Feb. 28, 1939. W. J. WESSELER 2,148,517

KNITTING APPARATUS

Filed July 30, 1934 2 Sheets-Sheet 1

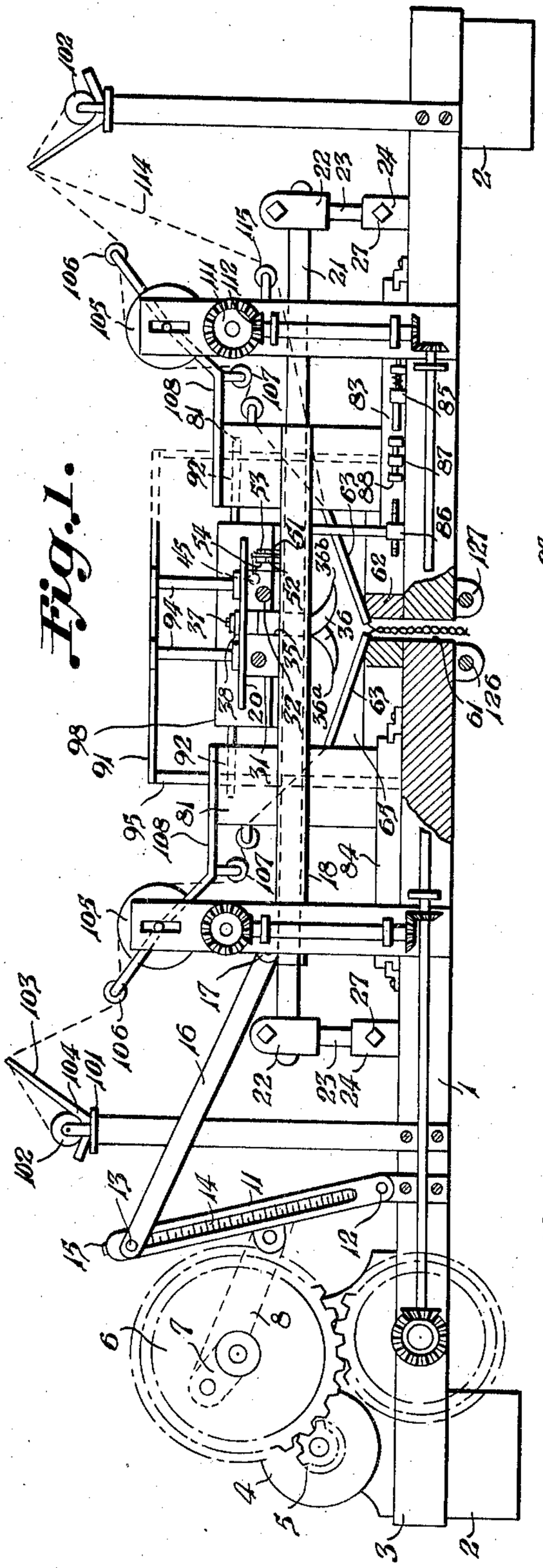

Fig. 1.

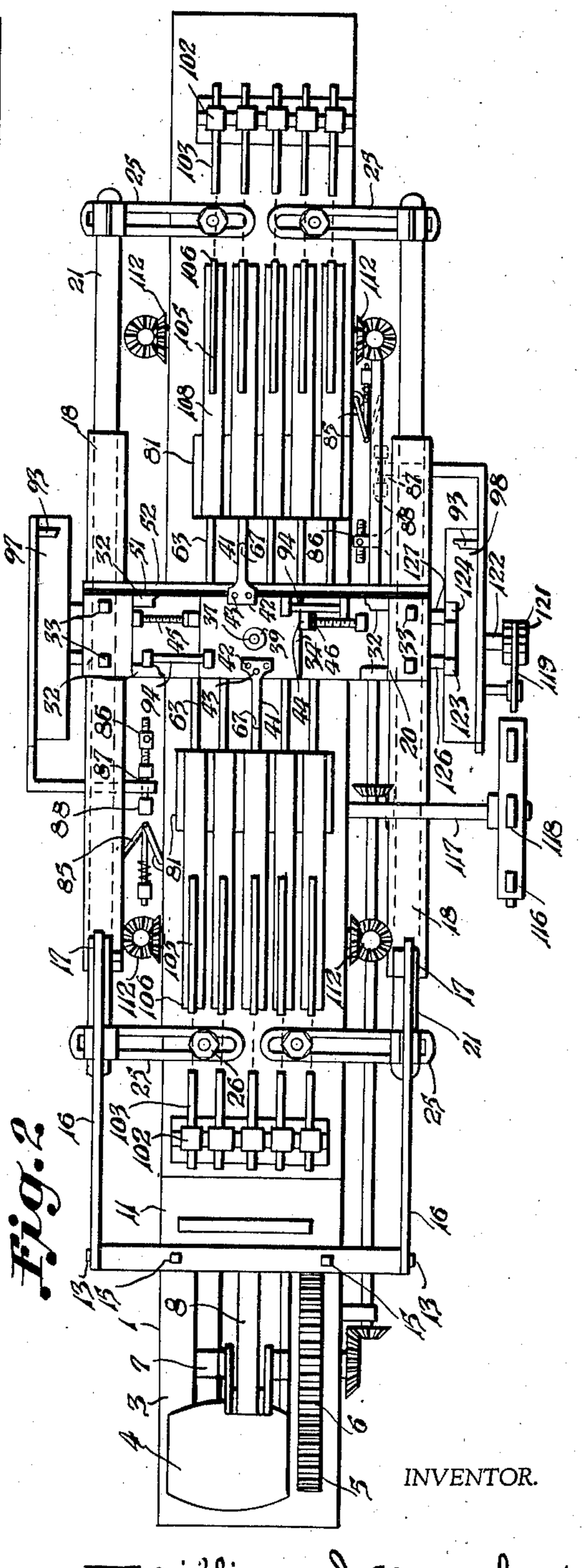

Fig. 2

INVENTOR.

William J. Wesseler.

Feb. 28, 1939.

W. J. WESSELER

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Fig. 3.

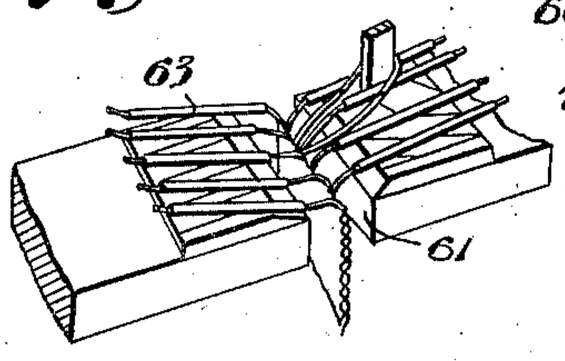


Fig. 4.

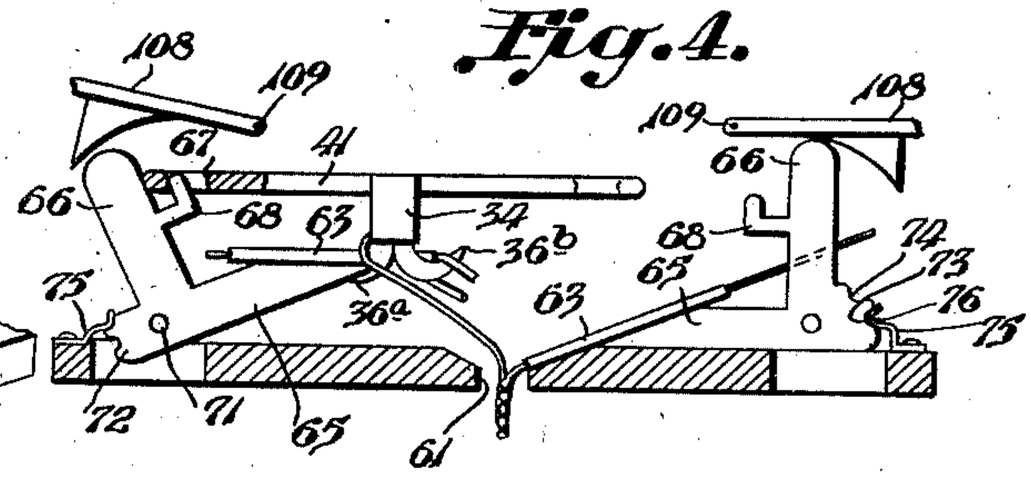


Fig. 5

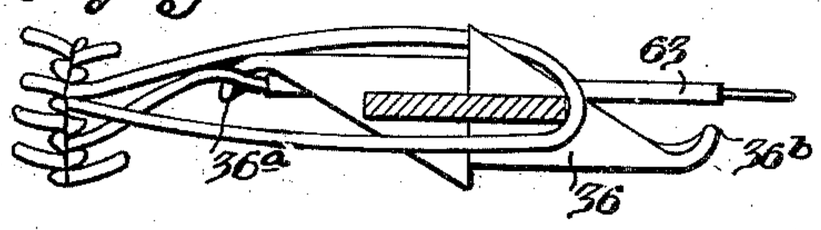


Fig. 6.

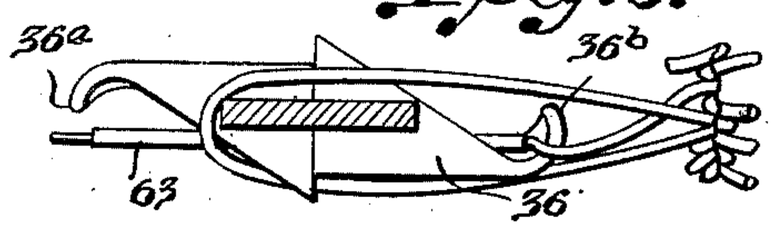


Fig. 7.

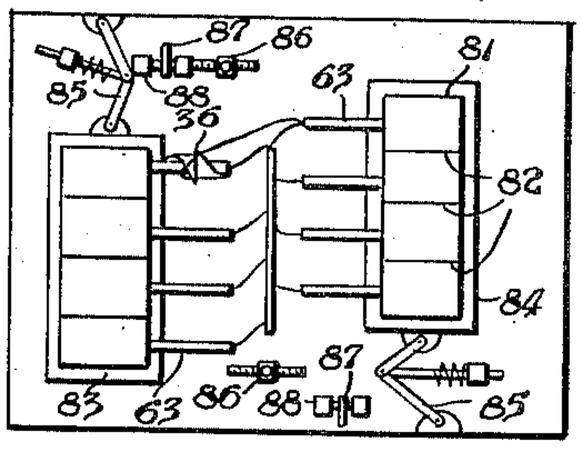


Fig. 8.

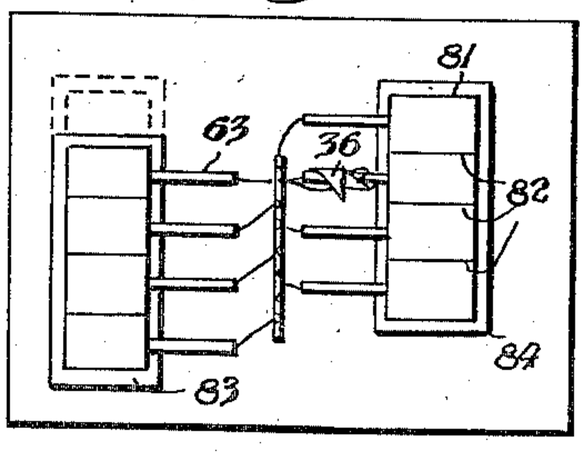
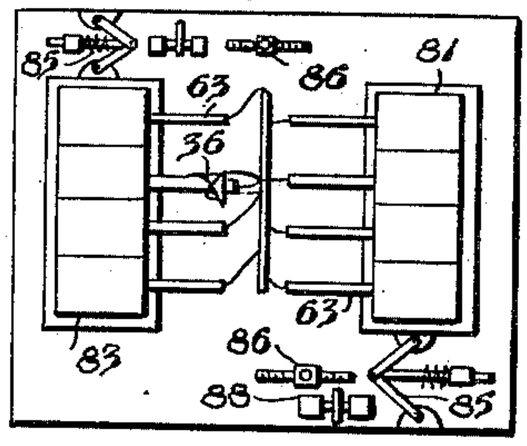


Fig. 9.



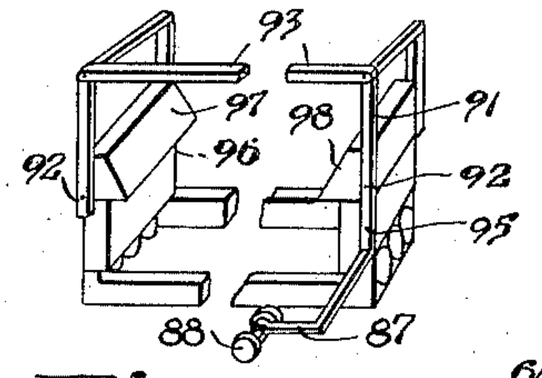


Fig. 11

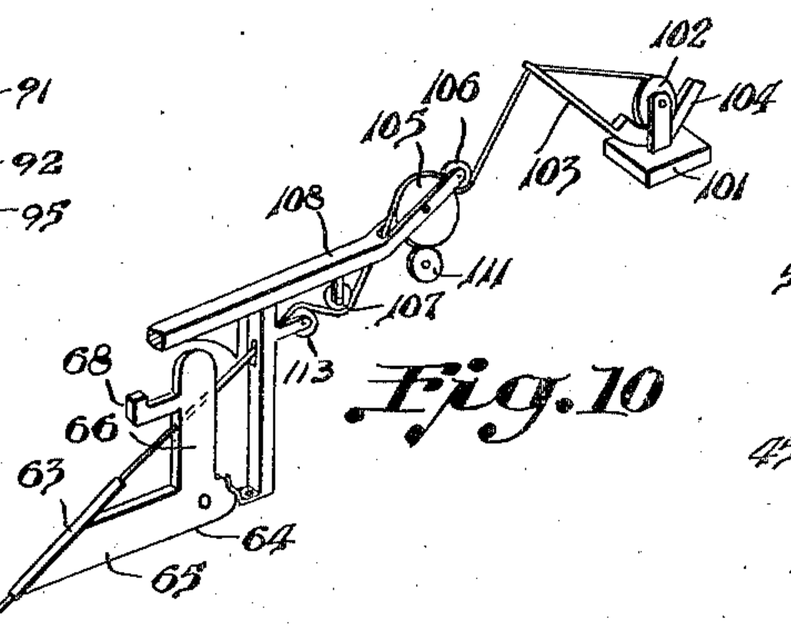


Fig. 10

Fig. 13

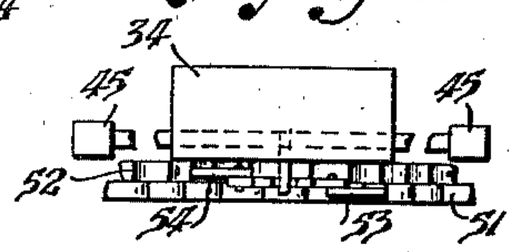
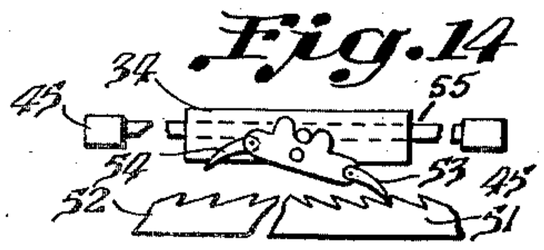


Fig. 14



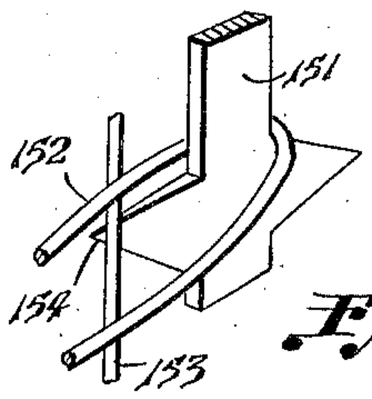


Fig. 12

INVENTOR.

William J. Wesseler

Patented Feb. 28, 1939

2,148,517

UNITED STATES PATENT OFFICE

2,148,517

KNITTING APPARATUS

William J. Wesseler, East Cleveland, Ohio

Application July 30, 1934, Serial No. 737,648

13 Claims. (Cl. 66—1)

This invention relates to knitted fabric and to the method and apparatus for producing the same. This application is a continuation in part of application Serial No. 560,398, filed August 31, 1931, which has been issued as Patent No. 1,968,066, July 31, 1934. More particularly, the invention comprises a fabric of the general type shown in my Patent No. 1,738,486, and embodying additional features to that disclosed therein, such fabric being formed by a knitting operation wherein the stitches or loops making up the same may be drawn to any desired size and may be so tightly seated upon adjacent stitches or loops as to present what may be termed a "needle-tight" fabric. Such fabric may be used as a plain or finished fabric of a wide variety of types including among others warp knitting, purl knitting, Milanese knitting, or it may be used as a base or backing fabric for a filler or for a pile provided on one or both sides thereof. It may also be used for various plating, striping, reinforcing embossing, or like effects.

It also comprises a method of knitting wherein each knitting instrumentality, whether a needle or other type of device, such as a knitting bar or pin rigidly mounted as one of a set, or individually pivoted, and having preferably special shape and range of action, is adapted to operate successively on independent yarns of separate series, and wherein the yarns may be drawn as desired to any pre-determined loop size after being cast off from said needles, or other knitting instrumentalities, and wherein additional or auxiliary yarns may be used to form single or double face pile fabric plated, striped, reinforced or embossed fabric or any other desired effects.

The invention also has in view the provision of apparatus for producing the various types of fabric described, such apparatus embodying means for producing tightly pulled loops or loops drawn to predetermined size, with or without interlocked additional or auxiliary threads. Apparatus is also provided to produce purl fabric in a novel manner at high speed and with or without tightly drawn loops and in plain form or with additional pile or other yarns interlocked therewith.

The invention also includes an apparatus using multiple series of yarn feeds to cooperate in the preforming of loops of pile or other yarns over backing yarns made ready for the loop forming members.

The invention also has in view the introduction into a knitted backing or base fabric formed of standard or purled or Milanese type loops drawn to any desired degree of loop size of additional yarns engaged with said backing and anchored thereto. Such additional yarns may be used for plating, reinforcing, embossing or like purposes, or may be in the form of loops which form a pile standing outwardly from one or both sides of said base fabric. The pile fabric so formed may be of the cut or uncut variety and may be united with the base in various forms of anchoring loops, some of which may closely resemble what has been termed an oriental knot.

In addition to the pile fabric being adapted to be united with the base by various forms of anchoring engagement therewith, the direction in which the pile yarns are fed to the base may be varied and a plurality of series of pile yarns may be supplied to the knitting instrumentalities.

The backing fabric may be likewise changed as to the number of series of yarns from which the same is made, or as to the color or strength of the yarns of said series, and as to the direction in which such yarns are supplied to and taken from the knitting instrumentalities.

The present invention may be embodied in various types of apparatus and may comprise straight machines adapted to knit a fabric with a selvage at either edge, and the fabric may be fed upwardly or downwardly or horizontally if desired. Likewise the mechanism shown may be in the form of a circular machine knitting tubular fabric which likewise may be fed in any desired direction, although in each instance it is believed downward feeding would prove more advantageous inasmuch as the yarn feeding tubes where needle-tight tension is desired will serve as abutments to position the fabric and no auxiliary tension apparatus need be utilized, the finished fabric descending by gravity as formed. It is also to be understood that whereas the reciprocation of the loop forming instrumentality is described in the present application, such instrumentality or instrumentalities could be held stationary and the yarn feeding elements moved in appropriate directions in relation thereto.

In one form of my apparatus I have illustrated means for supplying each knitting instrumentality with a plurality of selectively operable yarn feeds so that any desired color of a full series of colors may be supplied to the knitting instrumentality for any position in the fabric and such yarns may thereafter be floated or severed and again called into use when desired. Such yarn feeds may be arranged to supply pile fabric yarns along with the backing fabric yarns and the backing fabric yarns in such instance may be of uni-

form color while the pile fabric yarns embody the assortment of colors to be selectively incorporated in the finished fabric.

Mechanism is provided for the narrowing and widening or shaping of the marginal or other portions of the fabric.

Other features of the invention relate to the supplying of the pile yarns to the knitting instrumentalities under any desired tension and carrying said yarns, after their formation into pile loops, over instrumentalities which determine their size.

Other and further features of the invention will appear in the course of the following description.

The annexed drawings and the following description set forth in detail certain fabrics and the means and mode of carrying out the invention, such disclosed means and mode illustrating, however, but several of the different ways in which the principle of the invention may be used and the fabrics produced.

In said annexed drawings:

Figure 1 is a side elevation showing one form of apparatus embodying the principles of the invention;

Figure 2 is a top plan view of the apparatus shown in Figure 1;

Figure 3 is a fragmentary perspective view showing the fabric in relation to the yarn feeding tubes;

Figure 4 is a diagrammatic side elevation showing the method of drawing a loop;

Figure 5 is a diagrammatic plan view showing the relative position of the parts when drawing a loop;

Figure 6 is a view similar to Figure 5, showing the loop-forming element associated with the opposite yarn carriage;

Figure 7 is a similar view showing the loop-forming carriage shifted transversely of the frame;

Figure 8 is a similar view showing the drawing of the succeeding loop;

Figure 9 is a similar view showing the loop-forming element back to the first position and the second carriage returned to its original position;

Figure 10 is a fragmentary perspective view showing the loop-tensioning mechanism;

Figure 11 is a fragmentary perspective view showing the fabric narrowing mechanism;

Figure 12 is an enlarged detail view showing a modified form of loop-forming element;

Figure 13 is a fragmentary top plan view showing the rack bars and associated pawl mechanism; and

Figure 14 is a fragmentary front elevation of the structure shown in Figure 13.

In the form of apparatus illustrated more particularly in Figures 1 and 2, there is shown a machine adapted to produce flat purl fabric with a selvage edge at either side and having a narrowing and widening attachment as well as means for supplying pile yarns to produce a pile fabric. In said structure a base plate 1 is provided supported upon suitable standards 2 and having an extension 3 at one end upon which is mounted an electric motor 4 carrying a pinion 5 meshing with the gear wheel 6 operating a crank shaft 7, the crank of which is connected by a link 8 with pivots 9 mounted on a rocking frame 11. The rocking frame is provided with a pivot 12 at its lower portion at each side of the base plate and carries at each of its side edges outwardly projecting pivot pins 13 interengaged with slideways 14 at the margins of said frame and adjustable toward or away from the pivots 12 of said frame, preferably by means of vertical positioning screws 15. Upon each of said pivot pins links 16 are engaged, the other ends of which are passed through the space between a pair of ears 17 on the upper side of pairs of sleeves 18 respectively on opposite sides of a sliding frame presently to be described.

In order to provide trackways or supports for a sliding frame 20, a pair of longitudinal bars 21 is provided, each bar being supported at the ends respectively in telescopic standards 22 which clamp about said bars at their upper ends and have stem portions 23 received in socket portions 24 provided at the ends of slotted bracket arms 25 which are held to the base plate by means of bolts 26. Thus, the bars or trackways may be moved outwardly from the central line of the machine, or the brackets may be swung at an angle with reference to the machine in order to change the position of the trackways, and such adjustment may be firmly maintained by securing the bolts firmly to the base plate. By means of set screws 27 on the socket portions of the bracket arms, the standards may be raised and lowered so as to bring the trackways at any desired elevation with reference to the upper fabric margin presently to be described.

The sleeves 18 have secured to their upper sides at an intermediate position terminal blocks 31 apertured to receive a pair of cross bars 32 which are held in adjusted position by means of set screws 33. Upon the parallel horizontal cross bars 32 a sliding carriage 34 is engaged. Centrally of said carriage a socket 35 is provided within which the end of the body portion of the loop forming element 36 is engaged. A screw threaded terminal portion 37 engaged by lock nuts 38, 39, serves to firmly hold the loop forming element in any desired position of adjustment. Upon the upper face of the carriage 34 at a central position a projecting operating arm 41 is provided on each side, such arm being adjustably secured to the top surface of the carriage by means of set screws 42 engaged through slots in a terminal plate portion 43 at the inner ends of said respective operating arms. At each face of the carriage 34 a screw threaded socket 44 is provided in which is engaged a screw threaded stem of a shifter bar contact member 45, a lock nut 46 on said member serves to hold the same in any position of adjustment. On one side of the carriage slideway, provided by the frame 20, extending transversely of the apparatus and spaced slightly above the sleeves, toothed rack bars 51, 52 are provided, the rack bars having their teeth oppositely directed so that the rack bar 51 may be used in conjunction with a pawl 53 for holding the carriage after shifting transversely in one direction and the rack bar 52 in conjunction with its pawl 54 serving to hold the carriage after shifting in the opposite direction. The pawls 53, 54 are carried on the carriage and operated by a common slide member 55 adapted to be shifted so as to alternately throw the pawl 53 into operative engagement with its rack bar 51 or to withdraw such pawl and throw the companion pawl 54 into engagement with its rack bar 52.

Centrally of the base plate a transverse slot 61 is provided which serves as a fabric receiving throat, said slot preferably having an upstanding slotted plate 62 above the same which serves

as a rest for the ends of the tubular yarn feeds **63**. These yarn feeds are disposed in parallel rows opposite to each other but may be staggered individually as to the opposite members and are formed of thin tubular members which engage about the yarn so that the free sliding movement of the yarn may be had within the same, yet the space occupied by such tubular yarn feeds is so slight that firm needle-tight stitches or loops may be formed in the fabric without impressing any transverse strains upon the respective yarn feeds. This is particularly true in connection with purl knitted fabric wherein the opposite yarn tubes are individually in closely spaced staggered relation to each other. When tension is applied to the yarns within the tubes the free ends of the tubes rest firmly against the upper fabric margin and serve as abutments to draw tight any loops which have been formed on any of the yarns issuing from the individual yarn tubes and serves also to support and position the fabric without the use of any fabric tension device or any synchronized fabric take-up mechanism.

The yarn feeding tubes are each mounted on supporting plates **64** having a horizontal portion **65** engaged with the tubular yarn feeds **63** so as to hold the same at a slightly downwardly disposed angle at its free end and having an upstanding portion **66** adapted to be engaged by the free end of the adjacent projecting operating arm on the carriage heretofore described. This operating arm **41** is provided with an opening **67** adjacent its end which is adapted to be engaged by a projecting pin **68** secured to the upstanding arm **66** in spaced relation slightly below the path of movement of the operating bar **41**. The operating arm or bar **41** at the same time enters between plates **82** on the frame **81**, and this provides with the pawls **53**, **54**, on the carriage **34** and the rack bars **51**, **52**, on the carriage slideway, for the transverse movement of the carriage **34** in one direction and its return in alternate cycles of step by step knitting across the frame first in one direction and then in the reverse direction with repetitions of such movements thereafter. The tubular yarn feeds are thus moved into substantial alinement with the yarn feeds of its companion baseboard of the parallel baseboards **83**, **84**, such companion baseboard being inactive at such time, as will be hereafter described. As the carriage is shifted longitudinally the end of the operating bar will contact with the upstanding arm and move the same rearwardly whereupon the pin **68** will engage within the slot **67** and move upwardly therein. The slot **67** is elongated and upon the reverse movement of the carriage will have a degree of sliding movement which will not affect the position of the upstanding arm **66** and its associated tubular yarn feed, but after the carriage has moved sufficiently to engage the loop forming element with the new yarn, the rearward end of the slot will engage the rearward face of the pin **68** and will turn the upstanding arm back to its original position. Each of the supporting plates **64** is formed with a pivot aperture **71** centrally of the meeting point of its horizontal and upstanding arms and concentrically therewith is provided with a segmental plate **72** having a pair of notches **73**, **74** at its rearward edge adapted to be engaged by a spring finger **75** having a rounded terminal **76** at its face end to ride into such notches. The supporting plates **64** for the yarn feeds are mounted in a frame **81** formed of a plurality of thin spaced metal plates **82** open at their front edges and rearward edges and over a portion of the top edges so as to form firm guide members for the plates and yarns. The spaced plates provide passageways within which the operating arms **41** engage upon the reciprocation of the carriage. This engagement of the arms with such plates serves to move the carriage **34** whenever the yarn-carrying frames on the baseboards **83**, **84**, respectively, are shifted laterally. To provide for this lateral shifting of the yarn-carrying frames and the associated tensioning mechanism, the same are supported upon baseboards **83**, **84**, respectively. When Milanese knitting takes place, the yarn carriers respectively on the baseboards **83**, **84**, may each be shifted in opposite directions. When other types of purl fabric are being made, either carriage or baseboard **83**, **84** may be shifted first in one direction and then the other, or in my preferred form of shifting, the yarn carriage on the base-board **83** may be shifted each time the loop forming element approaches that side of the knitting path until the loop-carrying element has completely traversed the apparatus from one side to the other. Thereafter, the yarn-carrying frame mounted on the base-board **83** is held stationary while the yarn-carrying frame and its associated mechanism mounted on the base-board **84** is shifted step by step in the return passage across the apparatus, whereupon the cycle will be repeated and the motion again transferred to the yarn-carrying frame on the base-board **83** similar to that first described. In this manner, a selvage will be knitted at each edge of a section of flat fabric. A number of loop-forming elements may be supplied on the sliding carriage **34**, the number being limited only by the amount of space required for the loop-forming element to have satisfactory working clearance.

The mechanism for shifting the yarn-carrying frames and their associated mechanism mounted on the respective base-boards **83** and **84** comprises a spring-pressed toggle member **85** and a shifter-bar **86** carried on the inner sides of the sleeves **18** adjacent opposite ends for the oppositely positioned yarn-carrying frames and baseboards. In the normal path of movement of the sliding sleeves **18**, the shifter bars will not have sufficient movement to actuate the carriages. In order to effect such actuation, an intermediate member **87** is provided having a sliding shuttle bar **88**. The shuttle bar on one side will normally be out of alinement with the path of movement of the shifter bar, as shown at the right in Figures 7 and 8, while the other side is in direct alinement, as shown at the left in Figures 7 and 8, and permits the intermittent transverse shifting of the base-board. The means for throwing the shuttle bars into and out of operation comprises a pivoted frame **91** provided at each side of the transverse path of movement of the sliding carriage, the frame being pivoted on arms **92** at each side of the narrowing and widening abutment **98**, hereinafter to be explained. As the sliding carriage **34** moves to one side, an upstanding arm **94**, mounted on extensions at each lateral end face of the carriage **34**, as shown in elevation and plan, respectively, in Figures 1 and 2, will strike the frame **91**, and thereafter the arm **95** of the frame **91**, extending downwardly to the position of the toggle mechanism and supporting the intermediate member **87**, will move the shuttle bar **88** in the appropriate direction. A similar upstanding arm **96**, like the arm **94**, is

provided on the opposite side of the carriage 34 to shift the shuttle bar 88 on opposite side in the appropriate direction. The members 95, 96, have a connecting bar 93 which serves to give opposite movement to its companion bar.

The narrowing and widening mechanism comprises a pair of abutments 97, 98 adapted to be contacted by the shifter bar contact members 45 which change the position of the pawls 53, 54 engaging the rack bars 51, 52, so that the motion of the carriage will be reversed in synchronism with the reversal of the toggle mechanism operating means.

The yarn-tensioning means comprises a mechanism interposed between the source of yarn supply in the form of an elevated platform 101 carrying spools 102 upon which the yarn is wound and feeding through the flexible arms 103 which control brakes 104. The yarns travel from the ends of said arms to the yarn-tensioning rollers 105 running beneath idlers 106 on one side and idlers 107 on the opposite side. The idlers 107 as well as idlers 106 are carried upon a bar 108 adapted to be lifted by the supporting plates for the yarn feeding tubes, as will be presently described. The bars 108 are mounted on pivots 109 on the inner side of the respective yarn carrying frame 81, and upon the bars 108 being lifted, they will lift the tensioning rollers 105 along with the idlers. This will serve to shorten the yarn path and provide abundant slack yarn for the knitting operation, and upon the restoration of the parts to the position shown in the drawings will again tension the yarn by resuming their position, as well as setting in motion the yarn tensioning operation. The rollers 105 are adapted to be moved in a yarn tensioning direction through contact with the continuously operating roller 111 driven from the motor by a line of shafts and bevel gears 112. Apart from the action of the yarn tube plates in lifting the bar 108, the action of the roller itself will lift the bar if the tension becomes too great by drawing the yarn taut beneath the idler 107, whereupon it will act as the bar-lifting means in view of the yarn extending over an adjacent idler 113 at a slightly higher point. Thus the yarn tensioning movement of the roller will be momentarily interrupted and excessive yarn tension will be avoided. Where pile yarns are fed to the mechanism they will avoid the tensioning apparatus just described, and as noted in Figure 1, the pile yarn 114 will pass directly to the yarn tube 63 after extending about an idler 115. If desired, any necessary amount of tension may be applied to the pile yarns to insure sufficient take-up to avoid waste of material.

In order to shape the marginal portions of the fabric unsymmetrically with reference to each other, it will be necessary to change the height of the abutments 97, 98 relatively to each other. This may be accomplished by a suitable cam mechanism being interposed beneath the abutments, the cam being operated from a drum 116 driven from the line of shafting which actuates the tensioning rollers, the transverse shaft 117 connecting with the drum 116 which carries on its outer circumferences a series of cam plates 118 which actuate a shifter bar 119 which turns a ratchet wheel 121 connected by a shaft 122 with the cam 123 operating cam 124 and shaft 127. Where differential action is desired, the cam 123 is brought into contact with the cam 124 and shaft 126, which serve to transmit reverse action to the opposite abutment through the shaft 126 extending beneath the base plate 1 of the apparatus. In this way the shifter bar contact members 45 strike the respective abutments at different times, as will the bars 94, 96 which move the respective carriages or baseboards 83, 84, and thus the point of reversal of the direction of movement of the sliding carriage will be changed as desired.

In place of carrying the spread loop over the end of the yarn feeding tube, it is possible to utilize a specially shaped yarn feeding element which carries a spread loop adjacent a substantially vertically held strand of yarn and form the loop directly from such strand without the intervention of a tube beneath the yarn forming element.

In Figure 12 is shown a loop-forming element 151 having a spread loop 152 past the strand of yarn 153 in a position wherein the loop-engaging point 154 is in the yarn engaging position and upon the reverse movement of the yarn loop-forming element will draw a loop similar to the loops heretofore shown.

The apparatus herein described is adapted for high speed operation and with multiple yarn feeds similar to any of the series of yarn feeds here described and multiple loop-forming elements similar to such elements here described the output of the fabric can be very rapidly stepped up without in any way affecting the quality of the product.

The operation of the apparatus has already been indicated in connection with the description of the several parts, but the operation will now be described first to show how the apparatus will operate as a full width plain fabric high speed production machine, disregarding any narrowing and widening adjustments and disregarding for plain fabric production the supplying of pile yarns.

With a yarn in each tubular yarn feed 63 and preferably with the free ends extending through the slot and with all the yarns connected to a bar clamp or light weight or merely joined in a common knot, a single slip loop from one yarn, such as is shown over the loop forming element 36, in Figs. 1, 3, 4, 5 and 6, is placed over the projection 36*a* of the loop forming element on the side toward which the sliding frame 20 is to be moved. The sliding frame 20 carries the carriage 34 on which the looping element 36 is supported. Each yarn it will be noted by reference to Figure 10 extends from its spool 102 through the yarn tensioning elements. The yarn, as stated, then passes into the tubular yarn feeds 63 and into the fabric slot or throat 61.

As the sliding frame 20 is moved to the left in Figure 1, it lifts the first of the left hand tubular yarn feeds 63, in the manner shown in detail in Figure 4, the projecting arm 41 tilting the member 64 by engaging the upright portion 66, the pin 68 simultaneously entering the slot 67, and the spring finger 76 riding into the upper notch 74. As disclosed in Figure 4 the loop is carried over the tubular feed 63 and the opposite projection 36*b* of the loop-forming element 36 is then in position to engage the yarn in the tubular yarn feed 63 which as stated has been tilted to horizontal position. Just before the carriage reaches its limit of movement to the left it slides the baseboard 83 and its whole series of tubular yarn feeds transversely one space so as to aline the upturned horizontally positioned yarn feed

with the opposite yarn feed on the right as shown in Figures 1 and 7.

This transverse movement is brought about by contact of the shifter bar 86 with the sliding shuttle bar 88 which is in line by reason of the position of the shifting mechanism shown in detail in Figure 11, and in general position in Figures 1 and 2, and these alined members act on the spring-pressed toggle member 85, which shifts the baseboard 83. As the baseboard 83 shifts the arm 41 interlocked with the partition plate 82 moves the carriage 34, and the pawl 53 locks the carriage in the new position. The sliding frame then moves to the right carrying the loop-forming element to the position shown in Figure 8. As it moves, the pin 68 is contacted by the arm 41 after using up the lost motion provided by the slot 67, the new loop is drawn, the horizontal tubular member is returned to its original inclined position, and the original loop is cast off. The tensioning elements automatically take up the slack and tighten the old loop about the base of the newly drawn loop. On the return movement of the projecting arm 41 it clears the partitions and releases the baseboard 83 and its associated parts which are returned to the original position by the spring pressed toggle member 85.

The second loop is now over the tubular member 63 on the right hand side as shown in Figure 8. After the release of the baseboard 83 the parts are in the position shown in Figure 9, the yarn looping member 36 slides straight across to a position on the second tubular yarn feed on the left. As it moves across it casts off the second loop which is tightened about the base of the second loop. The cycle is now repeated from the position shown in Figure 7 but with reference to the second tubular member on the left instead of the first tubular member as the drawings show. Thereafter operation will be repeated for each tubular member on the left as the knitting progresses, until the carriage has moved completely across the apparatus. This movement is one space at a time the pawl locking the carriage at each stage against return movement, when pressure on the toggle is released by the shifter bar 86 and its associated mechanism.

When the carriage reaches the outer side of the sliding frame 20 the shifter mechanism shown in Figure 11 is actuated and the shifter bar on the opposite side of the apparatus which is connected with the baseboard 84 is brought into action and the shifter bar actuating the baseboard 83 is rendered ineffective. This is accomplished by merely shifting the sliding shuttle 88 out of alinement on one side and into alinement with the shifting mechanism on the opposite side. The baseboard 83 then acts in the manner in which the baseboard 84 previously functioned, and this continues until the carriage has again reached the original position across the path of the series of tubular yarn feeds. The transverse cycle is then repeated and the action continues until the desired amount of fabric has been produced. On the reverse movement the pawl 53 is withdrawn and the pawl 54 is put into action by the mechanism shown in Figures 1, 2, and more in detail in Figures 13 and 14.

The narrowing and widening and fashioning mechanism is fully set forth and will be readily understood from the description at such points with the operation that has just been set forth. The addition of the pile fabric yarn is very simple inasmuch as there is no tensioning action on such yarns beyond that applied at the spools.

Other modes of applying the principle of my invention may be employed instead of those explained, change being made as regards the means and steps herein disclosed, provided the means and steps stated by any of the following claims or the equivalent of such stated means and steps be employed.

I therefore particularly point out and distinctly claim as my invention:

1. An apparatus of the character described having in combination a frame, a loop-forming means movably supported on said frame, means for reciprocating said loop-forming means longitudinally of said frame, means for moving said loop-forming means transversely of said frame, a plurality of oppositely disposed yarn-feeding elements adjacent the knitting margin of the fabric being formed, and means for bringing predetermined individual yarn-feeding elements adjacent the path of movement of said loop-forming means to permit said loop-forming means to interloop said yarns on said loop-forming means with previously formed loops.

2. An apparatus of the character described having in combination a frame, loop-forming means movably supported on said frame, means for reciprocating said loop-forming means longitudinally of said frame, means for moving said loop-forming means transversely of said frame, a plurality of oppositely disposed yarn-feeding elements adjacent the knitting margin of the fabric being formed, means for bringing predetermined individual yarn-feeding elements adjacent the path of movement of said loop-forming means to permit said loop-forming means to interloop said yarns on said loop-forming means with previously formed loops, and means for tensioning said yarns.

3. An apparatus of the character described having in combination a frame, loop-forming means movably supported on said frame, means for reciprocating said loop-forming means longitudinally of said frame, means for moving said loop-forming means transversely of said frame, a plurality of oppositely disposed yarn-feeding elements adjacent the knitting margin of the fabric being formed, means for bringing predetermined individual yarn-feeding elements adjacent the path of movement of said loop-forming means to permit said loop-forming means to interloop said yarns on said loop-forming means with previously formed loops, and combined take-up and tensioning means for said yarns.

4. An apparatus of the character described having in combination a frame, loop-forming means movably supported on said frame, means for reciprocating said loop-forming means longitudinally of said frame, means for moving said loop-forming means transversely of said frame, a plurality of oppositely disposed yarn-feeding elements adjacent the knitting margin of the fabric being formed, means for moving predetermined individual yarn-feeding elements vertically to a point adjacent the path of movement of said loop-forming means and thence transversely to permit said loop-forming means to interloop said yarns on said loop-forming means with previously formed loops, and combined take-up and tensioning means for said yarns.

5. An apparatus of the character described having in combination a frame, loop-forming means movably supported on said frame, means for reciprocating said loop-forming means longi-

tudinally of said frame, a pair of oppositely disposed yarn-feeding carriages adjacent the knitting margin of the fabric being formed, individual yarn-feeding elements positioned on said yarn-feeding carriages, means for moving predetermined individual yarn-feeding elements adjacent the path of movement of said loop-forming means to permit said loop-forming means to interloop said yarns on said loop-forming means with previously formed loops, means for shifting one of said carriages transversely of the knitting path with the associated loop-forming mechanism, and combined take-up and tensioning means for said yarns.

6. An apparatus of the character described having in combination a frame, loop-forming means movably supported on said frame, projecting members associated with said loop-forming means, means for reciprocating said loop-forming means in one direction on said frame, a plurality of oppositely disposed yarn-feeding carriages adjacent the knitting margin of the fabric being formed, individual yarn-feeding elements positioned on said yarn-feeding carriages, means for moving predetermined individual yarn-feeding elements adjacent the path of movement of said loop-forming means to permit said loop-forming means to interloop said yarns on said loop-forming means with previously formed loops, means permitting said projecting members to interengage with said yarn-feeding carriages, means for shifting one of said carriages with the interengaged projecting means transversely of the knitting path, and means for restoring said carriage to its original position.

7. An apparatus of the character described having in combination a plurality of tubular yarn feeds closely adjacent the fabric margin having at least one yarn extending through each tubular yarn feed, means for drawing said yarns through said yarn feeds in the process of forming a loop, whereby said tubes seat against the base of said loops to draw the same to permanent loop size.

8. An apparatus of the character described having in combination a plurality of tubular yarn feeds closely adjacent the fabric margin having at least one yarn extending through each tubular yarn feed, means for drawing said yarns through said yarn feeds in the process of forming a loop, whereby said tubes seat against the base of said loops to draw the same to permanent loop size, means for elevating selected yarn feeds, and means for forming loops from the yarns within said elevated yarn feeds.

9. An apparatus of the character described having in combination a plurality of tubular yarn feeds closely adjacent the fabric margin having at least one yarn extending through each tubular yarn feed, means for drawing said yarns through said yarn feeds in the process of forming a loop, whereby said tubes seat against the base of said loops to draw the same to permanent loop size, means for elevating selected yarn feeds, means for forming loops from the yarns within said elevated yarn feeds, and means for releasing the tension upon the yarn within the tubular feeds which are elevated.

10. An apparatus of the character described having in combination a plurality of tubular yarn feeds closely adjacent the fabric margin having at least one yarn extending through each tubular yarn feed, means for drawing said yarns through said yarn feeds in the process of forming a loop, whereby said tubes seat against the base of said loops to draw the same to permanent loop size, means for elevating selected yarn feeds, means for forming loops from the yarns within said elevated yarn feeds, and means actuated by the elevation of a selected tube for releasing the yarn tension when the loop is being drawn.

11. An apparatus of the character described having in combination a plurality of tubular yarn feeds closely adjacent the fabric margin having at least one yarn extending through each tubular yarn feed, means for drawing said yarns through said yarn feeds in the process of forming a loop, whereby said tubes seat against the base of said loops to draw the same to permanent loop size, means for elevating selected yarn feeds, means for forming loops from the yarns within said elevated yarn feeds, means actuated by the elevation of a selected tube for releasing the yarn tension when the loop is being drawn, and means for increasing the yarn tension as the tubular yarn feed is restored to its original position.

12. An apparatus of the character described having in combination a plurality of tubular yarn feeds closely adjacent the fabric margin having at least one yarn extending through each tubular yarn feed, means for drawing said yarns through said yarn feeds in the process of forming a loop, whereby said tubes seat against the base of said loops to draw the same to permanent loop size, means for elevating selected yarn feeds, means for forming loops from the yarns within said elevated yarn feeds, means actuated by the elevation of a selected tube for releasing the yarn tension when the loop is being drawn, means for increasing the yarn tension as the tubular yarn feed is restored to its original position, and independent means operable when said yarn feed is restored to position for applying further tension to the yarn passing through said tube.

13. An apparatus of the character described having in combination a plurality of tubular yarn feeds closely adjacent the fabric margin having at least one yarn extending through each tubular yarn feed, means for drawing said yarns through said yarn feeds in the process of forming a loop, whereby said tubes seat against the base of said loops to draw the same to permanent loop size, means for elevating selected yarn feeds, means for forming loops from the yarns within said elevated yarn feeds, means actuated by the elevation of a selected tube for releasing the yarn tension when the loop is being drawn, means for increasing the yarn tension as the tubular yarn feed is restored to its original position, independent means operable when said yarn feed is restored to position for applying further tension to the yarn passing through said tube.

WILLIAM J. WESSELER.