Dec. 3, 1929. V. LOMBARDI 1,737,597

KNITTING MACHINE

Filed Sept. 15, 1926 6 Sheets-Sheet 1

Fig. 1.

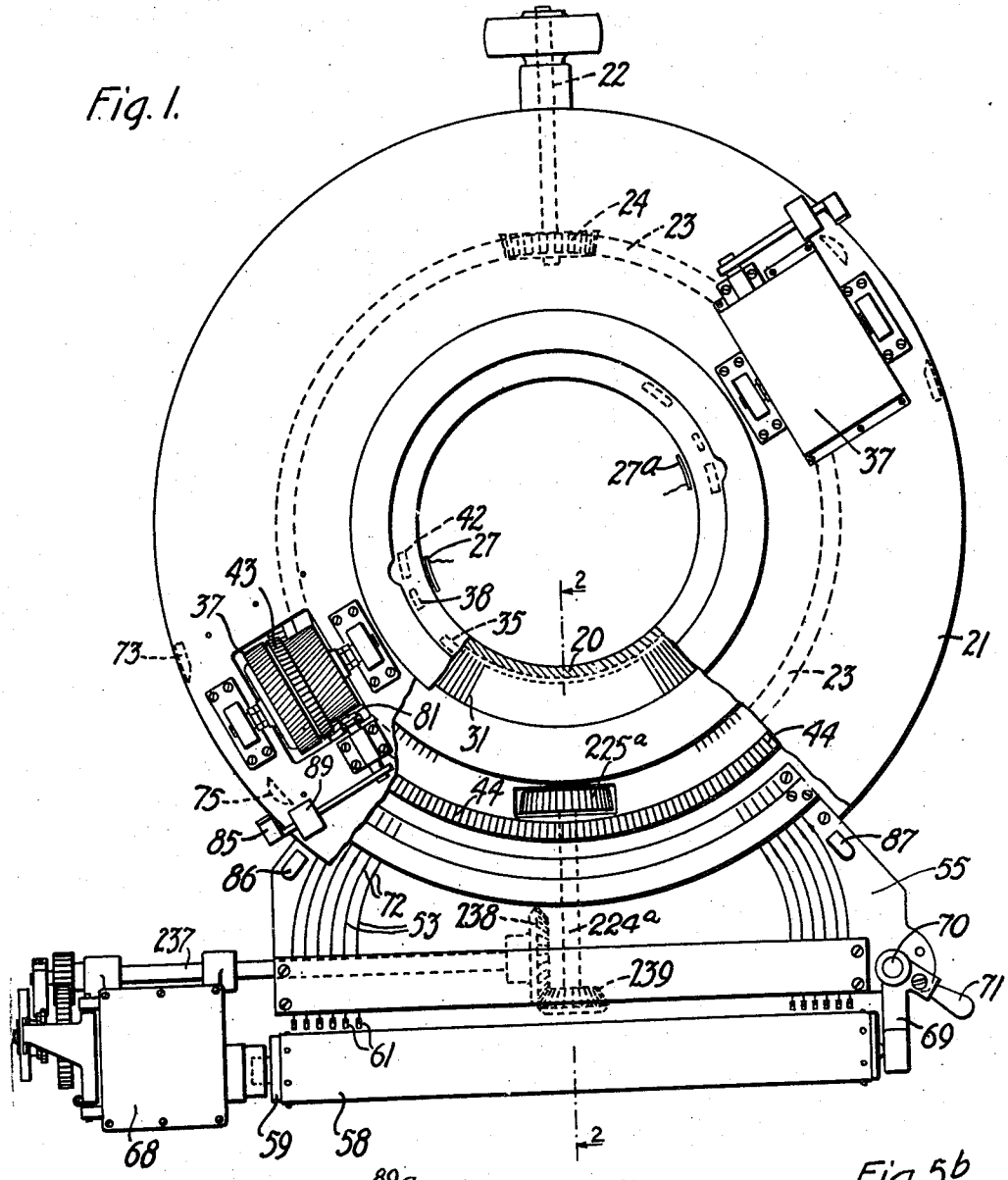


Fig. 5c.

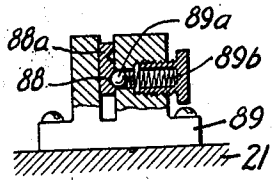
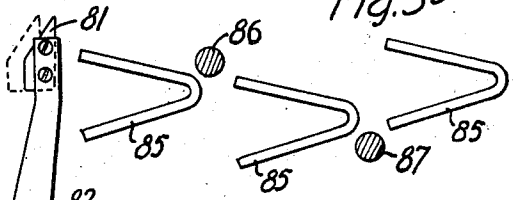


Fig. 5b



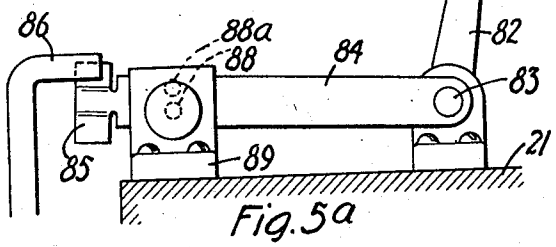


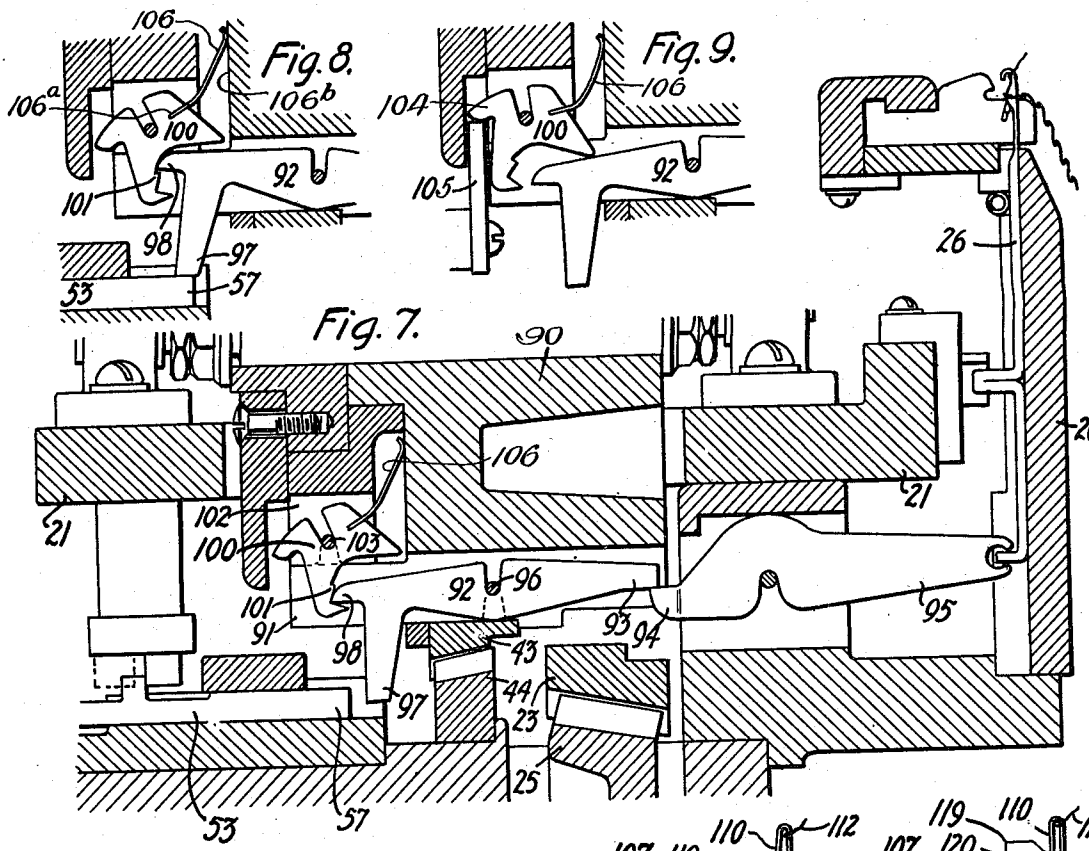
Fig. 5a

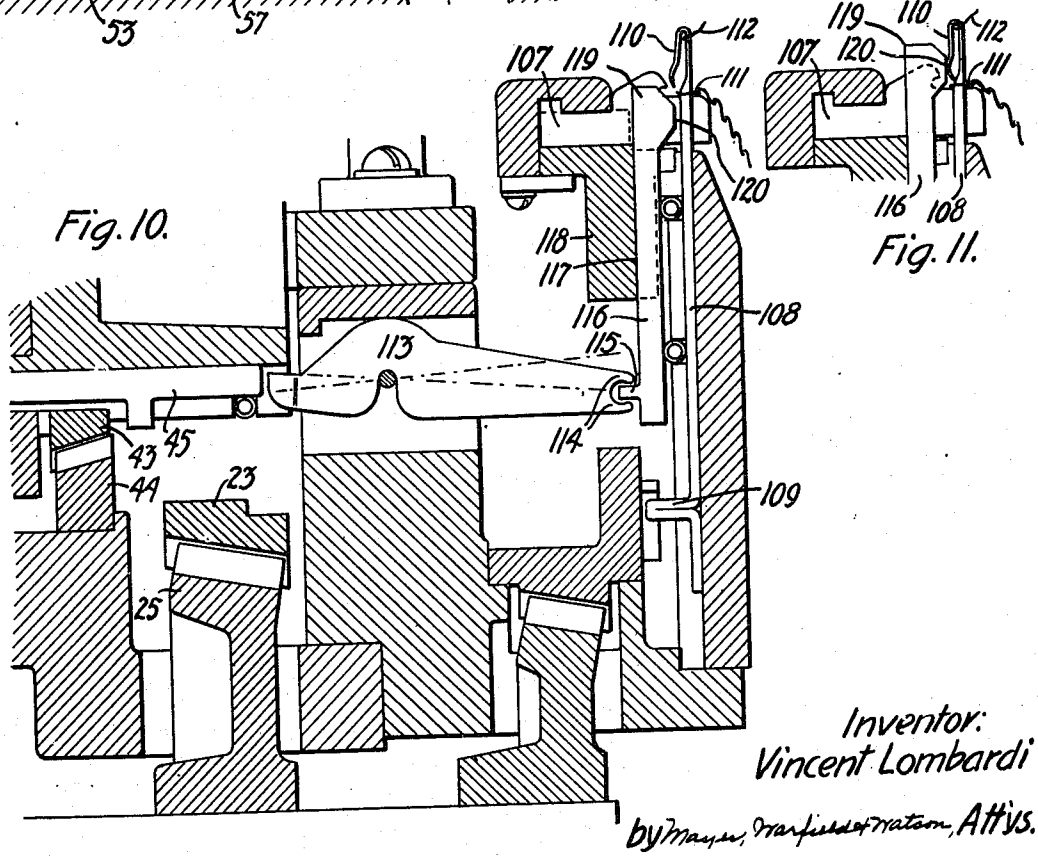
Inventor:
Vincent Lombardi
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Dec. 3, 1929. V. LOMBARDI 1,737,597

KNITTING MACHINE

Filed Sept. 15, 1926 6 Sheets-Sheet 2





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KNITTING MACHINE

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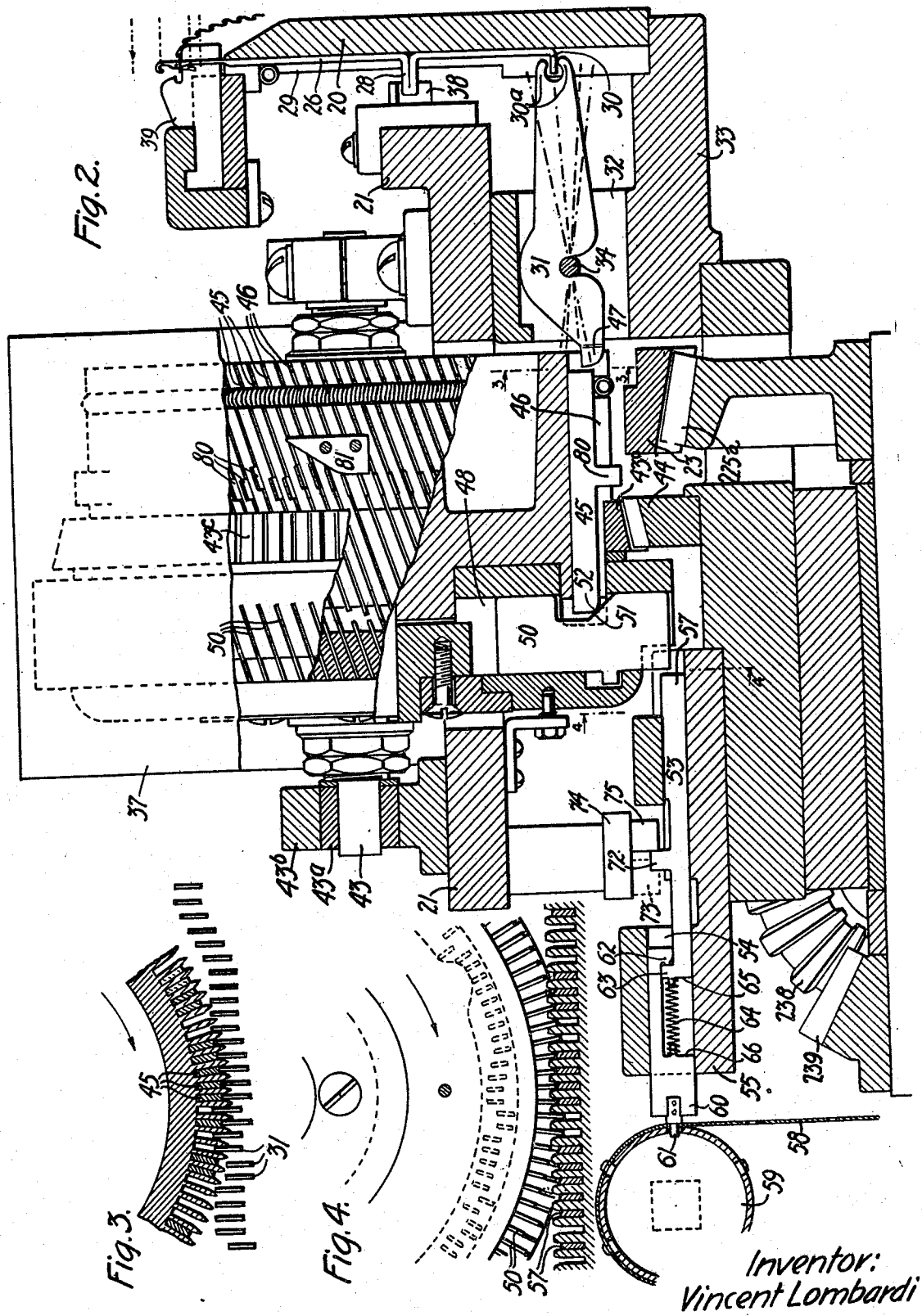


Fig. 2.

Fig. 3.

Fig. 4.

Inventor:
Vincent Lombardi

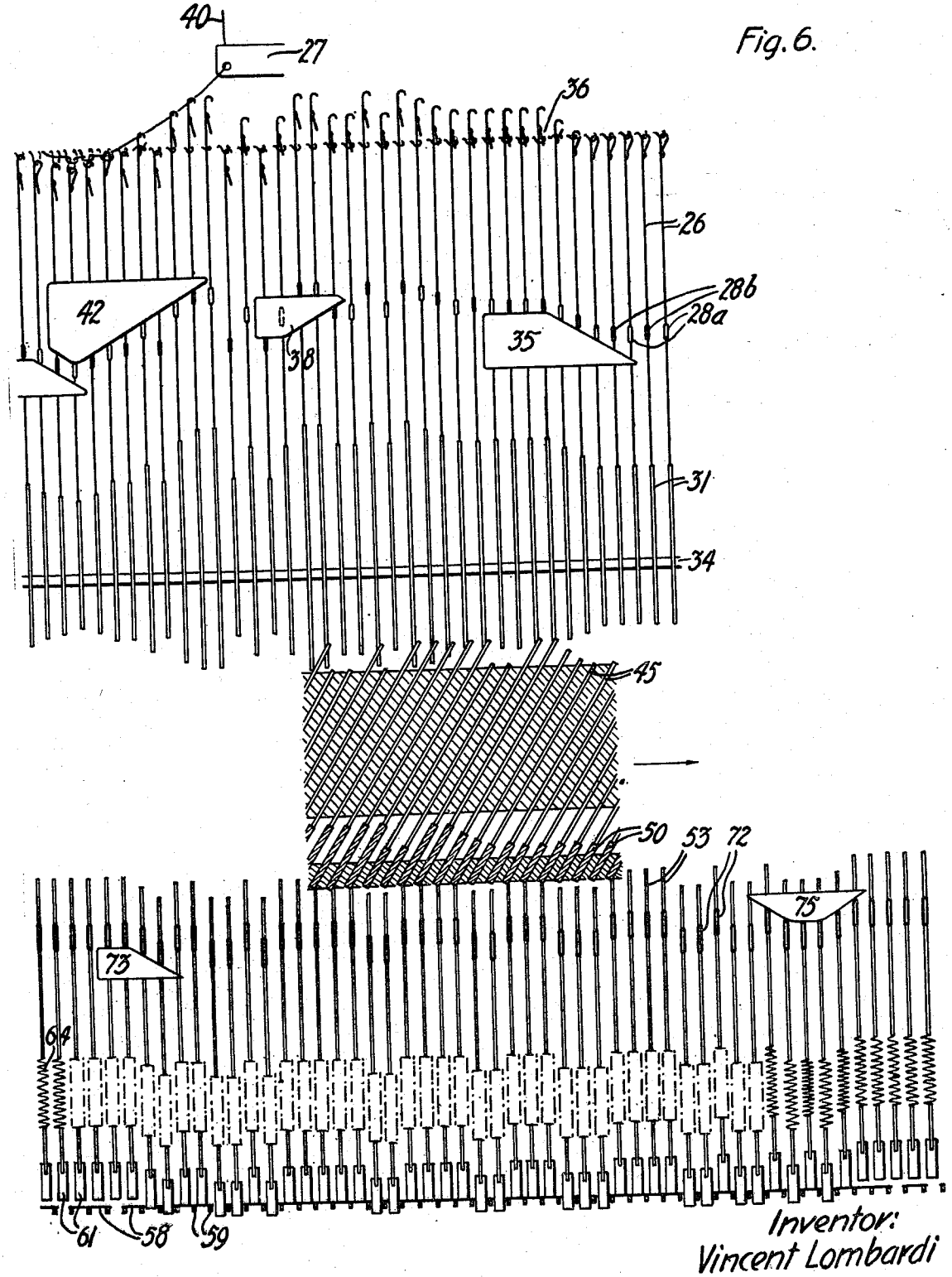
by Mayer, Maxfield & Pratson Att'ys.

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KNITTING MACHINE

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Fig. 6.



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KNITTING MACHINE

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Fig. 12.

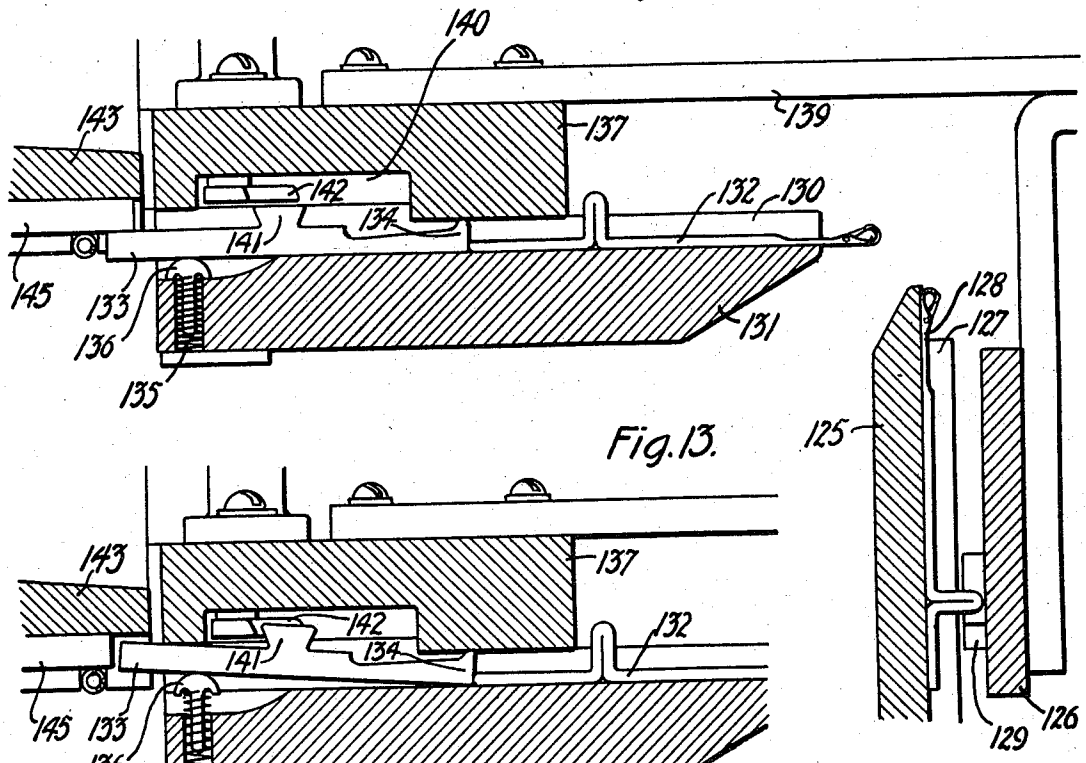


Fig. 13.

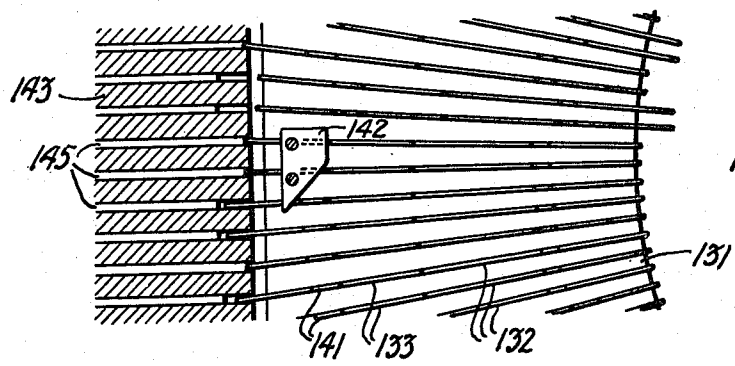


Fig. 14.

Inventor:
Vincent Lombardi

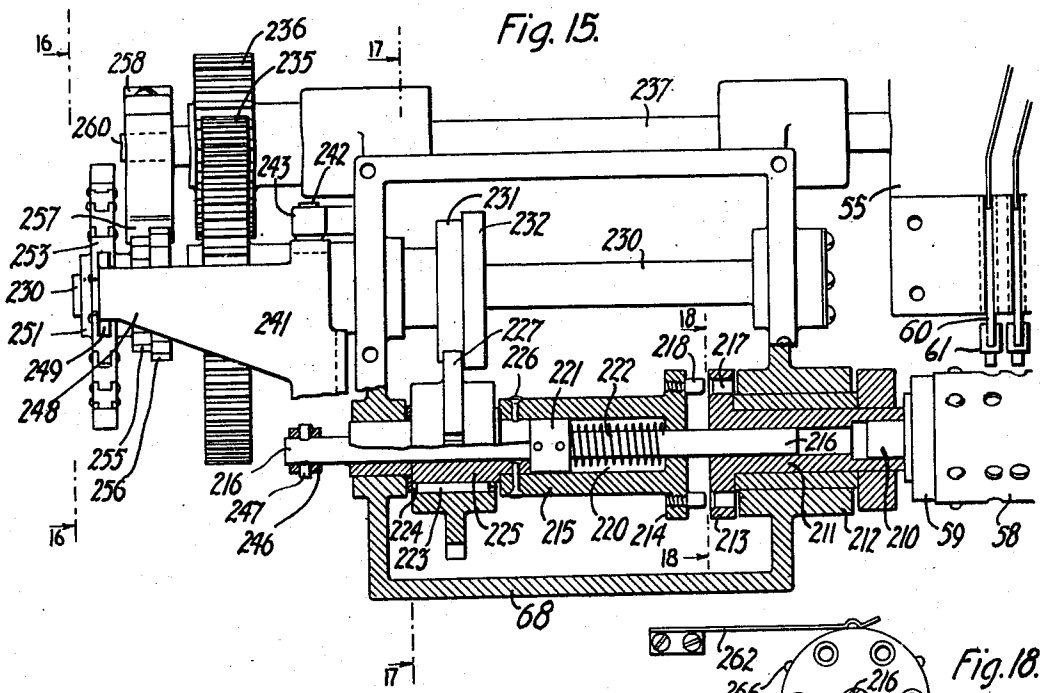
by Mayer, Mayfield & Gratson, Att'ys.

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KNITTING MACHINE

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Fig. 15.



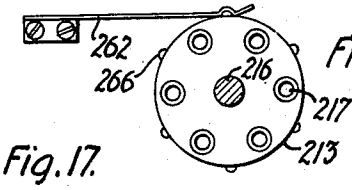


Fig. 18.

Fig. 16

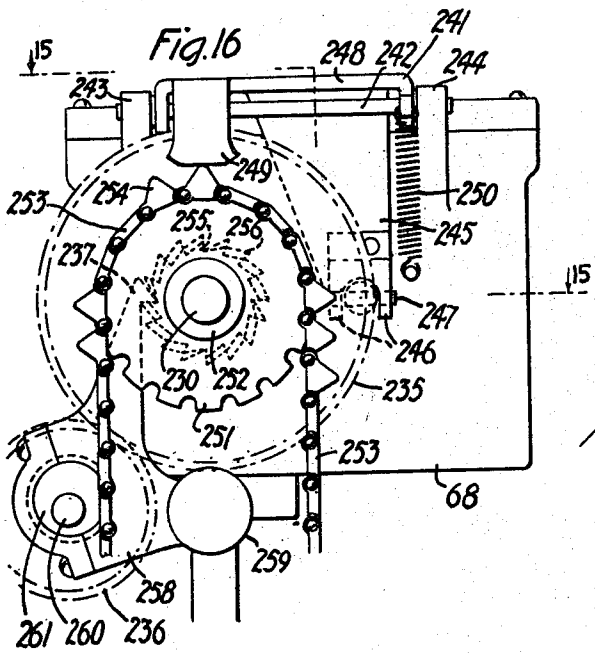
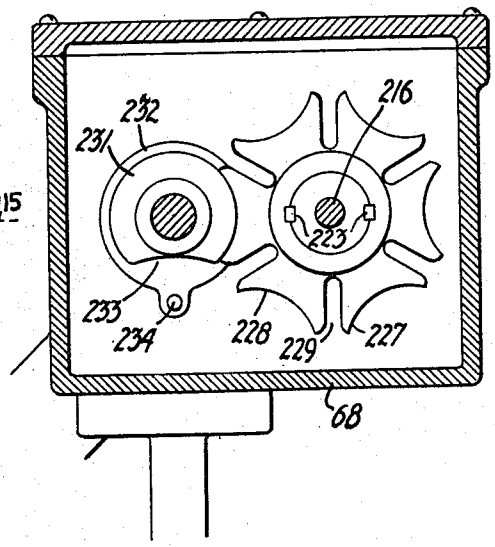


Fig. 17.



Inventor:
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Patented Dec. 3, 1929

1,737,597

UNITED STATES PATENT OFFICE

VINCENT LOMBARDI, OF BROOKLYN, NEW YORK

KNITTING MACHINE

Application filed September 15, 1926. Serial No. 135,533.

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 set periodically 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.

The invention accordingly comprises the features of construction combinations 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 drawing, in which:

Figure 1 is a top view of a machine embodying the invention.

Figure 2 is an enlarged sectional view taken in the direction of the arrows along the line 2—2 in Figure 1.

Figure 3 is a sectional view taken in the direction of the arrows along the line 3—3 in Fig. 2;

Fig. 4 is a sectional view taken in the direction of the arrows along the line 4—4 of Fig. 2;

Fig. 5^a is an enlarged detail view partly in section taken through the member 89 in Fig. 1;

Fig. 5^b is a somewhat diagrammatic view illustrating the actuations of the mechanism shown in Fig. 5^a;

Fig. 5^c is a detail view of the means for preventing displacement of the mechanism shown in Fig. 5^a;

Fig. 6 is a diagrammatic view of a series of needles and pattern-control mechanism illustrating a type of needle operation;

Fig. 7 is a sectional view illustrating an alternate form of pattern-control mechanism;

Fig. 8 is a detail view of a portion of the mechanism shown in Fig. 7, illustrating the same in a different position;

Fig. 9 is a detail view of the mechanism shown in Fig. 8, illustrating the same in still another position;

Fig. 10 is a sectional view illustrating another type of yarn-manipulating members and a further type of pattern-control mechanism;

Fig. 11 is a detail view of a portion of the mechanism shown in Fig. 10, illustrating the same in a different position;

Fig. 12 is a sectional view illustrating still another type of yarn-manipulating members and pattern-control mechanism;

Fig. 13 is a detail view of a portion of the mechanism shown in Fig. 12, illustrating the same in a different position;

Fig. 14 is a somewhat diagrammatic top view of the mechanism shown in Fig. 12;

Fig. 15 is a partly sectional view exemplifying a type of actuating mechanism for a pattern-control member;

Fig. 16 is an end view taken in the direction of the arrows along the line 16—16 in Fig. 15;

Fig. 17 is a sectional view taken in the direction of the arrows along the line 17—17 in Fig. 15; and

Fig. 18 is a sectional view taken in the direction of the arrows along the lines 18—18 in Fig. 15.

The invention is exemplified in connection with a circular knitting machine of the vertical type, comprising a pair of cylindrical members arranged for relative rotation. In the present instance, there is provided a stationary needle cylinder 20 and a rotatable cylinder 21 extending about the same and operatively connected to a driving shaft 22 through the medium of a tooth rack 23 on the cylinder 21 and a crown 24 on the shaft

22. As exemplified, the cylinder 20 supports a row of vertical latched needles 26 adapted to be advanced and retracted to receive yarn from a pair of yarn feeds 27 and 27ª, carried by the cylinder 21 and to incorporate the same into a fabric either by knitting continuous rows of loops thereof to form Jersey cloth, or by interlocking, tucking, or otherwise varying the knitting. The needles exemplified are formed intermediate the ends thereof with outwardly extending butts 28, certain of the needles in the present instance having short butts 28ª and others having long butts 28ᵇ. The needles 28 are mounted for vertical movement, in the usual manner, in grooves 29 in the cylinder 20 and, in the present instance, are formed adjacent the face thereof with outwardly extending lugs 30. About the lug 30 on each needle there extend the two arms 30ª of the bifurcated end of a needle-supporting and shifting lever 31. This lever is mounted in a slot 32 in an annulus 33 in the cylinder 20 and is pivotally supported upon a rod 34 extending across the slot. The usual sinkers, such as those shown at 39 are provided between the needles.

On the cylinder 21 are carried certain cams operative upon the needle butts 28 for imparting certain actuations to the needles, and in the present exemplification, these cams are shown for the sake of convenience as arranged to cause a needle movement of the general type exemplified in my Patent No. 1,541,230, whereby there may be provided a multi-color fabric, such as exemplified in my said patent as well as in my Patents Nos. 1,426,576 and 1,541,230 and in my application Serial No. 37,076, filed June 15, 1925, wherein one yarn is formed into a series of interknitted loops in one section of the fabric, and a second yarn is formed into a series of interknitted loops in another section of the fabric, the yarn not entering into the fabric in any section being interlocked with the interknitted loops by being caught between the loops in certain, preferably alternate, wales, and being extended behind the interknitted loops in adjacent wales. To this end, as will be seen by reference to Figs. 1 and 6, there is provided on the cylinder 21 in advance of each yarn feed in the direction of movement of the cylinder a cam 35 arranged to cooperate with the needle butts to move all the needles to a partially advanced yarn-receiving position wherein a previously received yarn, such as the yarn 36 shown in Fig. 6 is still retained by the needle latches. Following the cam 35 but positioned outwardly from the same is a pattern-control drum 37 (hereinafter to be described) forming a part of the pattern control mechanism arranged in the present instance to cause a further advance of certain needles through the medium of the lever 31 so as to cast off previously received yarn from the latches. A thin cam 38 adapted to retract from yarn receiving position those long butt needles not actuated by the pattern-control mechanism follows the drum 37. Thus, in the present instance, needles actuated in response to the operation of the pattern-control mechanism are in an advanced position to receive the yarn (such as shown at 40) from the yarn feed for interknitting the same with the yarn 36; the remaining short butt needles are in an intermediate position to receive the yarn 40 for interlocking with the knitted yarn 36 retained thereby, and the remaining long butt needles are in a retracted position wherein they will not receive the yarn 40. Following each of the yarn feeds 27 and 27ª on the cylinder 21 is a cam 42 arranged to retract all the advanced needles so that they may perform the desired knitting or interlocking operations.

In the exemplified apparaus each of the drums 37 is provided with an axial shaft 43 which is rotatably mounted in bearings 43ª supported in brackets 43ᵇ on the cylinder 21, and is arranged for independent rotation in response to the relative rotation of the cylinders by means of a peripheral gear 43ᶜ meshing with a stationary circumferential toothed rack 44 extending about the cylinder 20 beneath the drum. With a view to providing for the actuation of the needle shifting levers 31, each drum 37 carries about its periphery a plurality of adjustable elements or plungers 45 arranged for sliding movement in a plurality of oblique slots 46, the ends of which are adapted to receive the bent outer ends 47 of the levers 31 so that when a plunger 45 is in inward position (with respect to the cylinder 20) at the time of the passage of the drum over a particular shifting lever, the plunger will press upon the end 47 of the lever to advance the needle associated therewith. Each drum 37 also carries slidably mounted in a plurality of oblique radial slots 48 a plurality of radially slidable members 50. On the inner side of each member 50 there is formed a sloping bearing surface 51 adapted to cooperate with the bearing surface 52 on the outer end of the plunger 45 so that upon a movement of the member 50 toward the axis of the drum the plunger 45 associated therewith will be thrust inwardly (toward the needle cylinder 20). For the purpose of actuating the radial members 50 of each drum at least once during each revolution of the cylinder 21, there are provided a number of plungers 53 each supported in a horizontal slot 54 in a stationary table 55, and each arranged for sliding movement to a position wherein a radial member 50 on the drum will be pressed upon the top of the inner end 57 of the plunger as the drum moves past the same. It will be observed that in the present instance the adjustable elements or plung-

ers 45 are in such an oblique position that the inner ends thereof are behind the outer ends thereof in the direction of rotation of the drum, so that whenever a plunger 45 is actuated by a member 50, the actuation will have occurred before the plunger reaches the proper position for imparting actuation to the member, such as a needle lever 31, to which the actuation is to be imparted.

With a view to controlling the operation of the plungers 53, there is provided a pattern-determining element, which is exemplified by an endless perforated tape 58 mounted on a cylinder 59, and cooperating mechanism exemplified by a row of slidable plungers 60 extending into the slots 54 and formed at their outer ends with fingers 61 arranged for insertion in perforations of the tape 58 when such perforations are aligned therewith. On the inner end of the plunger 60 is a lug 62 extending downwardly along the inner side of an upwardly extending lug 63 on the plunger 53, these lugs being normally held adjacent one another by a spring 64 arranged to press against opposed shoulders 65 and 66 of the plungers 53 and 60, respectively.

The particular pattern band 58 exemplified is perforated to form a series of longitudinal rows of pattern control configurations and is arranged for step by step movement upon the cylinder 59, in a manner hereinafter to be described, whereby said rows may be aligned with the row of fingers 61 as desired. The cylinder 59 is mounted at one end in gear box 68 and at the other on an arm 69 supported on the table 55. For the purpose of permitting the replacement of a tape 58 by a tape having different pattern controlling configurations, the arm 69 is removably secured upon the cylinder 59 and is rotatably mounted at 70 to the stationary table 55. A handle 71 is provided thereon to facilitate the operation thereof.

In order to permit the step by step movement of the tape 58, there is provided means for withdrawing the fingers 61 inwardly from the tape. In the present instance, this means comprises upwardly extending lugs 72 on the plungers 53 and cooperating cams 73 carried by a carrier 74 attached to the cylinder 21 and so positioned as to follow each drum in the direction of movement of the cylinder. This cam is arranged to bear on the outer edge of the lugs 72 to cause inward movement of the plungers 53 and the finger-carrying plungers 60.

For the purpose of causing the proper positioning of the plungers 53 with respect to a particular pattern controlling configuration on the perforated tape, there is provided in the exemplified apparatus a cam 75 carried by the annulus 74 in a position in advance of the drum in the direction of movement of the cylinder and adapted to bear against the inner edge of the lugs 72 to thrust the plungers 53 outwardly. As the plungers 53 are thrust outwardly, the spring 64 is compressed so as to exert pressure upon the finger-carrying plungers 60. Accordingly, when a perforation in the tape 58 is aligned with a finger 61 on a plunger 60, the finger will enter the perforation and the plunger 60 will be carried outwardly, permitting the plunger 53 to remain in an outward position; but, when there is no perforation in the portion of the tape aligned with a particular finger 61, the spring 64 is retained in a compressed position so that, when the bearing surface of the cam 75 recedes, the compression of the spring will press the plunger 53 inwardly to a position wherein it will be operative to cause actuation of the sliding members 50 and a resultant inward movement of the plungers 45 on the drum.

As will be apparent from the foregoing exemplification, a wide variety of fabrics may be produced in accordance with the invention, by the employment of pattern bands having various types of configurations. Among the various types of cloth which may be produced upon a machine embodying the present invention are fabrics embodying an "interlock" stitch such as disclosed in my prior Patents Nos. 1,426,572 and 1,541,230. For example, in the production of such a fabric upon a machine having two yarn feeds and equipped at each feed with cams and drums such as the members 35, 37, 38 and 40, the pattern band may be formed so that the perforations on each pattern row appear only adjacent those fingers 61 with which a perforation in the preceding pattern row was not aligned. For example, assuming that the machine has finished an operation wherein one or more pattern rows without perforations have been used to produce a Jersey stitch, wherein each of the needles have knitted so that the position of the last yarn received is represented by the yarn 36 in Fig. 6, the next pattern row on the pattern band will be formed with perforations at the points indicated in Fig. 6, so that certain pluralities of adjacent needles and certain individual needles will not be actuated prior to the passage of the yarn feed 27, and the cam 38 will be operative on such of these needles as have long butts. The next pattern row, which is operative to set the fingers 61 for the adjustment of the adjustable elements on the drum preceding the yarn feed 27^a, will be perforated at those points where there were no perforations in the preceding pattern row and will have no perforations at those points where the preceding pattern row was perforated, so that all of the needles which were advanced for knitting the yarn from the yarn feed 27 will not be actuated, and will have been separated by the cam 38 preceding the yarn feed 27^a, so as to be in interlocking position at the time

of the passage of the yarn feed; and so that those needles which were in interlocking position at the time of the passage of the yarn feed 27, and which consequently did not knit the yarn 40, will have been actuated so as to be in knitting position at the time of the passage of the yarn feed 27ª. If further information with respect to knitting operations of this general type is desired, reference may be had to my said Patent No. 1,541,230. It is to be understood, of course, that the invention is in no wise limited to the use in connection with the production of an "interlock" fabric or of any other particular type of fabric, but may be used in the production of any wide variety of types of fabric. If the machine is to be used to produce a fabric wherein the pattern effects vary from row to row, in the knitting, the perforations or other pattern control configurations may appear at any such points on the pattern control member as will cause the proper needle actuations for that purpose. As will be apparent, the invention makes possible the variation of patterns from row to row and from wale to wale of a fabric according to any predetermined design and accomplishes this result in a ready and facile manner.

Moreover, the invention may be employed to form as exceedingly finely knit fabric containing varied pattern effects, since mechanism such as exemplified is readily adapted for use in the actuation of needles spaced as closely as twenty-seven or more to the inch.

In practice, it is ordinarily desirable to perform the knitting operations with a row of needles extending entirely around the needle cylinder, and it will be evident from the above that once the plungers 45 on the drum are adjusted, pattern control actuations will not only be imparted to certain needles of the group corresponding to the plungers 53, but also to similarly placed needles in succeeding groups about the cylinder 20. In order, however, to realign the plungers 45 on each drum after a revolution of the drum about the cylinder 20, each of these plungers is formed, in the present instance, with a radial butt 80, and associated with each drum there is provided an aligning cam 81 mounted for revolution but not for rotation with the drum, and movable into position for aligning the butts 80 prior to the passage of the drum over the plungers 53. As exemplified, each cam 81 is carried on the end of a lever 82 standing upwardly from a shaft 83 rotatably mounted on the cylinder 21 in a position in advance of the drum in the direction of movement of the cylinder. Attached to the shaft 83 and extending outwardly therefrom is an actuating lever 84 having on the outer end thereof a member 85 formed with upper and lower cam surfaces. In order to cause the cams 81 to be moved into punger-aligning position at the desired time in the operation of the machine, there is provided a pin 86 mounted on the stationary table 55 adjacent the first plunger 53 in the direction of movement of the cylinder 21 in such position that, when the cam 81 is in inoperative position, the pin will be in the path of the upper cam surface of the member 85, to cause an outward movement of the cam 81 to plunger aligning position.

With a view to permitting the plungers 45 to remain throughout the remainder of the revolution of the drum, in the position in which they have been set by the tape controlled plungers so as to cause succeeding groups of the needles throughout the cylinder to be actuated in the same manner as the group of needles actuated directly in response to the position of the plungers 53, there is provided on the stationary table 55 adjacent the last plunger 53 in the direction of the cylinder 21 a releasing pin 87 adapted to cooperate, when the cam 81 is in operative position with the lower cam surface of the member 85 to cause downward movement of the lever 84 and an inward movement of the cam 81.

In order to prevent the displacement of the lever 84 from the position in which it has been set by the pins 86 and 87, the lever is provided with lower and upper notches 88 and 88ª and there is mounted on a bracket 89 extending upwardly adjacent the lever 84 from the cylinder 21, a ball 89ª arranged to be thrust into an aligned notch by a spring 89ᵇ.

While the mechanism above exemplified is well adapted for use in accordance with the invention, it will be appreciated that various other types of movement-imparting members may be employed without departing from the spirit and scope of the invention. For example, instead of members such as plungers 45 other types of adjustable elements may be employed in the pattern drums. An example of mechanism employing one such alternate type of adjustable elements is shown in Fig. 7. A drum 90, which, as exemplified, is similarly mounted and is generally similar in form to the drum 37, is formed with a plurality of axial slots 91 in which there are mounted a plurality of levers 92. The inner ends 93 of these levers are adapted to press against the outer ends 94 of needle shifters 95, which may be similar in all respects to the needle shifters 31 except that the outer end thereof is not bent, since the slots on the drum are not oblique. Each adjustable lever 92 is pivoted on a rod 96 extending across the lever slot 91 and is provided with a radial extension 97 so formed that when the inner end 93 of the adjustable lever is in a position above the normal position of the shifting lever 95, the extension 97 will project downwardly a sufficient distance so that it will contact with a lever 53, such as described

above, when the latter is in an inward position so that the extension 97 will be forced upwardly to cause a pivotal movement of the adjustable lever 92 and an operative shifting of the shifter, 95.

For the purpose of maintaining the adjustable lever 92 in position for exerting downward pressure on the inner end of a successive shifter 95 to impart an actuation to needles in a successive group, each lever 92 is provided with an outwardly extending projection 98 operatively associated with which is a locking member 100 having formed thereon a dog 101. Each locking member is pivotally mounted in a slot 102 on the drum and is pivoted on a rod 103 extending across the same in such manner that when the downward extension 97 of the lever 92 is forced upwardly by being brought into contact with a plunger 53, the projection 98 will catch on the dog 101 and be maintained in such position. In order to release the projection 98 from the dog 101 after the drum has completed each cycle of revolution, there may be provided suitable tripping means, such as outwardly extending projections 104 on the pivoted locking members and a cooperating tripping cam 105 whose operations may be controlled by mechanism similar to that employed for operating the cam 81.

The locking member 100 is normally retained in operative position by means of a spring 106 fastened to the locking member at 106^a and bearing against a surface 106^b provided by a portion of the frame of the drum.

As will be apparent, the pattern-controlling actuations imparted to the needles may be such as to cause a vertical movement of vertical latched type needles, such as those described above, or to cause any other type of needle actuation.

There is shown in Fig. 10, for example, a type of mechanism adapted to impart pattern-controlling actuations to the beards of spring beard needles. This mechanism is exemplified in connection with a machine containing the usual cams for advancing and retracting needles, a series of sinkers 107 and pattern controlling mechanism of the same general type as that exemplified in Figs. 1 to 6 inclusive. The needles, as exemplified at 108 are provided in the usual manner with butts such as shown at 109 intermediate their ends but, instead of being latched, they are of the spring beard type with the hook thereof extended to form a spring beard 110, the point of which is adapted to be closed to permit yarn already received, (such as shown at 111) to be passed over the same upon the retraction of the needles. When the beard is not pressed closed on the other hand, the yarn previously received will ride upon the shank of the needle and will enter the beard along with the yarn (such as the yarn 112) received from a yarn feed.

Accordingly, there is provided in the present instance a shifting lever, 113, substantially similar to the shifting lever 31. Extending between the bifurcated ends 114 of this lever is a lug 115 extending outwardly from a beard pressing plunger 116 slidably mounted in a slot 117 aligned with the needle slot and formed in an annulus 118 attached to the needle cylinder. On the upper end of the plunger 116 is a cam member 119 arranged to press against the beard 110 of the needle when the presser is raised and the needle is lowered from yarn-receiving position, but not to press against the same when the presser is not raised.

Accordingly, when a particular adjustable element (such for example as plunger 45) on the drum is in an inward position, the lever 113 will be actuated and the presser 116 raised to operative position wherein it will press beard 110 inwardly to cause the needle to cast the previously received yarn, whereas if the plunger 45 is in an outward position, the lever 113 will not be actuated to raise the presser and the latter will remain in a position wherein it will not be adjacent the bulge 150 on the beard, and the group of the previously received yarn will slip into the hook of the needle.

Various modifications of the above mechanism are of course permissible. For example, it will be apparent that mechanism of the general type described may be used in the actuation of pressers mounted in any of a variety of ways, as by being pivotally mounted. (See the patent to Howie, No. 1,407,684.)

It will moreover be apparent that mechanism embodying the invention may be employed to actuate yarn-manipulating mechanism other than needles or needle beards. For example, such mechanism may be used in the actuation of the sinkers so as to control the tightness of the knit by a movement of the sinkers such as disclosed in my copending application, Serial No. 37,076, filed June 15, 1925. It will be obvious that the use of mechanism, such as above described, would permit the actuation of the sinkers so as to vary the tightness of the knit from row to row and from wale to wale.

The invention, moreover, is in no wise limited to the use of a series of vertical needles, but is well adapted for employment with various types of needle arrangements. An exemplification of one such other arrangement is shown in Figs. 12 to 14, wherein the pattern control mechanism, such for example as that shown in Figs. 1 to 9 inclusive, may be employed to impart pattern determining actuations to a series of dial needles on a circular machine of the composite type. The machine may be of any usual form, but in

order to provide sufficient room for the arrangement of the mechanism for actuating the dial needles, it is ordinarily desirable to position the latter with their hooked ends pointing inwardly.

The exemplified machine includes a pair of supporting members 125 and 126 fragmentary sections of which are shown in Fig. 12 arranged for relative rotative movement, the member 125 serving as a needle carrier, and the member 126 serving to support the needle actuating mechanism. Preferably the needle carrying member 125 is stationarily mounted and the member 126 rotatably mounted. In the present instance there are formed on an inner cylindrical surface provided on the member 125, a plurality of slots 127, in which a circular row of vertical needles 128 are mounted for longitudinal movement in response to needle actuating mechanism of any suitable type carried by the member 126. This mechanism comprises a complete set of needle actuating cams or other members, only the cam 129 being illustrated. An annulus 131 which in the present instance is also stationarily mounted, is formed with a plurality of radial grooves 130 in the inner end of which a series of dial needles 132 are mounted for inward and outward horizontal movement to perform knitting operations in conjunction with the vertical needles 128 in such manner as will be readily apparent to those skilled in the art. In the outer end of the slots 130 are a plurality of plungers 133, each arranged for sliding movement to impart actuations to one of the needles 132. Each of plungers 133, as exemplified, is also arranged for pivotal movement upon a nub 134 extending upwardly from the inner end therof, and is normally held in a raised position by a spring 135 which is mounted in annulus 131 and arranged to thrust a knob 136 against the lower surface of the plunger. Positioned directly above the plungers 133 is an annulus 137 arranged to rotate in unison with the rotatable member 126 and attached to the main body thereof by means of a series of brackets 139. In the lower surface of the annulus 137 is an annular groove 140, into which a plurality of butts 141 formed on the plungers 133 are adapted to extend when the plungers are in a raised position. Mounted on the annulus 137 and extending therefrom into the groove 140 is a cam member 142, arranged to bear upon the butts 141 when the plungers 133 are raised, so as to thrust the plungers inwardly and to cause an inward movement of the needles 132. The cam 142 is so positioned, however, that when the plungers 133 rest upon the bottom of the slot 130, the cams will pass over the butts 141 without actuating the plungers. Accordingly, there may be provided suitable pattern-control mechanism operative upon the upper ends of the plungers 133 for selectively pressing the plungers downwardly toward the bottom of the groove 130, and to this end there is employed, in the present instance, a drum 143, similar to the drum 37 shown in Fig. 2, and carrying independently adjustable elements 145 which may be similar to the plungers 45 on the drum 37, and which are arranged for selective adjustment to positions wherein they will bear upon the outer end of the plungers 133 upon the rotation of the drum. The drum 143 may be mounted on the rotatable annulus 137 for independent rotation in response to the movement thereof, and may have associated therewith a suitable pattern-determining element and suitable pattern-control mechanism supported on a stationary table and arranged in a manner similar respectively to the pattern band 58 and the pattern-control mechanism shown in Figs. 1 to 9 inclusive. The needles 132, as exemplified, are formed with upwardly-extending butts in the usual manner, and there may be provided suitable cooperating mechanism carried by the annulus 137 and including a restoring cam, of any well known type, for restoring the needles 132 and the plungers 133 to their original positions.

In certain instances, it is desirable that each group of needles repeat a certain type of knitting operation for incorporating a particular pattern into the fabric throughout a number of rows before a variation in the pattern occurs. This result may be obtained, of course by repeating on successive rows of the pattern-determining element the pattern-control configurations on previous rows thereof, but such an arrangement limits the variety of configurations that can be formed on a pattern band of a given length. To avoid this difficulty, there may be provided means whereby the perforated tape or other pattern-determining means may be shifted one step at each cycle of the operation of the machine or may be retained in position throughout several cycles, in accordance with the operation of setting mechanism connected therewith.

One form of such means is exemplified in Figs. 15, 16, 17 and 18.

In the present exemplification, the tape-carrying cylinder 59 has a square end 210 projecting into a close fitting cavity of a sleeve 211 which is rotatably secured within a collar 212 forming a portion of the gear box 68. The further end of the sleeve (with reference to the tape cylinder 59), provides a driven clutch member 213 adapted to cooperate with the driving clutch member 214 on a sleeve 215 slidably and rotatably mounted on a shaft 216 extending into the sleeve 211. In the present exemplification, the clutch member 213 is formed with a plurality of indentations 217, and the clutch member 214 is formed with a plurality of projections 218 arranged to fit into said indentations. The sleeve 215, as exemplified,

is formed with an enlarged central recess 220, in the further end of which is a collar 221 fixedly mounted on the shaft 216. The end of the sleeve 215 near the tape cylinder 59 fits about the shaft 216, and between this end and the collar 221 is fitted a coil spring 222. The sleeve 215 is affixed to a sleeve 225 by pins 226 and both sleeves are mounted for rotation upon the shaft 216. Loosely keyed to sleeve 215 by means of a plurality of keys 223 in keyways 224 is fixedly mounted on the sleeve 225 the driven member 227 of a Geneva movement, the driven member 227, in the present instance, being formed with six locking surfaces 228 and six driving slots 229. On a shaft 230 extending across the gear box and mounted thereon are secured the locking disc 231 and the driving member 232 of the Geneva movement. The locking disc 231 is so formed that the circumference will fit into an adjacent locking surface 228 of the member 227 during five-sixths of the revolution of the disc, but is recessed, as shown at 233, to permit the rotative movement of the member 227 during the remaining one-sixth of its revolution. To cause such movement there is provided a pin 234 carried by the driving member 232 in a position adjacent the recess in the member 231 and adapted to fit into a slot 229 to move the driven member 227 one-sixth of a revolution. The shaft 230 is operatively connected through the medium of a pair of gears 235 and 236 to a shaft 237, which, in turn, is operatively connected to a drive shaft 224^a by a further pair of gears 238, 239 (Fig. 1). On the drive shaft 224^a is a gear 225^a meshing with the tooth rack 23. In the present exemplification, wherein two yarn feeds are employed, the gearing is arranged to cause two rotations of the shaft 230 to each rotation of the cylinder 21 so that a stepping movement of the pattern band 58 may be caused (when the clutch-members 213, 214 are in engagement) prior to the passage of each drum (such as shown at 37) over the actuating members exemplified by the plungers 53.

As set forth above, there is preferably employed suitable mechanism for withdrawing the clutch-member 214 from engagement with the clutch-member 213 at predetermined intervals in the operation of the machine, and to this end, there is provided, in the present exemplification, a lever 241 pivotally mounted on shaft 242, which, in turn, is supported on arms 243, 244 extending outwardly beyond the gear-box 68. One section arm 245 of the lever 241 extends downwardly from the shaft 242 and is formed with a bifurcated end 246, the divisions of which are secured about a pin 247 which extends through a hole in the shaft 216 and is rotatable therein. The other section 248 of the lever extends outwardly from the gear-box and is formed at its outer end with a downwardly extending arm 249. The lever is normally held with the end 246 thereof adjacent the gear-box, so as to permit the clutch-members 213, 214 to remain in mesh, by means of a coil-spring 250. Directly beneath the arm 249 of the lever is a sprocket-wheel 251 attached to a sleeve 252 extending about the shaft 230 and carrying, in the present instance, an endless chain 253. With a view to causing the projection 249 on the lever 241 to be raised so as to carry the end 246 of the lever and the shaft 216 in a direction away from the cylinder 59 so as to cause the clutch-members 213, 214 to be disengaged at certain periods in the operation of the machine, certain links in the chain 253 are formed with projecting cam-members 254 arranged for operative engagement with the projection 249. In order to cause the rotation of the sprocket-wheel 251 and a consequent movement of the chain 253 thereon, the sleeve 252 may be fixedly secured to the shaft 230, but in order to secure a greater variety of design in the fabric produced by the machine without the employment of a chain of undue length, there may be employed suitable mechanism for causing a movement of the chain or other lever-actuating member during only certain portions of the movement of the shaft 230. To this end, there is provided in the present exemplification a ratchet wheel 255 attached to the sleeve 252 and a larger ratchet wheel 256 loosely mounted on the sleeve 252 in a position adjacent the wheel 255. A pawl 237 of sufficient width to extend across both wheels is mounted on a member 258 formed with a counter-weight 259 and mounted on an eccentric disc 261 formed on the end of the shaft 260. In order further to limit the extent of movement of the chain with respect to the movement of the machine, the larger wheel is so formed, in the present instance that only the notches between every fourth tooth will be of sufficient depth to permit the pawl to be operative upon a tooth of the wheel 255 to turn the same so as to cause the chain to be moved one link by the sprocket wheel. In the present exemplification the gearing is arranged to cause four revolutions of the shaft 237 to each revolution of the cylinder 21. Other arrangements may of course be employed. In order to prevent accidental shifting movements of the cylinder 59 when the clutch-members 213 and 214 are out of engagement, there may be provided suitable means, such as the six knobs 266 (as shown in Fig. 18) formed on the periphery of the clutch-member 213 and a cooperating spring 262, arranged to releasably engage the knobs.

While a machine embodying two yarn feeds and two drums has been exemplified, it will be understood that any further number of yarn carriers and corresponding pat-

tern-control mechanisms may be employed. It will be appreciated, however, that the space between successive drums, such as the drums 37, should ordinarily be sufficiently greater than the space occupied by the actuating-members, such as exemplified by the plungers 53, so as to permit the resetting of the pattern band, if desired, between the operation of the actuating-members upon successive drums. However, if such resetting is not desired between certain successive drums these drums may be arranged close together for actuation in response to a single position of the configurations presented by the pattern band. Furthermore, in certain cases certain of the drums may be omitted and an ordinary pattern wheel or other suitable mechanism employed at certain of the yarn feeds. It is to be understood, moreover, that while there are employed in the exemplified machine, elements for transmitting movement of the plungers to the needles, the invention in its broader aspects is capable of embodiment in machines so constructed that the adjustable elements on the drum or other rotating member actuate the needles directly.

It will be appreciated that the invention not only contemplates imparting selective actuations both to a row of latched needles (by causing longitudinal movement of certain of the needles) and to a row of spring needles (by causing the beards of certain needles to be closed) whether the needles actuated are the vertical or dial type or both; but in its broader aspects, it is adapted successfully to be embodied in connection with any of a wide variety of types of machines.

The term "cylindrical member" as used in the appended claims is intended to refer to either of a pair of members (one rotatable and the other stationary), employed in a circular knitting machine, the one to support the needles, the sinkers, and the members directly associated with the needles, and the other to support the needle actuating means mounted for movement with respect thereto, regardless of the general form of the supporting members or whether they are employed to support vertical "cylinder" needles, "dial" needles, or both, on the one hand; or, on the other, mechanism for causing the actuation of any of these needles.

Since certain changes may be made in the above construction and different embodiments of the invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawing 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 of 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.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In a knitting machine, in combination, a series of yarn manipulating members arranged to have pattern determining actuations imparted thereto, a drum mounted for movement with respect to said yarn manipulating members and for rotation in response to said movement, a plurality of adjustable elements carried by said drum, each of said elements being selectively adjustable between a position wherein it will cause pattern-determining actuations to be imparted to individual yarn-manipulating members, and a position in which it will cause no such actuations to be imparted, mechanism adapted to be set in a variety of positions to control the adjustment of said adjustable elements, and means to control the setting of said adjustment controlling mechanism, said latter means including a member arranged to present a succession of series of pattern-control configurations to said adjustment controlling mechanism, the configurations in each series being adapted to determine the selective actuation of a plurality of yarn manipulating members.

2. In a knitting machine, in combination, a stationary needle carrier, a series of needles mounted on said needle carirer, pattern-control mechanism movable along said series of needles and adapted to control the operation of said needles, said mechanism comprising a plurality of elements arranged for successive adjustment to cause a succession of varied actuations to be imparted selectively and individually to said needles, a stationary supporting member, means mounted on said stationary supporting member adapted to effect a series of such successive adjustments in said elements.

3. In a knitting machine, in combination, a needle bed, a series of needles carried by said needle bed and arranged to have pattern-determining actuations imparted thereto, a pattern-controlling drum, said drum and said needle bed being mounted for relative rotative movement and said drum being rotatable in response to said relative movement, a plurality of adjustable elements carried by said drum, each of said elements being adjustable between a position in which it will impart an actuation to individual ones of said needles in response to the rotation of said drum and a position in which it will not impart actuation to the needles, and pattern control mechanism comprising a plurality of independent members arranged to be set in position selectively and individually to control the adjustment of said adjustable elements and means to set said adjustment con-

trolling members from time to time during the operation of said machine.

4. In a knitting machine, in combination, a stationary needle bed, a series of needles mounted on said needle bed and arranged to have pattern-determining actuations imparted thereto, a drum mounted for movement along said needle bed and for rotation in response to said movement, a plurality of adjustable elements carried by said drum, means including said elements to impart pattern-determining actuations selectively and individually to said needles in response to the rotation of said drum, stationary supporting member and means mounted on said stationary supporting member selectively to control the adjustment of said adjustable elements from time to time during the operation of said machine.

5. In a knitting machine, in combination, a stationary cylindrical member, a series of needles carried by said cylindrical member, a rotatable cylindrical member, a plurality of yarn feeds carried by said rotatable cylindrical member, a stationary supporting member, pattern-determining means mounted on said stationary supporting member and arranged for the presentation of a succession of series of pattern-determining configurations, and pattern-control mechanism including means for individual needle control and arranged to impart selective actuations to certain of said needles prior to the passage of each yarn feed in response to the presentation of each of said series of pattern-control configurations.

6. In a knitting machine, in combination, a pair of cylindrical members mounted for relative rotative movement, a series of needles carried by one of said cylindrical members, a plurality of yarn feeds carried by the other of said cylindrical members, a stationary supporting member, pattern-determining means mounted on said stationary supporting member and arranged for the presentation of a succession of series of pattern-determining configurations, and pattern-control mechanism including means for individual needle control and arranged to impart a set of selective actuations to one group of said needles prior to the passage of each yarn feed in response to the presentation of one of said series of pattern-determining configurations and to impart the same set of selective actuations to a succeeding group of needles prior to the passage of the same yarn feed thereby.

7. In a knitting machine, in combination, a pair of cylindrical members mounted for relative rotative movement, a series of needles carried by one of said cylindrical members, a plurality of yarn feeds carried by the other of said cylindrical members, a rotatable drum carried by the last mentioned cylindrical member, a stationary supporting member, an endless pattern band having a series of rows of pattern-determining perforations formed thereon and mounted on said stationary supporting member for step by step movement to present successive rows of perforations, a plurality of finger members arranged to be set in accordance with the presentation of the perforations in each row, and pattern-control mechanism arranged to impart a set of selective actuations to individual ones of said needles prior to the passage of said yarn feed in response to the setting of said finger members, said mechanism including a plurality of independently adjustable elements carried by said drum, and selectively and individually adjustable in response to the setting of said finger members.

8. In a circular knitting machine, in combination, a stationary needle bed, a series of needles mounted on said needle bed, a cylindrical member mounted for rotation with respect to said needle bed, pattern-control mechanism carried by said rotatable cylindrical member and including a plurality of independently adjustable elements each adapted to cause an individual pattern-control actuation to be imparted to at least one of said needles upon the adjustment thereof, a stationary supporting member, and means mounted on said stationary supporting member for causing selective adjustment of said adjustable elements from time to time during the operation of said machine.

9. In a knitting machine, in combination, a series of needles arranged to have pattern-determining actuations imparted thereto, a rotatable drum mounted for movement with respect to said series of needles, a plurality of independently adjustable elements carried by said drum, each of said adjustable elements being adjustable to a position wherein it will cause selective pattern-determining actuations to be imparted to individual ones of said needles, and setting mechanism for causing selective adjustments of said adjustable elements from time to time during the operation of said machine, said adjustable elements being adapted to remain in their adjusted positions during a plurality of rotations of said drum after each operation of said setting mechanism.

10. In a knitting machine, in combination, a stationary needle bed, a series of needles mounted on said bed, means including a shifting lever to impart a pattern-determining actuation to each needle, pattern-controlling mechanism including a drum, said mechanism and said series of needles being mounted for relative movement and said mechanism being arranged to impart operative movements selectively and individually to said shifting levers in response to the relative movement of said mechanism and said needles, and stationary pattern means to determine the operation of said pattern-control mechanism on said levers.

11. In a circular knitting machine, in com-

bination, a pair of cylindrical members mounted for relative rotative movement, a series of needles carried by one of said cylindrical members, means carried by the last mentioned cylindrical member for imparting pattern-determining actuations to said needles, said means including a needle-shifting lever corresponding to each needle, a drum carried by the other of said cylindrical members and mounted for rotation in response to the relative rotation of said cylinders, a plurality of independently adjustable elements carried by said drum and arranged for selective adjustment to positions for the actuation of one of said levers upon each rotation of said drum, and means adapted to cause selective adjustment of said adjustable elements from time to time during the operation of said machine.

12. In a knitting machine, in combination, a series of needles, a drum movable adjacent said series of needles and rotatable during such movement, a plurality of independently adjustable elements carried by said drum and arranged to impart pattern-controlling actuations selectively and individually to said needles in response to the adjustment of said elements, a stationary supporting member, and means mounted on said stationary supporting member selectively to control the adjustment of said adjustable elements from time to time during the movement of said drum, said means including a plurality of independent members for individually and selectively adjusting said adjustable elements.

13. In a knitting machine, in combination, a stationary cylinder, a rotatable cylinder, a circular row of vertical needles mounted on said stationary cylinder, a lever associated with each needle and arranged to impart movement thereto, a drum mounted on said rotating cylinder and arranged for independent rotation in response to the rotation of the cylinder, a plurality of elements carried by said drum and arranged for independent adjustment to a position in which movement will be imparted to individual ones of said levers, and means including a stationary pattern band for causing selective adjustments of said elements from time to time during the rotation of said rotatable cylinder.

14. In a knitting machine, in combination, a stationary cylinder, a rotatable cylinder, a circular row of vertical needles mounted on said stationary cylinder, a lever associated with each needle and arranged to impart movement thereto, a drum mounted on said rotatable cylinder and arranged for independent rotation in response to the rotation of the cylinder, a plurality of elements carried by said drum and each arranged for independent adjustment to a position in which movement will be imparted to individual ones of said levers, a stationary table, a plurality of plungers carried by said table and each movable to a position for the actuation of an adjustable element upon the rotation of said drum, an endless pattern band, and means responsive to the position of said pattern band to cause the actuation of said plungers.

15. In a knitting machine, in combination, a plurality of cylindrical members mounted for relative rotative movement, a series of needles carried by one of said cylindrical members, a plurality of levers each arranged to cause a pattern-controlling actuation to be imparted to one of said needles, a drum carried by the other of said cylindrical members and mounted for rotation in response to the relative rotation of said cylindrical members, said drum being formed about its periphery with a plurality of oblique lateral slots, the end of said slots adjacent said needles being behind the other end thereof in the direction of rotation of the drum, a plunger mounted for sliding movement in each of said slots to a position wherein it will bear upon the outer ends of individual ones of said levers upon the rotation of said drum, a perforated pattern-control strip arranged for step by step movement, and means responsive to the position of said perforated strip for controlling the sliding movement of said plungers.

16. In a knitting machine, in combination, a stationary needle bed, a row of independent needles carried thereby, a drum movable with respect to said needle bed and rotatable in response to such movement, a plurality of independently adjustable elements carried by said drum, each of said elements being adjusted between a position in which it will actuate individual ones of said needles and a position in which it will not actuate the said needles, and stationary pattern means selectively and individually to adjust said adjustable elements from time to time during the operation of the machine.

17. In a circular knitting machine, in combination, a stationary needle cylinder, a row of independent needles carried thereby, stationary pattern means at one side of said cylinder, a drum revoluble about said cylinder and rotatable in response to such revolution, a plurality of adjustable elements carried by said drum and adapted to be selectively and individually adjusted by said stationary pattern means, and means including said adjustable elements selectively and individually to actuate said needles.

18. In a knitting machine, in combination, a row of yarn-manipulating members arranged for independent movement, a drum arranged for movement along said row and for rotation in response thereto, a plurality of adjustable elements carried by said drum, means including said elements for individually and selectively actuating said yarn-manipulating members, a stationary table, a plurality of plungers carried by said table and adapted to individually and selectively actu-

ate said adjustable elements upon the rotation of said drum thereby, an endless pattern band, and means to set said plungers in response to the position of said pattern band.

19. In a circular knitting machine, in combination, a stationary needle cylinder, a row of independent needles carried thereby, needle-actuating mechanism including a drum revoluble about said needle cylinder and rotatable in response to such revolution and a plurality of independently adjustable elements carried by said drum, each of said elements being adjustable to a position wherein it will cause the actuation of a needle at each rotation of said drum, a stationary supporting member, means mounted on said stationary supporting member for individually and selectively adjusting said adjustable elements once in each revolution of the drum about the needle cylinder, and means operative prior to the last mentioned means for positioning said elements for readjustment, said elements being adapted to remain in their adjusted position until the operation of said means for positioning the elements for readjustment, whereby the selective operation of the adjustable elements on a series of needles will be repeated on one or more succeeding series of needles about the cylinder.

20. In a circular knitting machine, in combination, a stationary cylinder, a row of vertically movable needles carried thereby, needle-actuating mechanism including a drum revoluble about said cylinder and rotatable in response to such revolution, and a plurality of independently adjustable elements carried by said drum, each of said elements being adjustable to a position wherein it will cause the actuation of a needle at each rotation of said drum, a stationary supporting member, means mounted on said stationary supporting member for individually and selectively adjusting said adjustable elements once in each revolution of the drum about the needle cylinders, and means operative prior to the last mentioned means for positioning said elements for readjustment, said elements being adapted to remain in their adjusted position until the operation of said means for positioning the needles for readjustment, whereby the selective operation of the adjustable elements on a series of needles may be repeated on one or more succeeding series of needles.

21. In a knitting machine, in combination, a row of yarn-manipulating members, a drum, means to mount said row of yarn manipulating members and said drum for relative movement, said drum being rotatable in response to said relative movement, a plurality of adjustable elements carried by said drum, each of said elements being adjustable to a position wherein it will impart pattern-determining actuations to individual ones of said yarn manipulating members in response to the rotation of said drum, and pattern control mechanism comprising a plurality of independent members arranged to be set in position to selectively and individually control the adjustment of said adjustable elements, and means to set said adjustment controlling members from time to time during the operation of said machine.

22. In a circular knitting machine, in combination, a pair of cylindrical members mounted for relative rotative movement, a series of needles carried by one of said members, a plurality of yarn carriers carried by the other of said members, a drum carried by said other of said members and mounted for independent rotation in response to said relative movement, a plurality of adjustable elements carried by said drum, each of said elements being adjustable to a position wherein it will impart pattern-determining actuations to individual ones of said needles in response to the rotation of said drum, and pattern-control mechanism comprising a plurality of independent members arranged to be set in position to selectively and individually control the adjustment of said adjustable elements, and means to set said adjustment controlling members from time to time during the operation of said machine.

23. In a circular knitting machine, in combination, a stationary cylinder, a rotatable cylinder, a circular row of vertical needles mounted on said stationary cylinder, a member associated with each needle and arranged to transmit movement thereto, a drum mounted on said rotatable cylinder and arranged for independent rotation in response to the rotation of the cylinder, a plurality of elements carried by said drum and arranged for individual adjustment to positions in which movement will be imparted to individual ones of said movement transmitting members, a stationary table, a plurality of plungers carried by said table and adapted to be set in position for the actuation of said adjustable elements upon the rotation of said drum thereby, an endless pattern band, and means responsive to the position of said pattern band to cause the actuation of said plungers.

24. In a knitting machine, in combination, a plurality of cylindrical members mounted for relative rotative movement, a series of needles carried by one of said cylindrical members, a plurality of members each arranged to cause a pattern control actuation to be imparted to one of said needles, a drum carried by the other of said cylindrical members and mounted for rotation in response to the relative rotation of said cylindrical members, said drum being formed about its periphery with a plurality of lateral slots, a plunger mounted for sliding movement in each of said slots to a position in which it will bear upon one of said actuation impart-

ing members upon the rotation of said drum, a perforated pattern-control band arranged for step-by-step movement, and means responsive to the position of said perforated band for controlling the sliding movement of said plungers.

25. In a circular knitting machine, in combination, a stationary needle cylinder, a row of needles mounted on the needle cylinder, a cylindrical member mounted for rotation about said needle cylinder, a plurality of yarn feeds carried by said rotatable cylindrical member, needle-actuating mechanism to cause yarn from certain of said yarn feeds to be formed into a series of rows of interknitted loops in one portion of the fabric, and yarn from certain other of said yarn feeds to be interlocked between said loops in alternate wales thereof and to be extended behind said loops in the remaining wales, and to cause yarn from said certain other of said yarn feeds to be formed into a series of rows of interknitted loops in another portion of the fabric and yarn from said certain yarn feeds to be interlocked between said last mentioned loops in alternate wales thereof and to be extended behind said last mentioned loops in the remaining wales, said needle-actuating mechanism including a plurality of drums mounted on said rotatable cylindrical member for independent rotation in response to the rotation of the cylindrical member, one of said drums preceding each of said yarn feeds, a plurality of independently adjustable elements carried by each drum, each of said elements being adjustable to a position wherein it may cause an actuation to be imparted to individual ones of said needles, stationary pattern control means arranged to selectively and individually adjust said adjustable elements from time to time during the operation of said machine, and means including said elements to determine the actuation of said needles for the formation of loops and for interlocking.

26. In a knitting machine, in combination, a stationary member, a row of yarn-manipulating members carried thereby, a drum movable with respect to said stationary member and rotatable in response to such movement, a plurality of independently adjustable elements carried by said drum, each of said elements being adjustable between a position wherein it will selectively actuate individual ones of said yarn-manipulating members and a position in which it will not actuate said members, and stationary pattern means for selectively and individually adjusting said adjustable elements from time to time during the operation of the machine.

27. In a knitting machine, in combination, a needle bed, a series of needles carried thereby, means movable relatively to said needle bed, a drum carried by the last mentioned means and adapted to be rotated in response to the movement thereof, supporting means immovable with respect to said needle bed, pattern-control mechanism carried by said supporting means, a plurality of independently adjustable elements carried by said drum and arranged to selectively and individually actuate said needles upon the rotation of said drum, and additional adjustable elements carried by said drum for selectively and individually controlling the operation of the aforesaid adjustable elements in response to the positioning of said pattern-control mechanism.

28. In a knitting machine, in combination, a plurality of cylindrical members mounted for relative rotative movement, a series of needles carried by one of said cylindrical members, a plurality of members each arranged to cause a pattern-control actuation to be imparted to one of said needles, a drum carried by the other of said cylindrical members and mounted for rotation in response to the relative rotation of said cylindrical members, said drum being formed about its periphery with a plurality of lateral slots, a plunger mounted for sliding movement in each of said slots to a position in which it will bear upon one of said actuation imparting members upon the rotation of said drum, a perforated pattern-control band arranged for step-by-step movement, control mechanism operated in response to the position of said perforated band, and additional adjustable elements carried by said drum for selectively and individually controlling the operation of said plungers in response to the positioning of said control mechanism.

In testimony whereof I affix my signature.

VINCENT LOMBARDI.