to provide a knitting machine which is simple in construction, economical of manufacture and assembly, readily adjustable, capable of a wide variety of uses, and adapted for ready and efficient operation.

Another object is to provide an improved pattern control mechanism capable of being operated by a simpler type of pattern-determining medium, such as a perforated strip of paper, than has heretofore been employed and in which for example a change in the characteristics of the said medium is required only when a change is desired in the said mechanism.

Still another object is to provide improved apparatus for wiping out the pattern in any desired part of the fabric to be knitted, which pattern would otherwise be incorporated therein under the control of the pattern-determining medium.

The invention accordingly comprises the features of construction, combination of elements and arrangement of parts, which will be exemplified in the constructions hereinafter set forth and the scope of the application of which will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention reference should be had to the following detailed description taken in connection with the accompanying drawings, in which:

Fig. 1 is a top view of a machine embodying the invention;

Figs. 2, 4 and 6 when placed side by side represent in schematic form a portion of the needle-lay-out along with the controlling cams, pattern-controlling mechanism and means for wiping out the pattern;

Fig. 3 is a schematic representation of the pattern wiping out mechanism which is shown operating on the needle jacks of Fig. 2;

Fig. 5 is a schematic representation of the pattern controlling drum and associated apparatus which is shown operating on the needle jacks of Fig. 3;

Fig. 7 is an enlarged sectional view of the pattern control mechanism for determining the pattern for any desired portion of the fabric to be knitted.

Fig. 8 is a top view of the control drum of Fig. 7;

Fig. 9 represents a drum cylinder carrying cams and used as a part of the mechanism of Fig. 7;

Fig. 10 is a schematic lay-out of the cams on the cylinder of Fig. 9;

Fig. 11 is an enlarged sectional view of the mechanism for wiping out the pattern in any desired portion of the fabric to be knitted.

Fig. 12 is a cross sectional view of the control drum of Fig. 11;

Figs. 13 and 14 illustrate details of certain portions of the movable parts linking the drum of Fig. 12 to the cams for the needle jacks;

Figs. 15 and 16 illustrate other details of certain movable parts controlled by the drum of Fig. 12 and controlling cams for the needle jacks;

Figs. 17, 18, 19, 20, 20—*a*, 21 and 22 represent sectional views of a needle and needle jack along with the various cams and controlling apparatus therefor;

Fig. 23 is a top view of an alternative form of a circular knitting machine embodying this invention;

Fig. 24 is an enlarged sectional view of the mechanism of Fig. 23 for wiping out the pat-

tern in any desired portion of the fabric to be knitted;

Fig. 25 illustrates details of certain portions of the movable parts linking the wiping out drum of Fig. 24 to the cams which control the needle jacks;

Fig. 26 illustrates certain of the pivoted levers associated with the drum of Fig. 24;

Fig. 27 illustrates the manner in which the drum of Fig. 24 may be stepped periodically in different parts of the machine;

Fig. 28 illustrates the manner in which the drum of Fig. 24 may be given one complete revolution in order to selectively set each slidable element thereon;

Fig. 29 represents another embodiment of this invention in which the wiping out mechanism is controlled by an endless chain instead of a perforated pattern;

Fig. 30 is a sectional view of certain portions of the machine of Fig. 29;

Fig. 31 represents one pattern effect that may be produced by the present invention; and

Figs. 32 and 33 represent still another alternative pattern effect that may be incorporated into the fabric.

Fig. 1 discloses a top view of a circular knitting machine of the cylinder type embodying the present invention. The machine is assumed to have four yarn feeds, 260, 261, 262, and 263 and four vertically disposed pattern drums 166, 243, 244, and 245, one for each yarn feed, are provided for determining the pattern effects to be incorporated in the fabric by the needles for each yarn. Each of these drums is mounted for movement around the needle cylinder 102 and rotating on its axis in response to this movement. These drums are an improvement upon and perform the same general functions as the pattern drums of my U. S. Patent No. 1,792,647 issued Feb. 17, 1931 and entitled "Knitting machines". Each of these pattern drums, contains elements which in turn are given pattern determining actuations by apparatus controlled by a pattern sheet mounted on a drum 61. The machine of Fig. 1 also includes four horizontally disposed drums 137, 247, 246 and 248 for wiping out the pattern settings of the needle jacks for any portion of the fabric whenever such an action is desired. Thus pattern drum 166 may selectively set the needle jacks to give a particular pattern effect in one portion of the machine and the wiping out drum 137 which immediately follows may wipe out these pattern effects before the passage of the yarn carrier for which the pattern settings are made. It may be assumed by way of example that the cylinder needles of the machine of Fig. 1 are divided into eight equal groups and that the pattern to be knitted is repeated at least eight times in the resulting tubular fabric. These sections for convenience have been numbered 1—A, 2—B, 3—A, 4—B, 5—A, 6—B, 7—A, and 8—B. For reasons to be described later the needle jacks in the "A" sections are different from those in the "B" sections. Thus the pattern drum for each yarn feed may cause the same particular pattern effect to appear in all of the eight sections except in those sections where the pattern may have been wiped out by the wiping out drum which follows each pattern drum. The setting of each wiping out drum is obtained from a pattern sheet mounted on drum 250. Further details of the general plan of the machine of Fig. 1 will be apparent after a description of certain subsequent figures has been given.

The apparatus for enabling the knitting of the needles to be automatically determined by the pattern medium such as a perforated paper pattern strip 60, will now be described particularly with reference to Fig. 7. The controlling apparatus immediately adjacent the pattern strip 60 is quite similar to the apparatus disclosed in my U. S. Patent No. 1,792,647, to which reference is made. The pattern strip 60 is mounted on a rotatable drum 61 mounted on a stationary part of the machine and arranged by suitable apparatus to be given a step-by-step movement at proper intervals. Two sets of pivoted levers, 63, 64 are associated with the pattern sheet. The fingers 62 of the set of levers 63 are adapted to be periodically raised away and subsequently lowered to either contact with the pattern sheet or pass through perforations therein. A rotating cam 71 periodically lifts the arm 70, pivoted at its upper end, to cause the rod 69, to rotate each lever 64 a small distance in a clockwise direction, which will cause one end 72 of the lever to raise the fingers 62 away from the pattern. These fingers are normally biased by springs 68 inside the housing 67. If a finger 62 is resting at any particular time on top of the paper pattern the other end of lever 63 is against shoulder 66, but if a finger 62 should find a hole in the pattern the opposite end of that lever 63 would rest against shoulder 65. The lower end of each lever 64 is apertured through which a small hollow rod 81 passes, having an adjustable stop 75 on one end and an adjustable nut 74 on the other end. A spring 73 tends to keep end 76 of the lever against the stop 75. A wire 77 passing through the tube 81 and fastened by a set screw in stop 75 leads to a bell crank lever 78 pivoted at the point 79. The other arm of this bell crank lever 78 rests in a socket in the lower end of a vertical jack 80 which is located in an external slot of the stationary cylinder 82.

The upper end of each jack 80 has a cam projection 83 so that the jacks 80 may be periodically raised by a rotating cam 84. It will be apparent that after the passage of cam 84 each jack 80 corresponding to a finger

which found a perforation in the pattern sheet will remain elevated while those jacks 80 corresponding to fingers finding no holes will be lowered again due to the action of springs 73.

The pattern determining actuations of jacks 80 are transferred to the needle jacks by a special mechanism 166 now to be described. Mounted on the rotating dial 85 is a fixed shaft 86. Suitably supported at the upper and lower ends of this shaft are two similar drums 87, 88 which are freely rotatable about the shaft 86. Each of these drums 87, 88 is slotted in its external surface and slidable elements 89 rest in corresponding slots in both drums. The lower end of each element 89 has a projection 90 which is adapted at times to contact with the part 91 of one of the jacks 80.

A cam cylinder 92 is mounted on shaft 86 in a non-rotatable manner and the details thereof are disclosed more particularly in Fig. 9 to which reference is made. Several cams are mounted on the cylinder 92 which cooperate with projections 93 on the slidable elements to give desired actuations thereto. If we assume an element 89 with it projection 93 in its upper and inner position, having been pushed in by a jack 80 it will ride on top of cam 96 but will be lowered by cam 97 and then pushed outwardly by cam 98 so that it is left in its lowered and outer position until a change is desired, when the said change will be made by the pattern sheet 60. The said projection 93 has therefore been changed from an upper and inner position to its lower and outer position. On the other hand, if we assume an element 89 with its projection 93 in its lowered and inner position, the said element 89 will be further lowered by cam 96 and will not be affected by cam 98 but will be raised by cam 94 and then pushed outwardly by cam 95 to its upper and outer position. Once the slidable element 89 has been given a selective inner setting by pattern sheet 60, the rotation of the sildable element around the cam cylinder 92 will cause the cams on cylinder 92 to raise those elements 89 that were previously in a lowered position and will lower those that were previously in a raised position. This means that the slidable elements once they have been selectively set and operated upon by cam cylinder 92 will continue to have that setting until a different setting is desired, i. e.: the elements 89 do not have to be set for each revolution around the needle cylinder as long as no change in the pattern is desired. For example if one projection 93 is in its upper and outer position because its corresponding finger 62 found a hole in pattern 60, it will remain in its upper position until its corresponding finger 62 encounters another hole in the pattern (which may not occur until the cylinder 61 has been stepped several times), whereupon it will be pushed in by jack 80 and then changed to a lowered position by cam cylinder 92. It will now remain in a lowered and outer position until its finger 62 encounters another hole later in the pattern sheet 60 whereupon the projection 93 will be pushed in by its jack 80 and then changed to its upper position by cam cylinder.

The pattern sheet 60 is therefore of novel design in that a hole is inserted therein along a line parallel to its length only when a change in the knitting of a particular needle is desired. Thus, for example the first hole in such a row under one finger 62 may mean that its needle will knit. This needle will continue to knit until a second hole appears in the pattern under said finger whereupon the said needle will interlock and continue to interlock until a third hole appears. This reduces considerably the number of holes required in a pattern sheet to produce a given pattern.

The manner in which the cams on cylinder 92 operate is illustrated schematically in Fig. 10. The projections 93 that are in their inward positions are shown as solid rectangles in Fig. 10, while the unfilled rectangles 93 represent projections 93 in their outer positions.

Each element 89 at its upper end has a projection 99 which is adapted to contact with a projection 100 on a needle jack 101 to push the needle jack inwardly into its slot in the needle cylinder 102 providing the said element 89 is in its raised position. If however any element 89 is in its lowered position it will not actuate its corresponding needle jack. The upper and lower positions of projections 99 are separated by a thin semi-annular plate 103 which insures that at the time each element 89 is adjacent the needle jacks there will be no danger that some slidable elements 89 will be at an undesired height. This plate 103 does not rotate with the drums 87, 88 but is stationary in the designated position as it is carried with the shaft 86 around the needle cylinder 102.

The outer projections 104 on the slidable elements 89 may be used at times in connection with the setting of the elements 89 by the manually operated cams 105 and 106, see Figs. 7, 8, and 10. If cam 106 is screwed in to be in operative position, it will contact with butts 104 on all slidable elements 89 in an upper position so that all those projections 93 which before the actuation by cam 106 were in their upper outer positions will be placed in their lower outer positions by the subsequent operation of cams 97 and 98. Those projections 93 which at the time of the placing of cam 106 into operation were in their lower outer positions will of course remain there and those that happened to be in their lower inner positions

will be raised by cams 94, 95 to their upper outer positions where they will be immediately actuated by cams 106, 97, 98 and ultimately brought to a lower outer position. This means that when cam 106 is operative all projections 93 will be placed in their lower outer positions. By a similar operation it will be apparent that cam 105 when placed in the path of projections 104 will cause all projections 93 to be in their upper outer positions. Hence with cam 106 operative all needle jacks 101 will remain out of their slots and by apparatus to be described later will cause all needles to knit loops, while if cam 105 is made operative all needle jacks 101 will be pushed into their slots and all needles will produce the interlock fabric.

In order to determine the effect of the slidable elements 89 on the needle jacks 101 reference is made to Figs. 17 to 22 inclusive. In the preferred form of this invention alternate needles have long butts while the remaining needles have short butts. This is shown in Fig. 17, for example, where 109 is a long butt needle, while 110 is a short butt needle. Mounted below each needle in the slots in the needle cylinder 102 is a needle jack 101. The needles are kept in place by a coiled spring 114 while needle jacks 101 are kept in place by a coiled spring 115. The usual sinkers 111 are disclosed mounted in a stationary plate 113 over which rides the usual sinker cam 112. Fig. 17 shows a rotatable cam 107 supported from a suitable cam cylinder (not shown) surrounding the needle cylinder and integral with the dial plate 85 on which the pattern mechanism 166 is mounted. This cam 107 is employed to thrust all needle jacks 101 outwardly in order that they may subsequently receive selective actuations from the slidable elements 89. All needle jacks 101 after passage of slidable elements are adapted to be raised to the interlock position by rotating cam 117 as shown in Fig. 18, and the needles are shown in the said interlock position in Fig. 19. Fig. 19 also shows that the plate 103 not only is used for separating the projections 99 in their upper and lower positions but also is used as a riding surface for projection 100 on each needle jack when it is in its raised position. Rotating cam 118 is used to lower those needles that have been raised to interlock position, while cam 119 is used to raise to full knitting those needles which have needle jacks remaining in their outward position after passage of slidable elements 89. Cam 121 is employed to lower needles from full knitting position to a level below normal after which they are brought back to normal by a raising cam 122. The various cams just described are mounted on a suitable cam cylinder surrounding the needle cylinder and a group of similar cams is of course provided for each yarn carrier. Certain of the other features disclosed in Figs. 17 to 22 will be described later.

A top view of the pattern mechanism 166 is disclosed in Fig. 8 wherein it is shown that the upper part of drum 88 has a plurality of ridges 237 for forming a tooth rack or gear, each tooth fitting into the space between adjacent needle jacks 101. The slidable elements 89 previously described fit in the slots between adjacent teeth 237 so that the meshing of teeth 237 and needle jacks 101 insures that each slidable element 89 will actuate, when desired, its corresponding needle jack 101. The two drums 87, 88 are positively rotated by the meshing of a gear 238 integral with drum 87 and a tooth rack 230 mounted on the stationary cylinder. The passage of the pattern drum 166 around the needle cylinder is secured by the tooth rack 231 mounted below the dial 85 and meshing with a crown 240 on a shaft 241 driven by a suitable source of power (see Fig. 1).

The mechanism by means of which the pattern may be omitted from any desired portion of the fabric will now be described. In general, this wiping out of the pattern is effected by a pattern drum similar to that disclosed in my prior patent No. 1,792,647. A plurality of slidable jacks 136 are located in slots in a stationary portion of the machine and are suitably controlled by a pattern sheet by pivoted levers and wires similar to those in said prior patent, and similar to wires 77 and levers 63, 64 of Fig. 7 of the present specification. A pattern drum 137 is mounted to move around the needle cylinder and rotates in response to said movement around its axis 138. The external surface of the drum is slotted to receive a plurality of slidable elements 139 corresponding in number to the number of jacks 136. At one end of each element 139, a pivoted member 140 is mounted for rocking movement in a manner as described in said prior patent. If one particular jack 136 is in its inner position nearest the needle cylinder it will contact with end 142 of its corresponding pivoted member and throw end 141 outwardly into the path of a cam 143 which will subsequently move the corresponding element 139 towards the needle cylinder. If another particular jack 136 is in its retracted position it will contact with end 141 of its corresponding pivoted member 140 and throw the end 142 outwardly into the path of cam 144, which will subsequently move the corresponding element 139 away from the needle cylinder. Cams 143, 144 are suitably mounted on the inside of the housing 145 for the drum. Each slidable element 139 has at its opposite end a projection 146 which in its forward position contacts, during the rotation of the drum, with one or more pivoted levers 147 which are distributed in pairs around the entire machine

at certain points to be described later. These pivoted levers 147 are suitably mounted on a stationary portion of the machine. It will be seen that if a projection 146 contacts with end 148 of a lever 147, this lever will be rocked counter-clockwise a small distance, which will cause end 149 of said lever to move the associated rod such as 150 and 210, towards the needle cylinder. Each rod 150 and 210 at its remote end has an upturned portion 151 which, when the rod is pushed forwards (Fig. 13) contacts with an arm 152 and moves the said arm in a clockwise direction. The arm 152 is fastened to the lower end of a vertical rotatable rod 153 which will be described later. Each arm 152 at its outer end has an upwardly extending projection 154 which may rest at one time against shoulder 155 or shoulder 156 of another rotatable arm 157, which is biased in a counter-clockwise manner. Thus if arm 152 is against shoulder 155 the previously described movement of the associated rod 150 will thrust arm 152 in a clockwise direction which will allow projection 154 to slide along the edge of arm 157 until brought to rest against shoulder 156. Each arm 157 has on the other side of its pivot a leaf spring 158 which lies in the path of either cam 159 or cam 160 and the contact of one of these cams with the strip 158 will reset the arm 157 by moving it against its stop 161 which will thereby restore arm 152 to its position against shoulder 155 from where it was moved by the forward thrust of the rod 150.

The biasing of each arm 157 is accomplished by a coiled spring 162 connected to an arm 163 fastened at the upper end of a small rotatable shaft 164, at the lower end of which is found the arm 157. The shafts 153 and 164 are suitably mounted in upright supports 165 which are mounted on the rotating dial plate 85 which also carries the pattern drums 166 and 137.

The arrangement at the upper end of each shaft 153 is illustrated in Figs. 15 and 16, taken in connection with Fig. 11. Referring more particularly to Fig. 15 the upper end of each shaft 153 bears an arm 176 carrying an upright pin 177 which is adapted to slide in a slot 178 in an arm 179 fastened to a rotatable sleeve in post 206 which sleeve at its upper end carries a cam such as cam 188. When arm 152 at the bottom of shaft 153 is moved counter clockwise, arm 176 will likewise move counter clockwise and the pin 177 will cause a similar counter clockwise movement of arm 179 as the pin 177 slides from the outer end of slot 178 towards the inner end of the slot in arm 179.

Before proceeding further with the detailed description of the apparatus associated with the wiping out drum 137, attention is drawn to the fact that the knitting machine being described has its needles divided into a number of groups equal to twice the number of yarn carriers, although the invention is not limited to such an arrangement. Thus with four yarn carriers the needles and needle jacks are divided into eight groups, each group having the same number of needles. Alternate groups, which we will call the "A" sections have certain characteristics that are similar, while the remaining groups, the "B" sections, are similar among themselves but possess different characteristics from the "A" groups. This division is for the purpose of facilitating the wiping out of the pattern at any desired time by means of the drum 137 of Fig. 11. There is no difference in the structure of the A section needles and the B section needles, as the needles in each A and B section comprise alternate long butt needles and short butt needles. The needle jacks in the A sections however are different from those in the B sections. The needle jacks of the A sections have two oppositely disposed butts 183 and 184 (Fig. 18) at one level, while the needle jacks of the B sections have two oppositely disposed butts 185 and 186 at a higher level, so that butts 183, 184 can be operated by one set of cams while butts 185, 186 may be operated by different cams. It may be noted that butt 186 for the B section needle jacks is actually an extension of the butt 187 which all needle jacks have to cooperate with rotating cam 107 and which butt 187 is actually a separate butt in the A section needle jacks.

In the specific machine disclosed in Fig. 1 there are four yarn carriers and for convenience it will be assumed that the needle jacks are in eight groups which will be termed in this description 1—A, 2—B, 3—A, 4—B, 5—A, 6—B, 7—A, and 8—B, the last needle jack of the 8—B section being of course next to the first needle jack in the 1—A section; so that there are four A sections and four B sections. It will now be shown how the apparatus of Fig. 11 can function, to wipe out the pattern in any one or all of the A sections or wipe out the pattern in any one or all of the B sections.

There are four sets of adjustable cams 188, 189 (Fig. 20) uniformly spaced around the needle cylinder, one set for each yarn carrier and each set being adapted to wipe out or reinstate the pattern for the following yarn carrier as far as the next B section is concerned or still other B sections subsequently reached in the rotation of the dial carrying the said cams. There are also four sets of cams 190, 191 which perform similar functions for any one or more of the A sections. Thus in Fig. 20 if cam 188 is brought into the path of the B section butts 185, while the said cam is traveling in an A section, 1—A for example, the said cam upon reaching the

2—B section will thrust all of that B section needle jacks into their slots so that they will not be raised by the subsequent passage of the knitting cam 119 previously described; which means that as far as that particular B section is concerned all the needles will produce interlock from the yarn from the next yarn carrier, regardless of any previous pattern settings by a pattern drum 166. During the passage of the said cam 188 through the next A section, 3—A for example, cam 188 may be retained in its operative position so that the pattern will be wiped out of the subsequent 4—B section where the needles will interlock and not knit loops; or in section 3—B the said cam 188 may be restored to an inoperative position so that it will not affect the needle jacks in section 4—B but will allow them to be selectively operated in accordance with the previous pattern settings by a pattern drum 166.

On the other hand, an adjustable cam 189 (Fig. 20) while traveling past section 1—A for example, may by apparatus shown in Fig. 11 be brought into the path of the B section butts 186, so that all the needle jacks in section 2—B will be thrust away from their slots, so that the subsequent passage of cam 119 (Fig. 20) will cause all needles in section 2—B to be raised to full knitting position, thereby wiping out the pattern from section 2—B for the yarn carrier that follows cam 119.

The A sections may have the pattern wiped out by the four sets of cams 190, 191. Thus if cam 190 is moved into the path of the A section butts 183, while the said cam is traveling opposite the 2—B section, it will be apparent that all the needle jacks in section 3—A will be thrust inwardly out of the path of knitting cam 119 so that section 3—A for the next yarn will only interlock. On the other hand if, while cam 191 is traveling opposite section 6—B for example, the said cam is placed in the path of the A section butts, then all the needle jacks in 7—A will be thrust outwardly and all the needles in section 7—A would knit from the next passing yarn carrier, regardless of any previous pattern setting of the said needle jacks.

There are therefore four cams 188 to 191 which precede each yarn carrier and follow each pattern drum, such as drum 166, so that for the machine of Fig. 1 there are four groups of such cams. Each group is adapted to be set so as to wipe out the pattern for any desired number of sections and cause the fabric in each section to be in accordance with the pattern settings or all interlock or all knit, whichever is desired. The apparatus shown in Fig. 11 illustrates how each of these cams 188 to 191 may be made operative or inoperative as far as the needle jack butts are concerned.

The manner in which the cams 188 to 191 are controlled by the drum of Fig. 11 will now be explained, reference being made to Figs. 11, 12, 15, 16, 18 and 20. Cam 189 (Fig. 11) is shown secured to an inner shaft 196 of a stationary post 197, while the lower end of shaft 196 is secured to the arm 198 similar in construction to arm 179 previously described. This arm 198 is also slotted at its end like arm 179 and embraces a vertical pin on an arm 199 connected to the upper end of a shaft 203 similar to shaft 153 previously described. This means that the movement of shaft 203 controls the position of cam 189 to make it either operative or inoperative on the butts of the next B section. The corresponding cam 191 for the A sections is mounted on a rotatable sleeve 200 external to shaft 196 but also supported by post 197. The lower end of this sleeve 200 is supplied with an arm 201 similar to the slotted arm 179. Arm 201 embraces a vertical pin on an arm 205 connected to the upper end of shaft 202 similar to shaft 153. This means that the movement of shaft 202 determines whether cam 191 is operative or inoperative.

Cam 188 is mounted on the inner shaft within a post 206 (which is similar to post 197) and is thereby connected to arm 179; and arm 179 as previously described embraces a pin 177 on the arm 176 which is connected to the top of shaft 153. The rotation of shaft 153 controls whether cam 188 is operative or inoperative. Cam 190 is connected to the outer sleeve within post 206 and is thereby connected to arm 207 which through arm 208, similar to arm 176, is controlled by the vertical shaft 204.

It will be understood that there are two rods such as 150, Fig. 11 opposite each of the eight sections into which the machine has been divided, although as will be seen later the two horizontal rods in each A section have their ends adjacent the needle cylinder but differing from each other and differing from the pairs in the B sections in order that one such rod in each A section will control cam 188 and the other rod control cam 189; and that one rod in each B section will control cam 190 and the other rod control cam 191. The end of the second rod for an A section is shown at 210 at Fig. 11. The two rods 150, 210, may be opposite section 1—A in order to control either cam 188 or cam 189 for section 2—B. Associated with the rods 150, 210 are the pivoted contacting levers 147, 211 which as shown in Fig. 12 are adapted to be controlled by two of the slidable elements 139 in drum 137. It will be noted from Fig. 12 that the slidable elements 139 are spaced in eight pairs around the periphery of the drum, one pair for each section of the machine, which is the preferred arrangement although a greater number of pairs may be used if desired. Thus elements in slots 125 may control two rods 215, 216 op-

posite section 2—B in order to control cams 190, 191 for the following section 3—A; elements in slots 212 may control rods such as 150, 210 opposite section 3A to control cams 188, 189 for section 4B, and so on around the wiping out drum, thus making elements in slots 213 control cams 190, 191 for section 1—A. For example, if the two rods such as 150, 210 or 215, 216 are opposite the center of each needle section the uniform arrangement of the slots in drum 137 would require that the drum 137 perform say nine complete revolutions in passing around the needle cylinder, while the pattern drum 166 performs eight complete revolutions in passing around the needle cylinder. That is the arrangement shown in the drawings to enable a different pair of elements on drum 137 to control the two horizontal rods such as 150, 210 or 215, 216 in each section.

It will be noted from Figs. 13 and 14 that the right ends of the horizontal rods 150, 210, 215, 216, are so turned that they control their appropriate vertical rods 153, 203, 202, and 204 respectively, Fig. 13 showing the control of vertical rods 202 and 204 by horizontal rods 215 and 216, while Fig. 14 shows the control of vertical rods 153 and 203 by horizontal rods 150 and 210. This means that the device shown in Fig. 13 is taken from a B section and controls the wiping out cams for an A section; and that shown in Fig. 14 is taken in an A section and controls the wiping out cams for a B section. To recapitulate rods 150 and 153 control cam 188; rods 210 and 203 control cam 189; rods 216 and 204 control cam 190; and rods 215 and 202 control cam 191. Each of the horizontal rods has a coiled spring 217 which tends to restore the horizontal rods after they have been advanced by drum 137. An adjustable stop 218, Fig. 11, is provided for each rocker arm 148 to limit its upper movement due to pressure from springs 217.

It will be noted by comparing Figs. 11, 13 and 14 that the resetting cam 160 for the B section rods is at such a height that it contacts with the upper arms 158 and 219 while the resetting cam 159 is at a lower level so that it contacts with arms 220, 221. The extent of movement of arm 158 for example is shown by the dotted line position in Fig. 14. Cams 159, 160 are located on the stationary base plate 225.

It is preferable that the sleeve supporting the arm 179 should also be provided with another arm 226 at an angle thereto and that the sleeve fastened to arm 198 should also be provided with a similar angular arm 227, the two arms 226, 227 being connected by a tensioned spring 228. This spring 228 is for the purpose of insuring that cam 189 is not in an operative position at the same time as cam 188. Arms similar to arms 226, 227 and connected by a coil spring serve the same purpose for cams 190, 191.

The drum 137 may be supported by shaft 138 upon roller bearings such as at the points 232 and 233. The outer surface of drum 137 has a gear 234 which meshes with gear 235. The shaft 138 is suitably supported by the member 236 which is mounted on the rotating dial plate 85.

Now that the sectional views of Figs. 7 and 11 have been described, the details of the plan view of the machine in Fig. 1 will be better understood. It is assumed that the machine has four yarn feeds with four pattern control drums 166, 243, 244, and 245, each similar to drum 166 which has been described in detail. Four wiping out drums 137, 246, 247, and 248 are provided, each similar to drum 137 previously described. The pattern drums 166, 243, 244, and 245 are controlled in turn in their counter clockwise movement around the needle cylinder by the paper pattern on cylinder 61 as described in Fig. 7. Another paper pattern on cylinder 250 or the equivalent thereof controls in turn the four wiping out drums 137, 246, 247, and 248. The manner of control by cylinder 250 and the perforated pattern thereon is similar to that of cylinder 61. Associated with the paper pattern on drum 250 are eight pairs of pivoted fingers 251, each corresponding to a row of pattern determinations in the pattern sheet, and each finger being adapted through a wire connection 252 to cause the advance or retraction of the slidable jacks 136 of Fig. 11 which are mounted in a stationary part of the machine. The details of this control are not shown since they correspond to the apparatus of Fig. 7 between finger 62 and element 78.

The two perforated cylinders 250 and 61 are mounted on shafts which are given a step-by-step rotary movement through suitable apparatus in housings 253, 254 connected by gears 255 to shaft 256, the other end of which is connected by crown 257 to the tooth rack 231, the details of which may be understood by reference to my U. S. Patent No. 1,737,598 issued Dec. 3, 1929.

As previously described the needle cylinder is divided for convenience into eight sections, 1—A, 2—B, etc., each section preferably containing the same number of needles. In the particular position of the apparatus shown in Fig. 1, the slidable elements of wiping out drum 248 are being set by the pattern on cylinder 250. After being set in this manner, the wiping out drum 248 passes over the horizontal rods 215, 216 opposite section 8—B and sets the said rods to control the cams 190, 191 which travel with drum 248 around the needle cylinder. The said cams 190, 191, so set, will control the needle jacks in section 1—A, when the drum reaches said section, for wiping out the pattern from yarn 260, providing one

of said cams was set in operative position. While the drum 248 is in section 1—A the arms 158 and 219 will first strike the releasing cam 160 to restore both cams 188, 189 to an inoperative position at the same time cam 190 or 191 may be working on the 1—A section needle jacks. After passing releasing cam 160 the drum 248 encounters the upturned ends of horizontal rods 150, 210 and the drum 248 by means of said rods may set either cam 188 or cam 189 for subsequent operation on the 2—B section needle jacks. Shortly after entering section 2—B the drum 248 reaches a position where arms 220 and 221 will be actuated by releasing cam 159 to restore either cam 190 or cam 191 to an inoperative position, depending on which one was operative in section 1—A. Drum 248 will then continue around the needle cylinder to set one of each of the other three pairs of rods 215, 216 and of the other three pairs of rods 150, 210 or none of them if desired, after which the elements of drum 248 may be reset by the pattern cylinder 250 for its next movement around the needle cylinder. In a similar manner wiping out drum 247 controls the wiping out of the pattern for yarn 261 in each section, drum 246 exercising similar control for yarn 262 and drum 137 for yarn 263.

Each of the vertical pattern drums 166, 243, 244, and 245 is set in turn by the perforated pattern sheet on drum 61. Each of these vertical drums preferably has a number of slidable elements equal to the number of needles in each section, which means that the pattern determinations applied to drum 166 for example will be repeated eight times around the needle cylinder and that each section may produce a pattern varying over the entire section. Vertical pattern drum 166 sets the needle jacks for yarn 263, drum 243 for yarn 262, drum 244 for yarn 261 and drum 245 for yarn 260. Each vertical drum has associated therewith the necessary cams for securing the desired type of knitting from the needles.

The various cams described particularly in Figs. 7 and 11 are also shown in top view in Fig. 1 with corresponding reference characters. There are four cams corresponding to each of cams 107, 117, 119, 118, 121 and 122, while there are only two cams 84 diametrically opposite each other with respect to the needle cylinder. The reason why only two cams 84 are needed in the particular form of Fig. 1 may be explained by stating that the preferred method of starting the machine is to adjust the manually operated cams 105, 106 to cause two oppositely disposed drums, say drums 243, 245, to form jersey cloth for all yarns and cause the other drums 166—244 to form interlock cloth. After several rows have been knitted in this manner the manually operable cams 105, 106 are made inoperative and the pattern sheet cylinder 61 started. Before the sheet 60 exerts any control the slidable elements of drums 245 and 244 are set oppositely due to the previous assumed control by cams 105, 106. Now if the pattern sheet 60, to reset certain of the slidable elements of drum 245 (due to perforations at certain points in sheet 60) positions corresponding jacks 80 after the cam 84 immediately preceding drum 245 has lifted all vertical jacks 80, it follows that the vertical jacks may remain in the position determined by this first pattern setting for the passage of the next drum 244 since by their remaining in the said positions it will means a change in the positions of these slidable elements of drum 244 corresponding to the changed elements of drum 245. That is, if pattern sheet 60 after passage of cam 84 causes one slidable element on drum 245 to be raised to its upper position by the actuation of a jack 80, the corresponding element in the following drum 244 will be lowered due to the actuation by the same vertical jack 80 without the necessity of a resetting by an intervening cam 84. In other words a jack 80 in operative position causes a change in the existing setting of its corresponding element in each drum, so that assuming its element in drum 245 is in a raised position jack 80 will cause it to be lowered and its element in drum 244 which is in a lowered position will be raised by the same setting of jack 80.

There now remains to be described the schematic view of the needle lay-out as shown in Figs. 2, 4, and 6. These three figures should be joined together with Fig. 2 on the left, Fig. 4 in the middle and Fig. 6 on the right in order to obtain the proper sequence of operation. The condition of section 1—A in Fig. 6 is the position after the passage of a yarn carrier and after all needles have been retracted, so as to place all parts in condition to receive pattern determinations or wiping out control prior to the passage of the next yarn carrier. With the parts in the position shown in Fig. 6, the levers 62 are now raised, the pattern paper cylinder 61 stepped one step and the levers 62 brought down again against the paper pattern or through holes therein, for example as shown for the cylinder 61 in Fig. 4. After this new setting of fingers 62, cam 84 passes along in the direction of the arrow advancing all slidable elements 80, some of which will remain advanced while others will be subsequently retracted by springs 73, depending on whether or not the corresponding finger 62 encountered a perforation in the pattern. Cam 107 operates at about the same time as cam 84 to push outwardly the lower ends of all the needle jacks 101 in order that they may be later selectively actuated. Cam 117 then raises all needle jacks 101 to cause all needles to be

partially raised to interlock position, as shown to the left in Fig. 4. This causes all the cam surfaces 100 to ride on top of the separating plate 103 when the rotatable pattern drum 166 now passes the needle jacks of section 1—A.

Each needle jack 101 in section 1—A is now selectively actuated by the upper ends of slidable elements 89 in accordance with the settings previously introduced by the last passage of drum 166 over the jacks 80; at the same time the lower ends of the drum elements 89 are receiving pattern determinations for subsequently controlling the needles of sections 2—B, 3—A, 4—B, 5—A, 6—B, 7—A, 8—B, 1—A in the order named.. That is while drum 166 is passing over section 1—A, the pattern actuations impressed on the needles of section 1—A are not those being given at that instant to the lower ends of elements 89, but correspond to the settings of the said lower ends on their prior passage over section 1—A. The manner in which the upper ends control the needle jacks and the manner in which the lower ends are controlled by the jacks 80 have been described in connection with Fig. 7.

It follows therefore that slidable elements 89 will push inwardly certain of the needle jacks of section 1—A while allowing others to remain in their outer positions. Referring now to Fig. 2 it will be seen that section 1—A next encounters the wiping out drum 137. The cams 190, 191 associated with drum 137 and which control the needle jacks of section 1—A are set by the drum 137 while the drum is passing over the previous section 8—B as shown in Fig. 2, where the said drum 137 through momentary cooperation with horizontal rods 215, 216 controls the cams 190, 191. As a result of this control, cams 190, 191 may be inoperative for section 1—A or one of them may be operative.

Assuming now that cams 190, 191 pass into section 1—A to actuate the needle jacks therein, if desired to wipe out the pattern, it will be seen from Fig. 2 that the needle jacks of section 1—A will next be controlled by cam 119 to raise to knitting position those needles whose jacks have remained in an outward position after being controlled by drums 166 and 137. The long butt needles of section 1—A that were previously raised to interlock position are now lowered by cam 118, although cam 118 does not actuate any long butt needle that has been raised to full knitting position. Cam 121 then lowers all needles to a sub-normal position, after which they are raised to their normal retracted position by the cam 122. This completes the cycle of operations for the needles of section 1—A as far as yarn feed 263 is concerned and it is evident that a similar description applies to the control of the needles of the other sections, not only for wiping out drum 137 and pattern drum 166 but for the other pattern drums and wiping out drums, each wiping out drum in turn being set by the pattern control sheet on cylinder 250 and each pattern drum being set in turn by the pattern sheet on cylinder 61.

Fig. 3 has been placed beside Fig. 2 and Fig. 5 has been placed beside Fig. 4 in order to aid in the identity of the various moving parts shown only schematically in Figs. 2 and 4.

The particular form of wiping out drum disclosed in certain of the Figures 1 to 22 inclusive just described is the invention of another and is described and claimed in a patent application to O. E. Rasmussen Serial No. 473,241, filed Aug. 5, 1930.

An alternative form of the wiping out drum and associated appartus is shown in Figs. 23 to 28 inclusive. Otherwise the top view of the knitting machine shown in Fig. 23 is similar to that of Fig. 1.

Referring more particularly to Fig. 24, the wiping out drum 300 has a plurality of parallel slots in its periphery similar to Fig. 12, there being thirty-two slots, four for each section of the machine. The four slidable elements in each group of these slots are of four different lengths, there being eight of each length spaced around the drum. Element 301 is the shortest and ends in a projection or butt 302. Element 303 is the next in length and ends in a butt 304. Element 305 ends in a similar projection 306. Element 307 is the longest and ends in a butt or projection 308. As shown in Fig. 25, butt 306 does not project straight away from the surface of drum 300 but is bent until a portion thereof is over the slot containing element 301. Similarly butt 308 does not project straight away from the surface of drum 300 but is bent parallel to the surface of the drum until a portion thereof is over the slot containing element 303. Each of these slidable elements, 301, 303, 305, and 307 has a pivoted member 310 at its other end, corresponding to pivoted member 140 of Fig. 11. The relative position of the jacks 311 in a stationary dial of the machine determines whether these pivoted members 310 will be rocked clockwise or counter clockwise as the drum 300 passes over the part of the machine containing the jacks 311. These jacks 311 may be set for each contact with pattern drum 300 by a perforated pattern sheet on cylinder 312, so that the control of jacks 311 by cylinder 312 is the same as with the apparatus of Fig. 11, where jacks 136 are controlled by the pattern sheet on cylinder 250 and the said control does not require a detailed explanation at this point in the specification. After the setting of pivoted members 310 by jacks 311, cams not shown but similar to cams 143, 144 (Figs. 11 and 12) determine whether each slidable element 301, 303, 305 and 307

is advanced or retracted with respect to the needle cylinder. If slidable element 301 is advanced thereby, its butt 302 will subsequently come in contact with an extension 313 carried by an arm 314 pivoted at the point 315, see Fig. 28. This arm 314 on its underside has a downwardly directed butt 316 which rests on the top of a rocker arm 319 which lies in an aperture in the stationary plate 318 and which corresponds to rocker arm 147 of Fig. 11. Similarly if slidable element 303 is advanced, its butt 304 will depress extension 320, which, by a construction similar to that just described, will depress a rocker arm 321 which lies beside arm 319 but it will be noted that the downwardly extended butt 317 on rocker arm 321 contacts with rocker arm 321 a small distance to the right of the point where butt 316 contacts with rocker arm 319. If the pattern requires that slidable element 305 be advanced it will contact with pivoted extension 323 and cause rocker arm 324 to be depressed in a similar manner. If slidable element 307 is advanced, its butt 308 will depress pivoted extension 325 and thereby move rocker arm 326 in a counter clockwise direction.

Rocker arms 319, 321, 324, and 326 control respectively horizontally movable rods 330, 331, 332 and 333. These four rods 330 to 333 are for the same purpose as and correspond to rods 150, 210, 215, 216 of Figs. 13 and 14. That is rods 330 and 333 control vertical rods to control the actuation of cams for the A section needle jacks, which cams will be designated 190^1, 191^1 corresponding to cams 190, 191 of Fig. 11, while rods 331, 332 control vertical rods corresponding to rods 153, 203 of Fig. 11 to control the actuation of cams 188^1, 189^1, respectively for the B section needle jacks. There are other minor differences however between Figs. 11 and 24. The horizontal rods 330 to 333 are mounted on a member 340 which is unitary with the mounting for drum 300 and which carries a tooth rack 341 so that the member 340 is moved around the needle cylinder along with the drum 300. That is, the drum 300 with its four rocker arms, its four horizontal rods, four vertical rods and the four cams 188^1, 189^1, 190^1, 191^1, move around the needle cylinder as a unit. Cams 188^1, 189^1, 190^1, 191^1 correspond in construction and function to cams 188 to 191 of Fig. 11. As shown in Fig. 23 the machine is divided into eight sections four A sections and four B sections, so that cams 188^1, 189^1, take care of the four B sections and cams 190^1, 191^1, take care of the four A sections.

Drum 300 does not have a continuous rotation about its own axis as it is moved around the needle cylinder, but is stepped to bring four new slidable elements into play just prior to its entry into a new section of the machine. However it is given a rotation in a continuous manner while it is passing over the jacks 311 controlled by the paper pattern cylinder 312. This is due to the fact that there is a stationary tooth rack 343, Fig. 27, opposite the cylinder 312, and meshing with gear 344 and having sufficient teeth to cause the desired groups of slidable elements on drum 300 to be set by the jacks 311. This setting of drum 300 takes place opposite a portion of section 8—B and since in this embodiment of the invention the setting of the slidable elements by the jacks 311 are transferred immediately to the cams 188^1 to 191^1, it is advisable to have in section 8—B needle jacks from which the butts corresponding to butts 183, 184, 185, 186, Fig. 11 have been omitted, although the needle jacks of the remaining sections of the machine of Fig. 23 have such butts. This merely means that the pattern can not be wiped out of section 8—B but will always be present. In an alternative arrangement the needles in section 8—B may be provided with special butts cooperating with special needle cooperating cam for each yarn carrier to cause these needles to knit and interlock alternatively in a well known manner irrespective of any pattern setting given to the needle operating jacks. In order that the teeth in gear 344 will mesh properly with rack 343, it is advisable to mount an arm 380 on the rotating shaft of drum 300 which arm will contact with a stationary pin 382 so as to initiate the revolution of the drum 300 at the beginning of the tooth rack 343.

After the drum 300 has passed the last tooth in rack 343, the rotating movement of drum 300 ceases for the time being. The last group of slidable elements 301, 303, 305, 307 to be set by jacks 311 will have transferred their actuations to the cams 188^1 to 191^1 while the cams are still in section 8—B, so that as soon as the drum has entered section 1—A the setting of either cam 190^1 or 191^1 to an operative position by the last group of slidable elements will cause the pattern to be wiped out in section 1—A. Any undesired setting of cams 188^1, 189^1, 190^1 and 191^1 due to the rotation of drum 300 over tooth rack 343 will be obliterated before the cams reach into section 1—A by means of a stationary release cam 363, similar to cam 159 of Fig. 13.

Near the end of the 1—A, section the drum 300 is actuated to be stepped around to bring a second group of slidable elements to the bottom of the drum to control the horizontal rods 330—333. It will be assumed that the wiping out drum 300 has given selective actuations either to slidable element 303 or 305 but not to slidable elements 301, 307 of this second group. The setting of cams 190^1, 191^1 will not be disturbed for section 1—A but these will remain in the positions determined by the slidable elements 301 307 of the group on the drum for the 1—A section

due to locking latches similar to those described in Figs. 13 and 14. Cams 188¹ or 189¹ may however have been set to wipe out the pattern as soon as the drum begins to pass over section 2—B.

This stepping movement of drum 300 near the end of section 1—A will be understood by reference to Fig. 26 showing a cam 350 mounted on the stationary dial 351. A pivoted arm 352 carried by the mounting for drum 300 and pivoted at the point 353 carries a roller 354 which is adapted to roll over cam 350 and raise lever 352 thereby. Lever 352 has a spring biased pawl 355 cooperating with the teeth in a wheel 356 mounted on the shaft of the drum 300. It will be apparent that the raising of arm 352 by cam 350 will cause pawl 355 to hook above the next tooth in wheel 356 and after cam 350 is passed over, the lever 352 will be lowered by spring 357 to cause the pawl 355 to step the drum 300 one step in a clockwise direction. A notched wheel 358 is also fastened to the shaft of drum 300 and a spring pressed roller 359 insures that the drum 300 stops at the proper point after each stepping by cam 350.

After the wiping out drum 300 has entered the 2—B section, a stationary cam 360 corresponding to cam 159 of Fig. 13, serves to bring both of cams 190¹, 191¹ to an inoperative position. Cam 360 also actuates the controls for cams 188¹ 189¹ but the cams 188¹, 189¹ are held in their preselected positions by the jacks in drum 300 so that either cam 188¹ or 189¹ is free to actuate the needle jacks in section 2—B according to the setting of the drum 300 due to the pattern sheet on cylinder 312. This cam 360 contacts with arms 158¹, 219¹ to produce the resetting of cams 190¹, 191¹. Just prior to leaving section 2—B the drum encounters another stationary cam 361 similar to cam 350 which steps the drum around to bring a third group of four slidable elements to the bottom of the drum path. The slidable elements 301, 307 of this group having previously been actuated by the jacks 311 will now operate the rods 330, 333 and associated mechanism to place either cam 190¹ or 191¹ into operative position if desired, which setting will have no effect as long as the drum 300 is in section 2—B, but will be effective as soon as the drum 300 enters section 3—A. After drum 300 has entered section 3—A, a stationary cam 362 (see Fig. 23), similar to cam 160 of Fig. 14, will be effective to restore cams 188¹, 189¹ to normal in a manner previously described, due to contacting with arms 220¹, 221¹. The drum 300 will continue around the needle cylinder, wiping out the pattern in one or more sections as determined by the pattern sheet on drum 312. Although for any one movement of drum 300 around the needle cylinder the setting of the slidable elements may be such that the pattern will be retained in all sections. Stationary cams similar to cams 360 are spaced in all the other sections except section 8—B, since none is required in section 8—B for arranging for the control in section 1—A.

Since for each section of the needle cylinder only two of the slidable elements of each group on the drum 300 needs to be selectively actuated, it follows that cylinder 312 requires only fourteen levers 370 actuated by the pattern sheet, two for each needle cylinder section 1—A, to 7—A, and none for section 8—B where the pattern is not wiped out under the control of the drum 312.

The machine of Fig. 23 is assumed to have four yarn carriers, so that four wiping out drums 300, 364, 365, 366 are provided, each set in turn by the pattern sheet or cylinder 312, each operating for one of the yarn feeds in the manner described for drum 300. The four vertical pattern drums 371, 372, 373, 374 are identical in form and function to the four pattern drums 166, 243, 244, and 245 of Fig. 1 and hence there is no need for detailed description at this point. These pattern drums just mentioned are selectively set in turn by the perforated paper pattern on cylinder 375, which corresponds to cylinder 61 of Fig. 7. The step by step movement of cylinders 312, 375 is obtained in the same manner as in Fig. 1. Certain parts of Fig. 23 that are identical with corresponding parts in Fig. 1 have been designated by a prime added to the reference characters used in Fig. 1. Fig. 25 illustrates an enlarged top view of the drum 300 and associated apparatus, a sectional view of which is shown in Fig. 24. In view of the previous description of Fig. 24, it is not believed that a detailed description of Fig. 25 is necessary. Certain primed reference characters in Fig. 25 refer to elements with corresponding unprimed characters in Figs. 11, 13 and 14.

Still another form that the wiping out mechanism of this invention may possess is shown in Figs. 29 and 30. In the cylindrical knitting machine of which a section is shown in Fig. 29, it is assumed that each pattern drum 400 of the machine is followed by a wiping out drum 401 capable of wiping out the pattern for any particular yarn around the entire machine. The pattern drum 400 may be of the type disclosed in Figs. 1 and 2 of my U. S. Patent No. 1,737,598 issued Dec. 3, 1929 to which reference is made for a detailed disclosure of the manner in which the slidable elements 403 of the pattern drum are set by a perforated pattern sheet and transfer the pattern determining actuations to horizontal jacks 402, of which there is one for each needle in the machine. The manner in which the jacks 402 are actuated by drum 400 is similar to the manner in which said patent jacks 39 are set by pattern drum 38, but there is a difference in the way in which the jacks 402 pass on their selective actua-

tions to the needles. Prior to the passage of pattern drum 400 a suitable cam 404 serves to elevate the ends of all needle jacks so that jacks corresponding to advanced slidable elements 403 will be depressed by the passage of the drum while the other jacks will remain elevated. Those jacks that remain elevated will be subsequently advanced towards the needle cylinder 406 by a cam 405 so that the other ends of such jacks will be projected into the path of a cam 407. The height of cam 407 is such that by its passage all needles will be raised to interlock position as shown in Fig. 29. It will thus be apparent that when a jack 402 rides on top of cam 407 that its corresponding needle will be elevated an additional distance equal to the thickness of jack 402 which will bring such a needle to full knitting position. Those long butt needles corresponding to jacks 402 that ride directly on cam 407 will be lowered by cam 409 while the short butt needles of this group will be retained in interlock position until after the passage of the yarn carrier when all needles will be lowered by an appropriate cam.

As previously stated each pattern drum 400 is followed by a wiping out drum 401 ahead of each yarn carrier and the wiping out mechanism will now be described. The drum 401 is mounted on a vertical shaft and is adapted to be moved around the needle cylinder since its shaft is mounted on the usual rotating dial 410 on which the pattern drums 400 are also mounted. The drum 401 is adapted to have fastened thereto by screws 411 a plurality of metal strips 412 which may be turned to have butts 413 at their upper ends or at their lower ends. The lower end of the drum 401 has a gear 415 which engages a pawl 416 in such a manner that the actuation of the pawl 416 will step the drum 401 the distance between two adjacent strips 412 for each actuation of the pawl. The pawl 416 is pivotly mounted on a pivoted arm 417, the projection 418 of which once for each revolution around the needle cylinder is adapted to be actuated by striking a cam 419 when the said cam is in its upper position as shown in dotted lines, Fig. 29. This cam 419 is mounted on a rod 420 which slides up and down in a slot in stationary member 421 and the lower end of this rod rests on a lever 422 pivoted at its opposite end 423. This lever 422 rides over a pattern chain 424 mounted on a sprocket wheel 425 which may be given a step by step movement in any desired manner. As long as the link immediately under lever 422 has no projection it is evident that cam 419 will remain in a lowered position and hence will not actuate wiping out drum 401. As soon however as a cam 426 gets on top, the lever 422 will be raised to raise cam 419 so that the next drum 401 which passes will have its pawl 416 act to step the said drum one step.

The manner in which the drum 401 wipes out the pattern previously set by drum 400 will now be described. The dial 410 carries opposite drum 401 two vertically disposed members 427, 428 joined at an intermediate point by a shaft 429. Mounted on this shaft is a rocker arm 430. Rocker 430 has butts 432 and 433 formed so that one lies directly above the other in a vertical plane. Spring 435 serves to hold arm 430 in its normal or middle position so that butts 432 and 433 lie in the path of any butts 414 at the upper or lower end of the wipeout drum.

Rocker arm 430 has a downwardly extending bifurcated projection 438 which encompasses a pin 440 which is mounted near the upper end of a lever 441 which is pivoted at the point 442 and which carries two cam members 443 and 444 on opposite sides of its pivot, both of said cams being normally out of contact with the ends of jacks 402. However when butt 432 encounters a butt 413 on the wiping out drum, projection 438 will be moved counter clockwise against pin 440 which will move cam 444 clockwise into the path of jacks 402 to cause all jacks to be lifted into the path of cam 405 until butt 414 is removed. Similarly when butt 433 encounters a butt 413, projection 438 will be moved clockwise, which will cause cam 443 to be moved counter clockwise into the path of jacks 402 as shown in dotted lines, which will cause all jacks 402 to be thrust out of the path of cam 405. The effect these actuations will have on the needles will be evident from the knitting operations previously described. It will thus be seen that the presence of butts on drum 401 will wipe out the pattern settings by drum 400, while the absence of butts on drum 401 will permit the desired pattern to be knitted.

The form of wiping out mechanism shown in Figs. 29 and 30 may be modified to include a plurality of chain controlled cams 419 placed at desired intervals around the periphery of the machine. By this arrangement it is possible to limit the wiping out action to only part of the total circumference of the fabric.

Examples of the varied pattern effects that may be produced by the machines of this invention are illustrated in Figs. 31, 32, and 33. It may be assumed that white and black yarns are being knitted to form the fabric of these figures. The white spaces of Fig. 31 may represent portions of white loops with the black yarn interlocked in the back of the fabric, such as in portions 450. In portions 451, the white spaces also represent white loops with the black yarn interlocked behind the white loops, while the shaded diamond sections represent black loops with the white yarn interlocked. The separating lines be-

tween the diamond shaped portions also represent black loops. Portion 453 is all black loops with white yarn interlock. In Fig. 32 variations of the pattern of Fig. 31 are shown in which the white and dark spaces means the same as in Fig. 31. It is of course to be understood that any or all rows in Figs. 31, 32 with no pattern may be jersey stitch in which both the white yarn and the black yarn form loops. In Fig. 33, the vertical dotted lines in the pattern represent alternate loops of black and white yarn. The diamond 455 to the left is intended to represent all black loops with white yarn interlock, while the diamond to the right is intended to represent jersey cloth with alternate rows of black and white yarn; and the space around the diamonds consists of white loops with black yarn interlock.

It will be appreciated that the invention, in certain of its aspects, is not limited to a machine employing latched needles, but other types of needles may be employed. It is also to be understood that the invention is not limited to a cylindrical type of knitting machine which form has been shown for illustrative purposes. Since certain changes may be made in the constructions and products set forth without departing from the scope of the invention, it is intended that all matter contained in the above description shall be interpreted as illustrative and not in a limiting sense. It is also to be understood that the following claims are intended to cover all the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween. As an example of one possible modification that may be employed, reference is made to Fig. 22 where the needle and the needle jack 101 are shown integral with each other instead of being separate elements as in the earlier figures such as Figs. 17 to 21. The combined needle and needle jack functions in the same manner and is controlled in the same way as if they were separate elements.

The invention claimed is:

1. A knitting machine comprising a row of needles, a plurality of yarn feeds each carrying yarn to be incorporated into a fabric by said needles, controlling means for said needles, means comprising a pattern drum mounted for movement along said row and rotating in response to said movement for automatically setting said control means to subsequently cause said controlling means to form pattern effects from said yarns, and means responsive to the operation of said machine for wiping out at times the pattern settings of said controlling means for a group of needles, said wiping out occurring before said pattern settings have been made effective on said last mentioned group of needles.

2. A knitting machine comprising a row of needles, a plurality of yarn feeds each carrying yarn to be incorporated into a fabric, a control member for each needle, means controlled by the setting of said members for giving selective actuations to said needles, pattern mechanism for selectively setting each of said members prior to the passage of a yarn carrier, and means supported independently of said mechanism responsive to the operation of the machine and operating upon said control members subsequent to said pattern mechanism but prior to the passage of said one yarn carrier for wiping out the pattern settings of a group of said control members while retaining the pattern settings of other groups of said control members.

3. A knitting machine comprising a circular row of needles, a plurality of yarn feeds, a control member individual to each needle, means controlled by the setting of said control members for giving selective actuations to said needles, pattern mechanism individual to one yarn feed for traveling past said control members in advance of the passage of said one yarn feed to give similar pattern determining actuations to successive groups of said control members, the settings differing for the control members within a group, and means individual to said one yarn feed and effective prior to the said passage of said one yarn feed for subsequently giving the same selective actuations to all of the control members of one group, while permitting the previous pattern settings to remain undisturbed in a second of said groups.

4. A knitting machine comprising a circular row of needles, a plurality of yarn feeds, a control member individual to each needle, means controlled by the settings of said control members for giving selective actuations to cause some of said needles to be partially advanced and others fully advanced, pattern mechanism individual to one yarn feed for traveling past said control members to give similar pattern determining actuations to successive groups of said control members, the settings differing for the members within a group, to cause certain needles in one group to be fully advanced and others of the same group to be partially advanced, and means individual to said one yarn feed and operating subsequently to said pattern mechanism for causing all of the needles in said one group to be partially advanced.

5. A knitting machine comprising a circular row of needles, pattern mechanism having predetermined configurations thereon, means responsive to said configurations for traveling around said row in advance of a yarn feed to impart pattern determining actuations to said needles in accordance with said configurations, and means operating prior to said advance of said one yarn feed comprising a drum mounted for movement around said row and

rotating in response to said movement for preventing said means from being effective in certain groups of said needles for said one yarn feed.

6. A knitting machine comprising a circular row of needles, a movable pattern mechanism having predetermined configurations thereon, means responsive to said configurations for traveling around said row in advance of the passage of a yarn feed to impart pattern determining actuations to said needles in accordance with said configurations, a second movable pattern mechanism having predetermined configurations thereon, and means controlled by said second mechanism for causing all of a group of needles to be partially advanced prior to said passage of said one yarn feed.

7. A knitting machine comprising a circular row of needles, a movable pattern mechanism having predetermined configurations thereon, means operating in advance of the passage of a yarn feed for causing the difference in said configurations to be carried to a group of said needles and then repeated in a second group of needles, a second movable pattern mechanism having predetermined configurations thereon, and means controlled by said second mechanism for causing all of the needles in one of said groups to be partially advanced and all of the needles in said second group to be fully advanced prior to said passage of said one yarn feed.

8. A knitting machine comprising a circular row of needles, a movable pattern mechanism having predetermined configurations thereon, means operating prior to a specified advance of a yarn feed for tending to cause the difference in said configurations to be carried to a group of said needles and then repeated in a second group of needles, a second movable pattern mechanism having pattern configurations thereon, a drum controlled by said second mechanism and mounted for movement around said row and rotating in response to said movement, and means mounted on said drum for rendering said first means ineffective for one group of said needles prior to said specified advance of said yarn feed.

9. A knitting machine comprising a circular row of needles, a pattern mechanism having pattern determining configurations thereon, a control member individual to each of a plurality of needles, means controlled by said mechanism for setting said members, a second pattern mechanism having configurations thereon, a drum mounted for movement around said row and rotating in response to said movement, and means comprising slidable elements on said drum controlled by said second mechanism for rendering said first means ineffective for one group of said needles.

10. A knitting machine comprising a circular row of needles, a movable jack individual to each of a plurality of said needles for actuating the needles, a movable pattern mechanism having predetermined configurations thereon, means operating in advance of a specified passage of a yarn feed for causing the difference in said configurations to be carried to a group of said jacks, a second pattern mechanism having configurations thereon, and means controlled by said second mechanism for resetting some of said jacks prior to said specified passage of said one yarn feed.

11. A knitting machine comprising a circular row of needles, a control member individual to each of a plurality of said needles, a pattern strip having a plurality of configurations in each of a plurality of rows for controlling prior to the passage of a yarn carrier, a group of said members in accordance with said configurations, and a second strip supported independently of said first strip and having a plurality of configurations in each of a plurality of rows for controlling a group of said members in a different manner after the control by said first pattern strip but prior to said passage of said yarn carrier.

12. A knitting machine comprising a circular row of needles, a plurality of yarn feeds, pattern mechanism actuated by said machine and having a plurality of different configurations in each of a plurality of rows, means tending to exercise a selective control on said needles in accordance with said configurations prior to the passage of a yarn feed, a second pattern mechanism actuated by said machine, and means effective after said first means but prior to said passage of said yarn carrier and controlled by said second mechanism for preventing certain of said needles from being controlled in accordance with said first mechanism.

13. A knitting machine comprising a circular row of needles, a drum mounted for movement around said row and rotating in response to said movement, a plurality of slidable elements mounted on said drum, means for imparting selective actuations to said elements, a plurality of slidable jacks mounted for movement around said row and selectively controlled by said elements, an adjustable cam mounted for movement around said row which in one position is adapted to control said needles and in a second position is inoperative to control said needles, and means controlled by said jacks for moving said cam from said second to said first position.

14. A knitting machine comprising a row of needles, a needle jack individual to each needle, said jacks for certain groups of needles being of one type and of a second type for other groups of needles, a pattern drum mounted for movement around said row and rotating in response to said movement movable elements on said drum for individu-

ally controlling said jacks, pattern mechanism for controlling said elements, a second drum mounted for movement around said row and rotating in response to said movement and having pattern determining elements mounted thereon, and means controlled by said second drum for collectively actuating all of the needle jacks of one group of said first type each in the same manner and for collectively actuating all the needle jacks in an entire group of said second type each in the same manner but differing from the manner in which the first types were actuated.

15. A knitting machine comprising a circular row of needles, a pattern drum mounted for movement around said row and rotating in response to said movement, slidable elements on said drum, means controlled by said elements for controlling said needles, a second pattern drum mounted for movement around said row and rotating in response to said movement, slidable elements on said second drum, means for imparting selective actuations to the elements on said drums, an adjustable cam adapted when in operative position to control a plurality of groups of needles, a second adjustable cam adapted when in operative position to control other groups of needles, means controlled by said second drum for placing of one of said cams into operative position and means for subsequently rendering said one cam inoperative.

16. A knitting machine comprising a circular row of needles, a pattern drum mounted for movement around said row and rotating in response to said movement, slidable elements on said drum, means for imparting selective operations to said elements, a needle jack individual to each needle and controlled by said elements, a second pattern drum mounted for movement around said row and rotating is response to said movement, slidable elements on said second drum, means for imparting selective actuations to the elements on said second drum, an adjustable cam adapted when in operative position to actuate certain of said needle jacks in one direction, a second adjustable cam adapted when in operative position to actuate said certain jacks in a different manner, and means controlled by said second drum for rendering one of said cams operative.

17. A knitting machine comprising a circular row of needles, a plurality of yarn feeds, a pattern drum for each yarn feed mounted for movement around said row and rotating in response to said movement, slidable elements on said drum, a perforated pattern strip for imparting selective actuations, to each of a plurality of said elements, a needle jack individual to each needle, groups of said jacks having butts at different levels from other groups of said jacks, means controlled by said elements on one drum for setting said jacks in advance of the yarn feed for the said one drum, a second drum for each yarn feed mounted in advance of its yarn feed but following the said first drum for each yarn feed and mounted for movement around said row and rotating in response to said movement, slidable elements on each of said second drums, a perforated pattern strip for imparting selective actuations to the elements on said second drums, an adjustable cam adapted to actuate the butts of certain groups of said jacks, a second adjustable cam adapted to actuate the butts of other groups of said needle jacks, and means controlled by one of said second drums for bringing said first cam into operative position and controlled by another of said second drums for bringing said second cam into operative position.

18. A knitting machine comprising a needle cylinder, needles mounted on said cylinder, an adjustable needle jack mounted below each needle, groups of said jacks having butts on one level, other groups having butts at a second level, cam means for actuating said jacks to cause needles to be partially raised, other cam means for causing said needles to be fully raised, a plurality of yarn feeds, a pattern drum for each yarn feed mounted for movement around said cylinder and rotating in response to said movement, slidable elements on said drums for controlling said jacks, a perforated pattern strip for controlling said elements to cause certain of said jacks within a group to be set to bring their needles to a partially raised position, and to cause other of said jacks within said group to be set to fully advance their needles, a second drum for each yarn feed mounted for movement around said cylinder and rotating in response to said movement, slidable elements on said second drums, means for imparting selective actuations to the elements of the second drums, and means controlled by the elements of said second drums for wiping out the selective settings of said jacks by said first drums.

19. A knitting machine comprising a row of needles, pattern mechanism having predetermined configurations thereon, means responsive to said configurations and tending to impart pattern determining actuations to said needles in accordance with said configurations prior to the seizing of a yarn by said needles, said means and said row being mounted for relative movement in the operation of said machine, and a second pattern mechanism supported independently of said first mechanism and effective prior to the said seizing of said yarn for preventing said means from being effective for a group of said needles, said mechanism and said row being mounted for relative movement.

20. A knitting machine comprising a row of needles, a plurality of yarn feeds, pattern mechanism actuated by said machine and having a plurality of different configurations

in each of a plurality of rows, means tending to exercise a selective control on said needles in accordance with said configurations prior to the seizure by said needles of a yarn from one yarn feed, a second pattern mechanism supported independently of said first mechanism and actuated by said machine, and means effective after said first means but prior to said seizure of said yarn and controlled by said second mechanism for preventing certain of said needles from being controlled in accordance with said first mechanism.

21. A knitting machine comprising yarn manipulating members, pattern mechanism having predetermined configurations thereon, means responsive to said configurations for imparting pattern determining actuations to a plurality of said members in accordance with said configurations prior to the manipulation of a yarn by said members, a second pattern mechanism supported independently of said first mechanism and having predetermined configurations thereon, and means responsive to the configurations of said second mechanism and effective after said first means but effective prior to the said manipulation of said one yarn for preventing said first means from controlling one of said plurality of members.

22. A knitting machine comprising a row of yarn manipulating members, pattern mechanism having predetermined configurations and tending to impart selective actuations to said members in accordance with said configurations prior to the actuation of a yarn by said members, said drum and said row being mounted for relative movement, and a second pattern mechanism supported independently of said first mechanism and effective prior to the said actuation of said one yarn for preventing said drum from being effective for certain of said members, said mechanism and said row being mounted for relative movement.

23. A knitting machine comprising a row of yarn manipulating members, pattern mechanism having pattern determining configurations thereon for tending to impart selective actuations to said members prior to the manipulation of a yarn by said members, a second pattern mechanism supported independently of said first mechanism and operating prior to said manipulation of said one yarn and having pattern determining configurations thereon for preventing said first mechanism from being effective on certain of said members, said mechanisms and said row being mounted for relative movement.

24. In a knitting machine a row, of yarn manipulating members, a pattern record for a set of said members, pattern repeating means for tending to impart to said set and a second set of said members selective actuations in response to designations of said pattern record, a second pattern record, and a second pattern repeating means supported independently of said first repeating means for preventing said first pattern means from being effective for one of said sets.

25. A knitting machine comprising a row of yarn manipulating members, a pattern record having a series of pattern designations thereon, a set of pattern responsive means for receiving and storing settings from successive series of said designations, means effective prior to the manipulation of a yarn by said members for intermittently translating said settings into selective actuations of said members unless otherwise prevented, and pattern mechanism supported independently of said intermittent means and having predetermined pattern characteristics for automatically causing, prior to said manipulation of said yarn, certain of said members to be controlled in a different manner than would follow from their exclusive control by said intermittently operating means.

26. A knitting machine comprising a yarn feed, a row of yarn manipulating members, a pattern record having predetermined configurations thereon, a plurality of movable elements for receiving and storing selective actuations from said record, pattern means actuated by said elements for imparting selective actuations to said members prior to the manipulating of the yarn from said yarn feed, said means and said row being mounted for relative movement, a second pattern record supported independently of said first record and having predetermined configurations thereon, a second plurality of movable elements for receiving and storing selective actuations from said second record, and a second pattern means responsive to said second elements for controlling said members prior to said manipulation, said row and said second pattern means being mounted for relative movement.

27. A knitting machine comprising a plurality of yarn feeds, a row of yarn manipulating members, a pattern record having predetermined configurations thereon, a plurality of movable elements for receiving and storing selective actuations from said record, controlling elements individual to said members for controlling the manipulation of the yarn by said members, pattern means actuated by said movable elements for selectively actuating said controlling elements prior to the manipulation of a yarn by said members, a second pattern record, a second plurality of movable elements independent of said first movable elements for receiving and storing selective actuations from said second record, and a second pattern means controlled by said second movable elements for altering the selective actuations of said controlling elements produced by said first pattern

means, said controlling elements being controlled successively by both of said pattern means prior to said manipulation of a yarn, said row and said two pattern means being mounted for relative movement.

28. A knitting machine comprising a circular row of yarn manipulating members divided into n groups, where n is any integer, a pattern drum mounted for movement around said row and rotating on its own axis in response to said movement for controlling said members, said drum rotating n times around its own axis for one complete movement around said row, and a second pattern drum mounted for movement around said row and rotating on its own axis in response to said movement for controlling said members, said second drum rotating (n plus 1) times around its own axis for one complete movement around said row.

29. A knitting machine comprising a circular row of needles, a control member individual to each needle, said control members being arranged in groups of one type separated by groups of a second type, a plurality of yarn feeds, a pattern record, pattern means responsive to said record for individually actuating said members, said means and said row being mounted for relative movement, cam means adapted to wipe out the actuations of said members by said pattern means for a group of said members of one type, said cam means and said row being mounted for relative movement, and pattern mechanism responsive to the operation of said machine for placing said cam means in an operative position while said cam means is opposite a group of said members of the second type.

30. A knitting machine comprising a circular row of needles, a control member individual to each needle, said control members being arranged in groups of one type separated by groups of a second type, a plurality of yarn feeds, a pattern record, pattern means responsive to said record for individually actuating said members, said means and said row being mounted for relative movement, a cam means adapted to wipe out the actuations of said members by said pattern means for a group of said members of the first type, a second cam means adapted to wipe out the actuations of said members by said pattern means for a group of said members of the second type, said cam means and said row being mounted for relative movement, and pattern mechanism responsive to the operation of said machine for actuating said first cam means when said first cam means is opposite a group of said members of the second type and for actuating said second cam means when said second cam means is opposite a group of members of the first type.

31. A knitting machine of the cylindrical type comprising a row of vertical needles, a cam contacting with said needles for raising said needles to a partially elevated position but insufficient in height to form loops, a slidable element individual to each needle adapted to be interposed in one position between said cam and its needle whereby the passage of said cam raises such a needle to full knitting position, each of said elements in a second position being out of contact with said cam and its needle and pattern means for controlling the movement of said elements from said second position to said first position.

32. A knitting machine comprising a needle cylinder, a circular row of needles mounted on said cylinder, cam means traveling around said cylinder for raising said needles to a certain level, a movable element for each of a plurality of said needles, each element in one position being adapted to be interposed between said cam means and the needle associated with the said one element whereby the passage of said cam means raises such a needle to a level higher than said certain level, each of said elements in a second position being free from actuation by said cam means, and pattern means for selectively setting said elements in said positions prior to a passage of said cam means.

33. A knitting machine comprising a row of needles, yarn feeds therefor, a cam for partially advancing said needles to a point insufficient to form loops of said yarn, a movable element individual to each needle adapted to be interposed in one position between said cam and its needle whereby the passage of said cam advances such a needle to full knitting position, each of said elements in a second position being free from actuation by said cam, and pattern means for controlling the movement of said elements from said second position to said first position.

In witness whereof I hereunto subscribe my name this 30th day of June, 1930.

VINCENT LOMBARDI.