Dec. 14, 1943. R. C. AMIDON 2,336,455

KNITTING MACHINE

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Fig. 1.

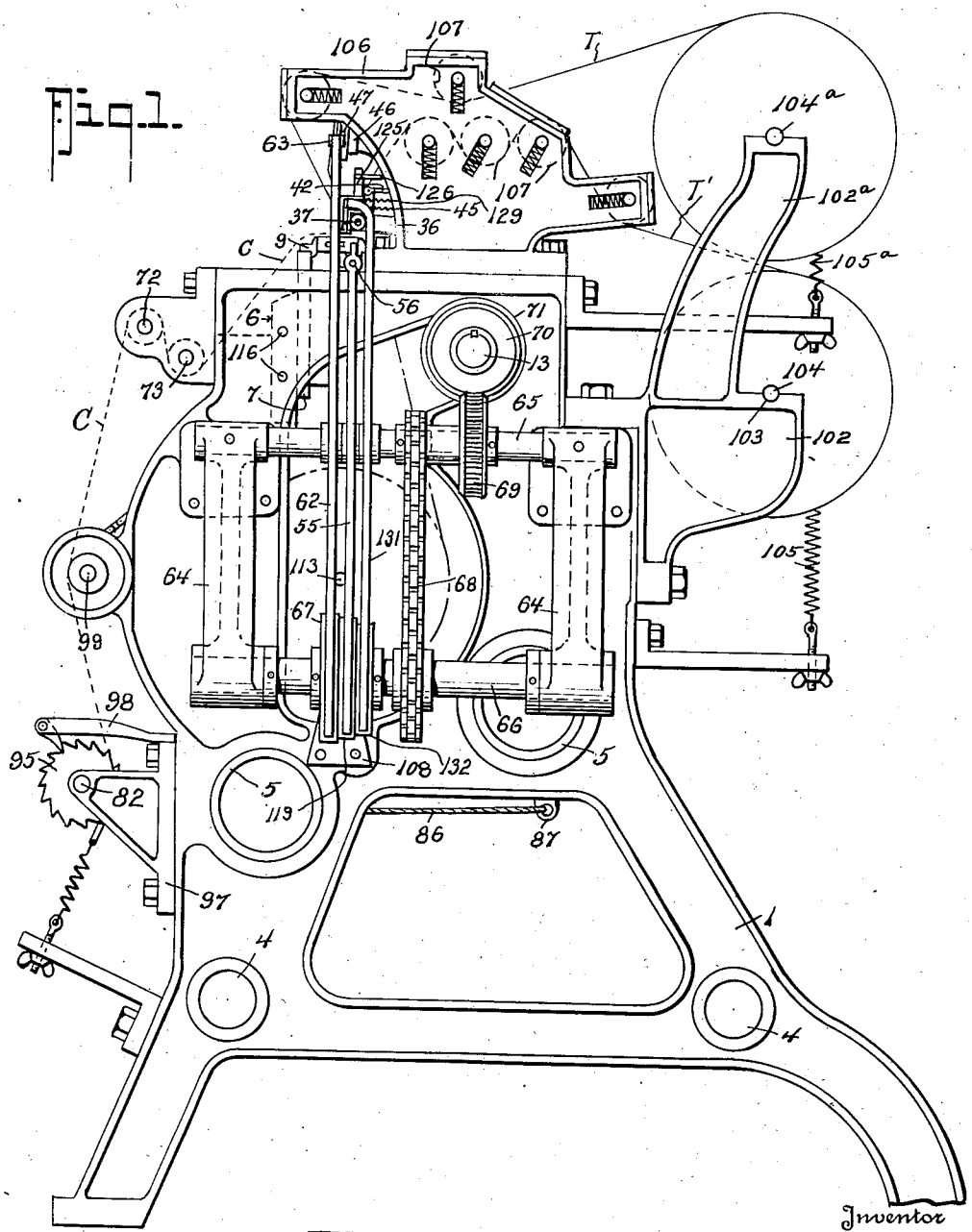
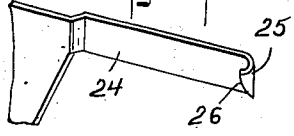


Fig. 23.



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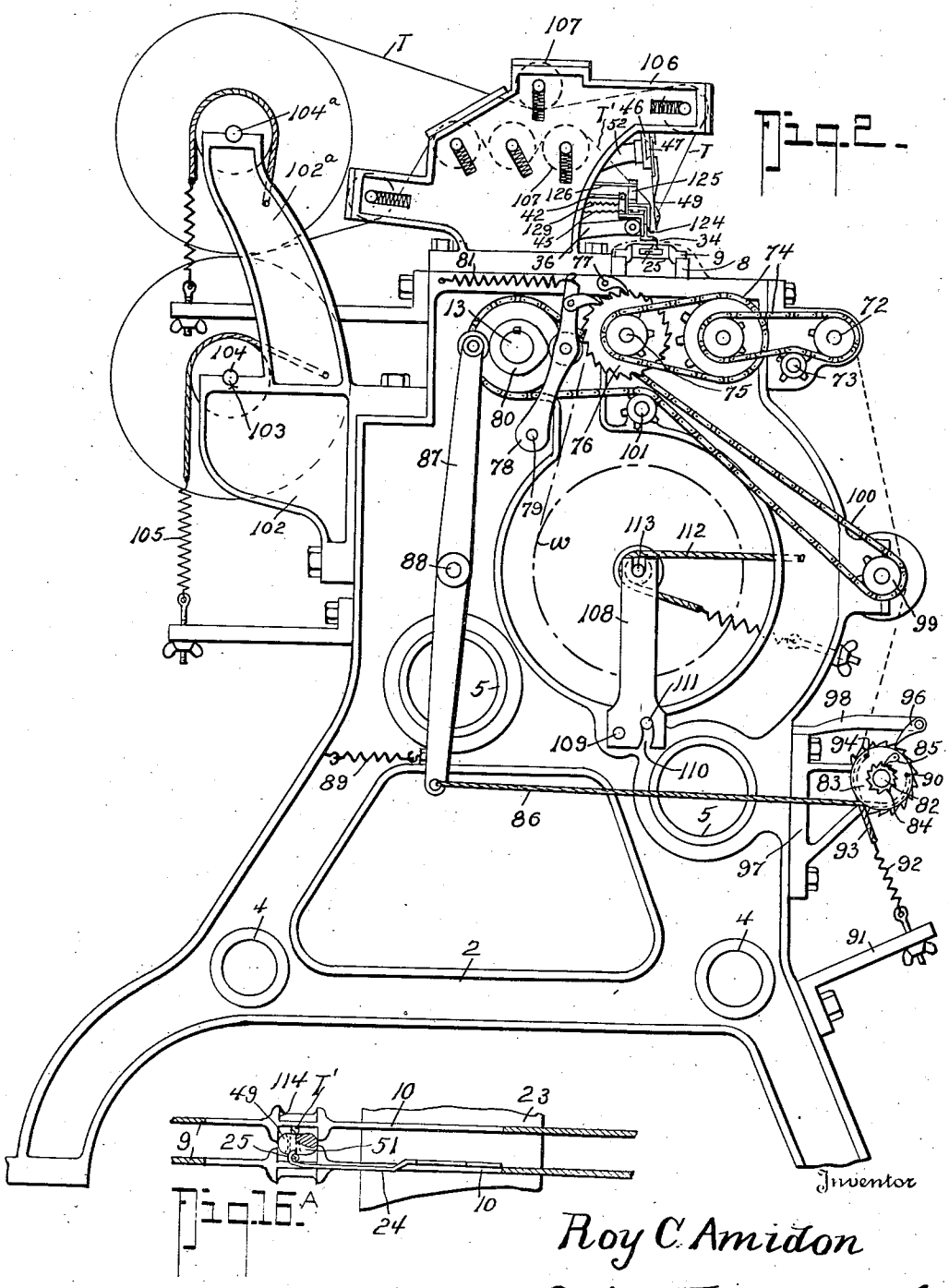


Fig. 2.

Fig. 16A.

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Fig. 3.

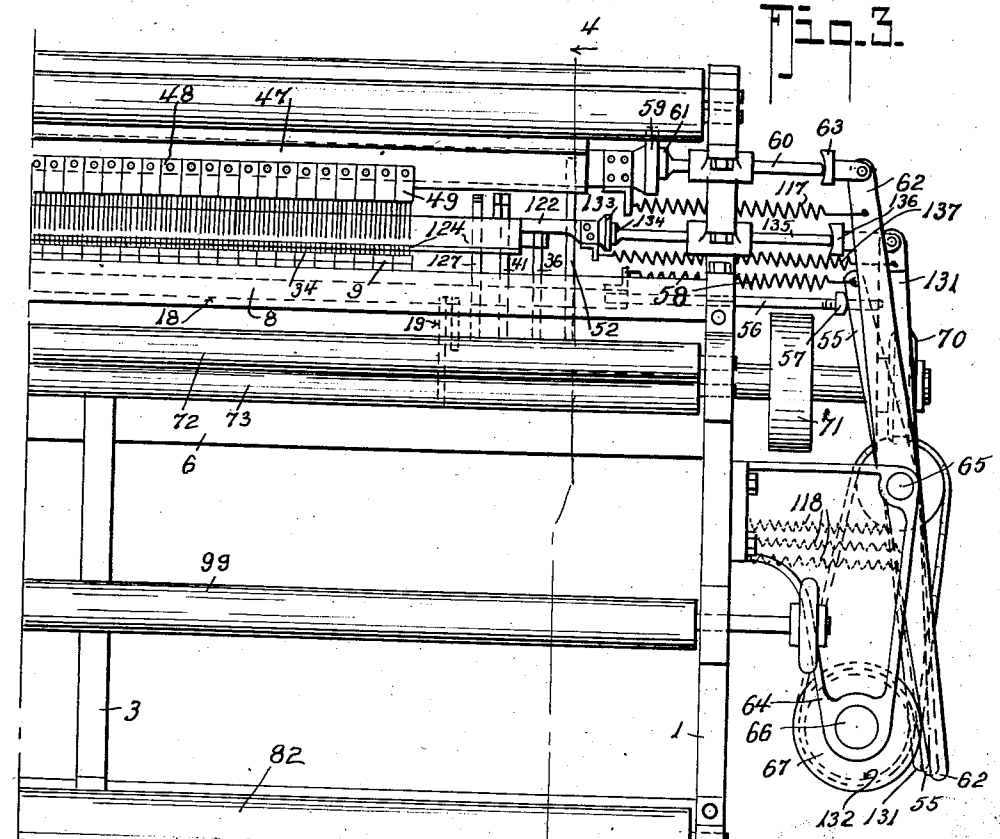


Fig. 17.

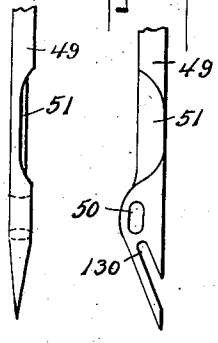
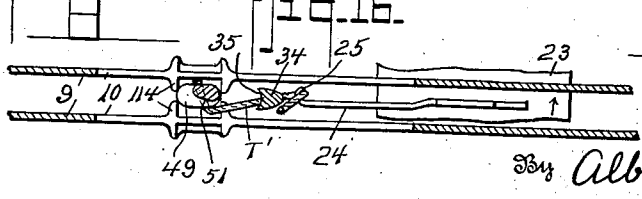


Fig. 18.

Fig. 16.



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Fig. 4.

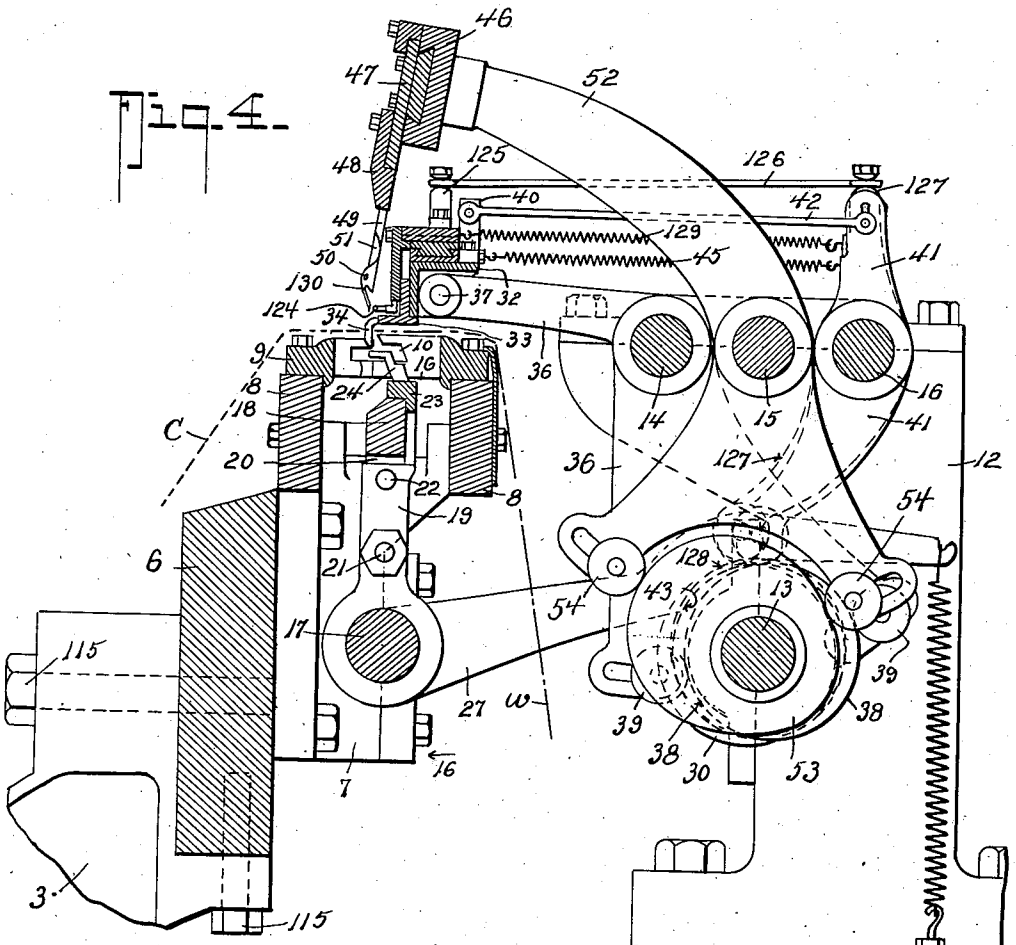


Fig. 21.

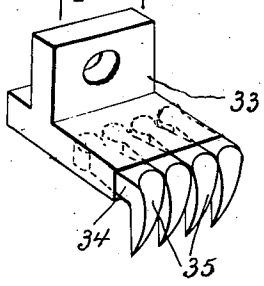
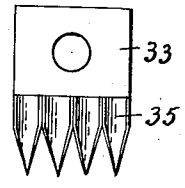


Fig. 22.



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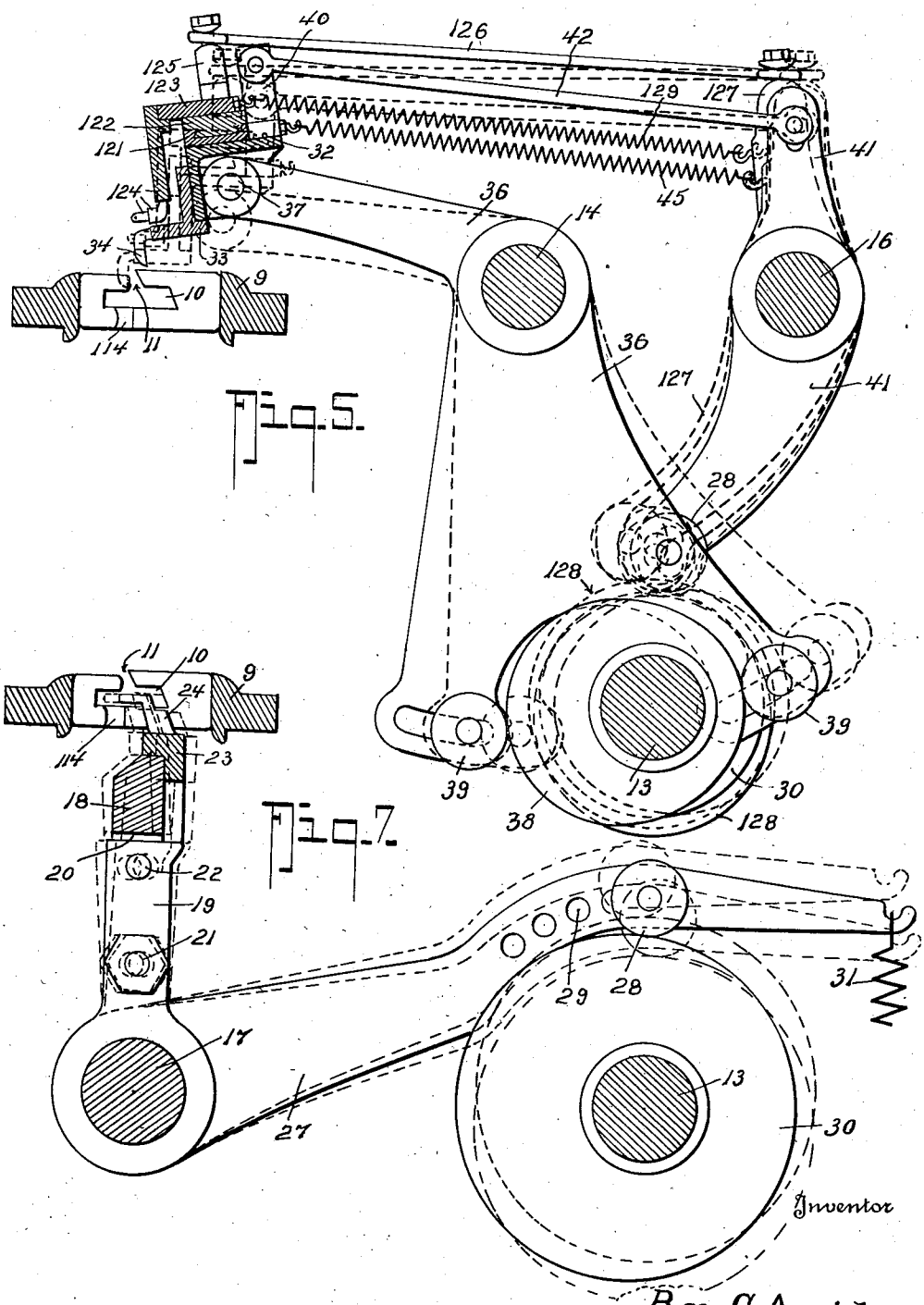


Fig. 5.

Fig. 7.

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Fig. 27.

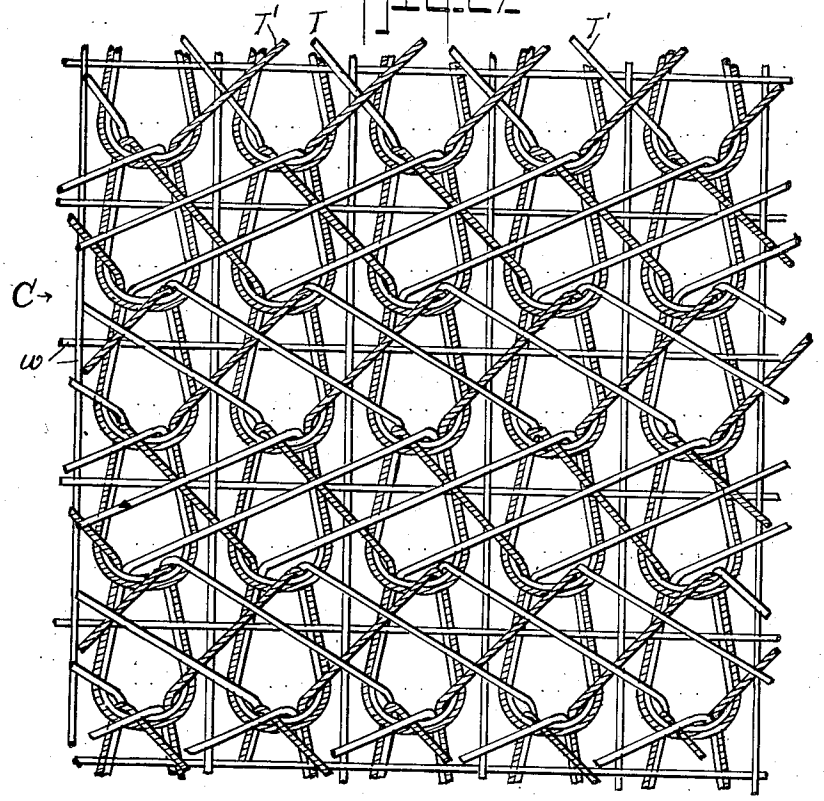


Fig. 19.

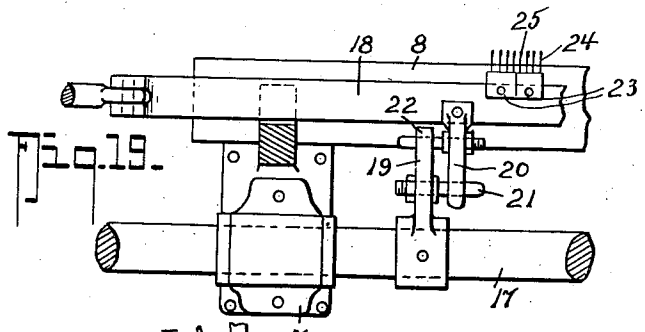


Fig. 24.

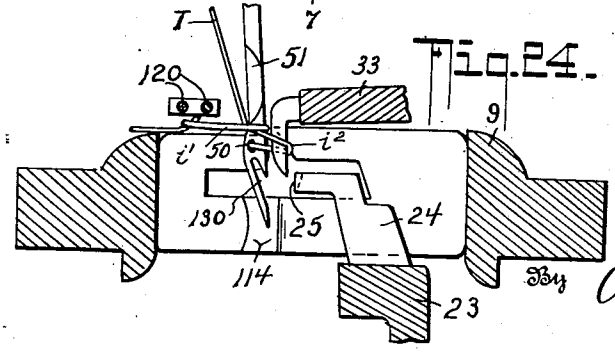
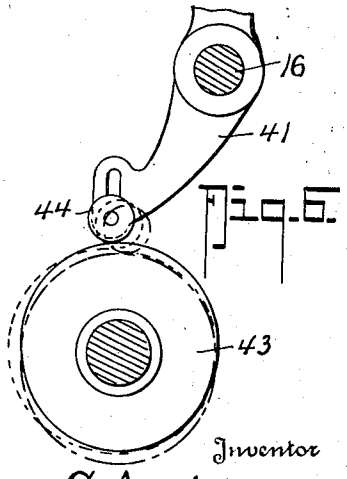


Fig. 6.



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Fig. 8.

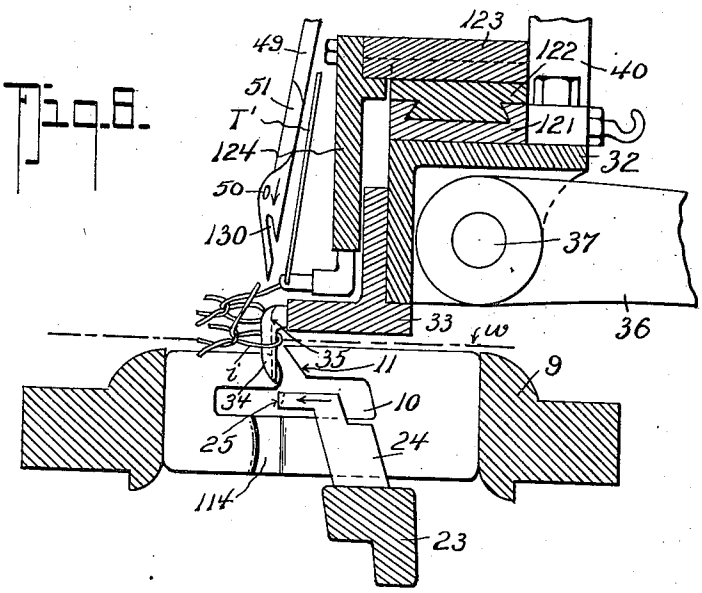
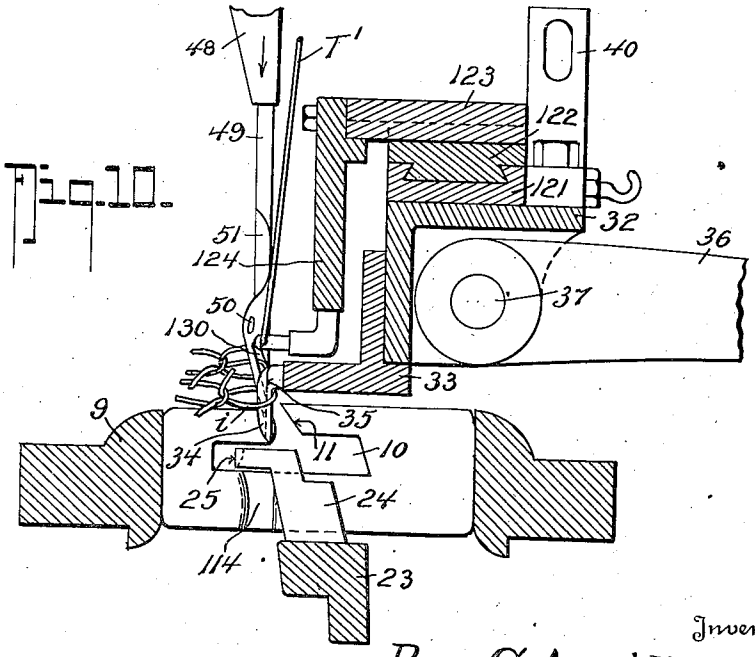


Fig. 10.



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Fig. 9.

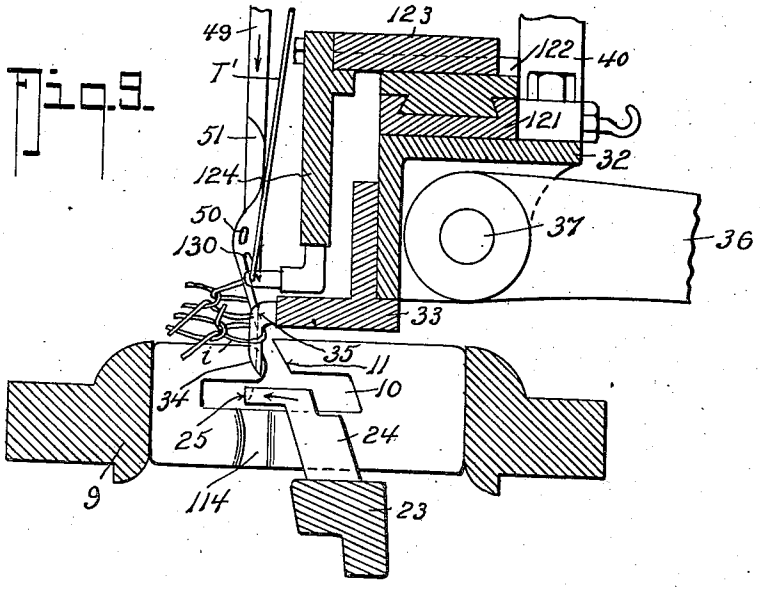
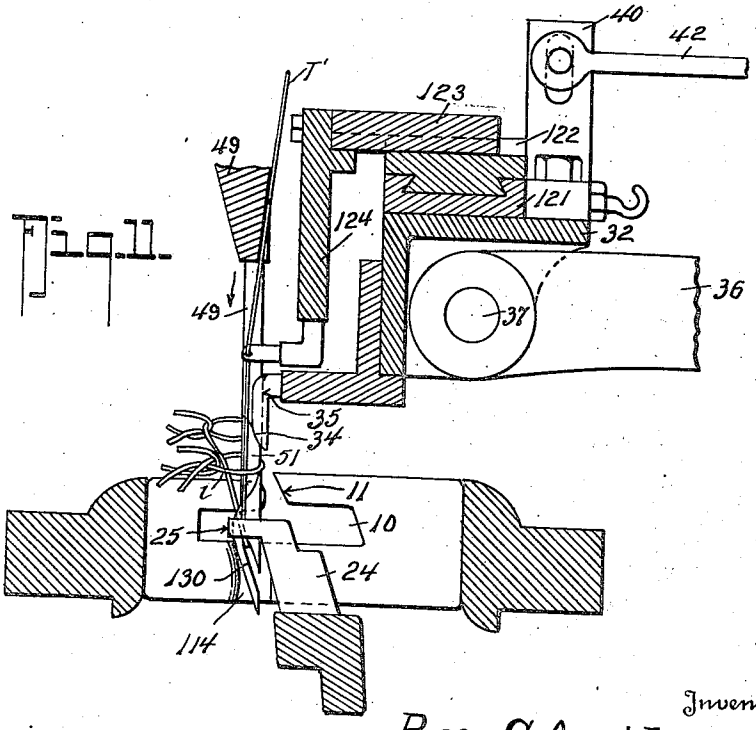


Fig. 11.



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Fig. 12.

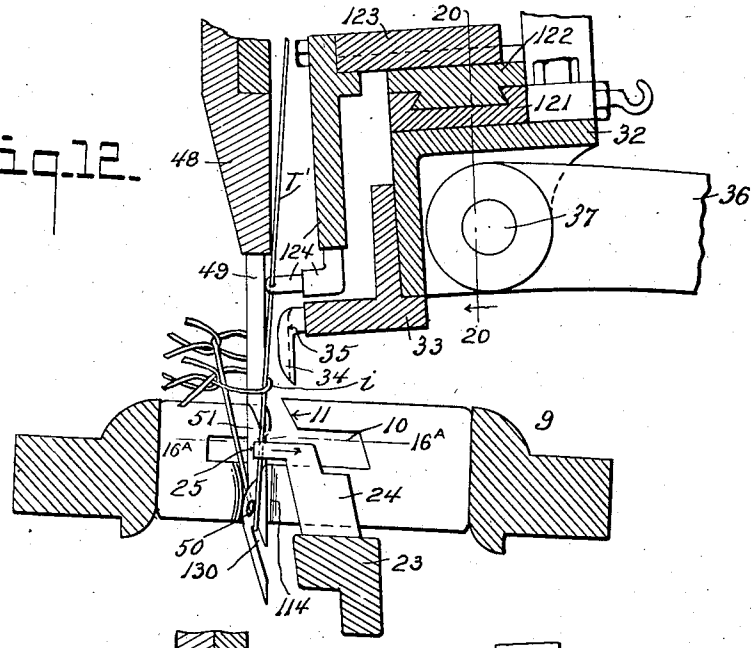


Fig. 13.

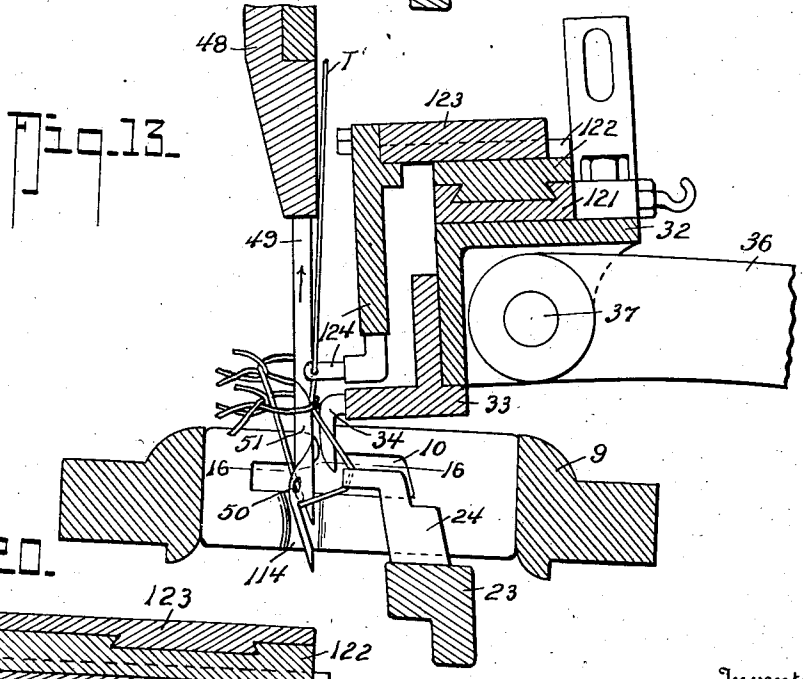
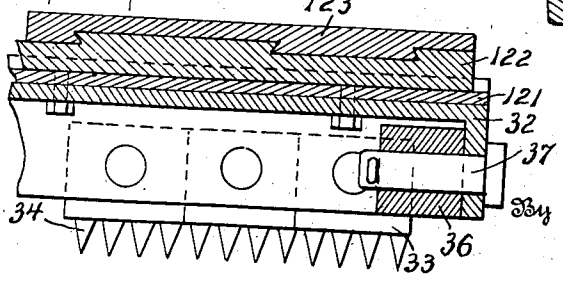


Fig. 20.



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Fig. 14.

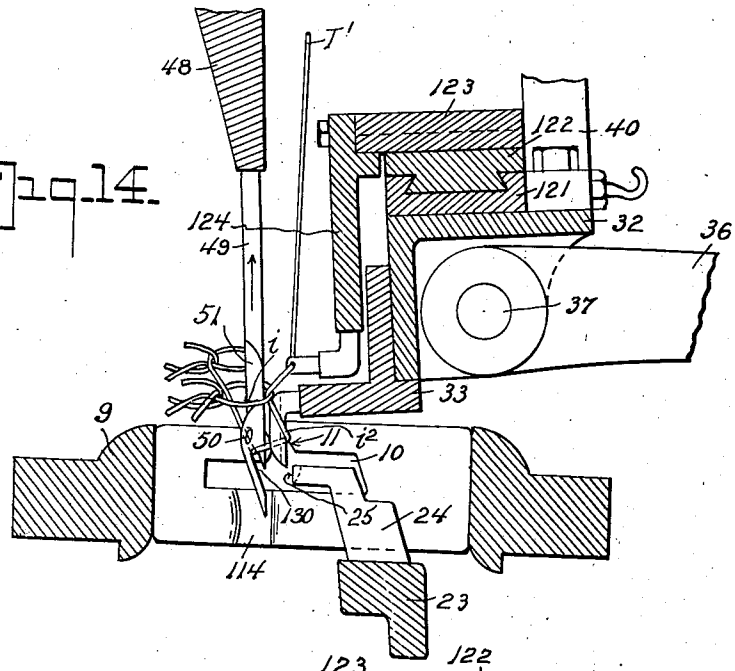
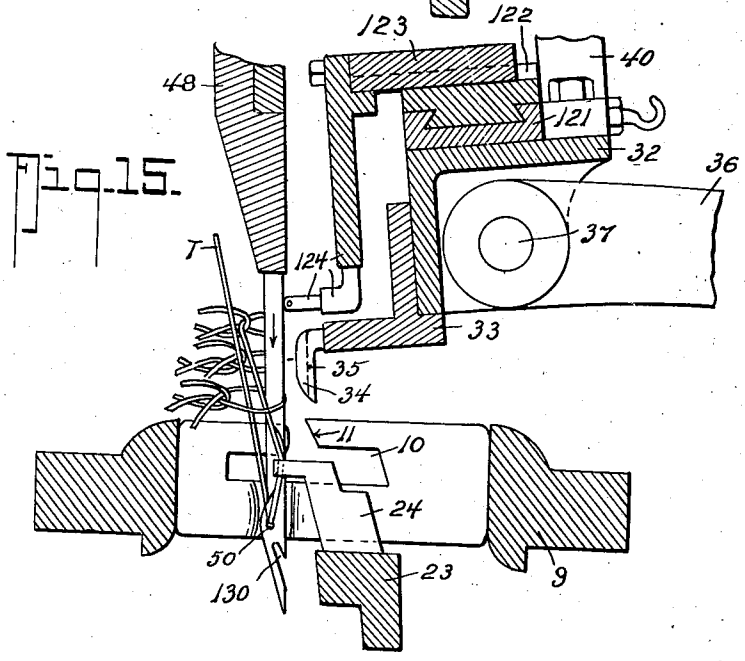


Fig. 15.



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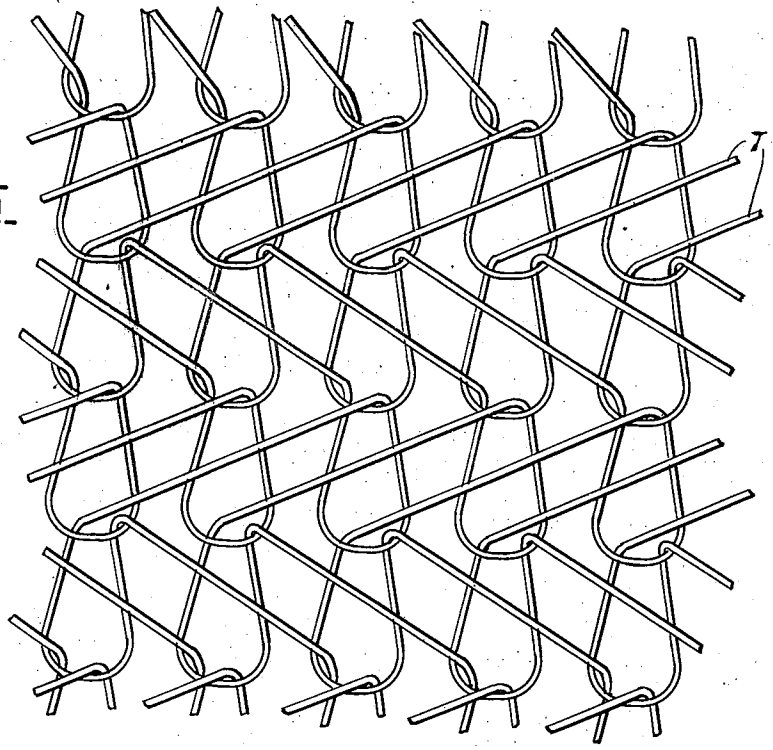
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Fig. 25.



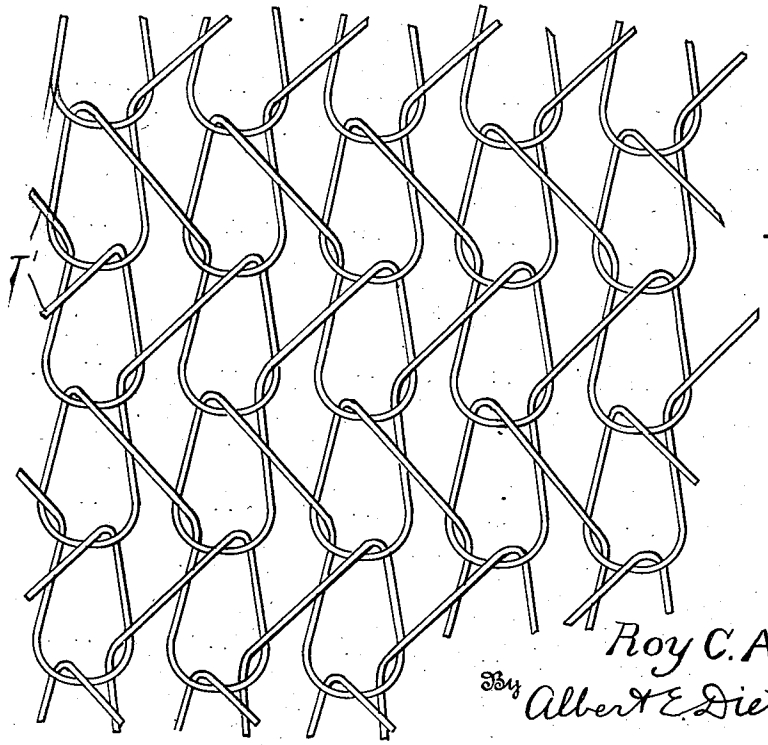


Fig. 26.

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Patented Dec. 14, 1943

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UNITED STATES PATENT OFFICE

2,336,455

KNITTING MACHINE

Roy C. Amidon, St. Johnsville, N. Y., assignor to Vanity Fair Mills, Inc., a corporation of Pennsylvania

Application March 2, 1942, Serial No. 433,057

30 Claims. (Cl. 66—1)

My invention, which relates to the art of knitting, has especial relation to that branch of the art in which the knitting is performed through a previously woven base fabric or sheet of base material; also that branch of the art which has to do with one or two guide bar knitting machines, such as the fast warp or Tricot machine, or other methods of knitting which use one or two guide bars from which a guide places a thread through and around a needle in a position such that the thread can be drawn under the beard of a bearded needle or within the latch of a latch-type needle.

The invention has for its object to provide a new and improved machine that will produce a single or dual thread knitting operation without the use of bearded needles and latch needles, and without the means for closing the beards of bearded needles while performing a knitting function.

A further object of the invention is to provide a needle which has an eye for threading and a slot into which a thread may be placed by a guide and by virtue of which the machine may have provision by which the needles may be racked across any reasonable number of stitches while the guide places a thread in the slot in a racking process from one line of stitches to another in the manner of dual thread knitting.

The invention also provides a guide working in between the needles in an in-and-out manner, as well as racking from stitch to stitch, by means of a pattern cam.

A further object of my invention is to provide a machine in which the needles have no dwells in their up and down strokes, in consequence of which shorter strokes of the needles may be used in the performance of the knitting operation and the speed of the machine be correspondingly increased. This is a marked improvement over the Tricot machines in which, during the knitting operation, there is a dwell of the needles during the knitting motion at the time the guide places the thread around the needle to be drawn under the beard and another dwell at the time the beard presser closes the needle beard.

Other objects will in part be obvious and in part be pointed out hereinafter.

To the attainment of the aforesaid objects and ends the invention still further resides in the novel details of construction, combination and arrangement of parts, all of which will be first fully described in the following detailed description, and then be particularly pointed out in the appended claims, reference being had to the accompanying drawings, in which:

Fig. 1 is a right side elevation of a machine embodying my invention.

Fig. 2 is a left side elevation of the same.

Fig. 3 is a front elevation of a portion of the machine.

Fig. 4 is an enlarged cross section on the line 4—4 of Fig. 3.

Fig. 5 is an enlarged detail view of the awl and thread guide operating mechanism.

Fig. 6 is a detail view of a portion of the awl mechanism.

Fig. 7 is a detail view of the looper mechanism.

Figs. 8 to 15, inclusive, are enlarged detail cross-sectional views of a portion of the machine on the line 4—4 of Fig. 3.

Fig. 16 is a detail section on the line 16—16 of Fig. 13.

Fig. 16^A is a detail section on the line 16^A—16^A of Fig. 12.

Fig. 17 is a front elevation of a portion of a needle.

Fig. 18 is a side view of the same.

Fig. 19 is a detail view in rear elevation of a portion of the machine, hereinafter specifically referred to.

Fig. 20 is a detail section on the line 20—20 of Fig. 12.

Fig. 21 is a perspective view of an awl block and its awls.

Fig. 22 is a front elevation of the same.

Fig. 23 is a detail perspective view of one of the looper hooks.

Fig. 24 is a view similar to those of Figs. 8 to 15, but showing a modification hereinafter referred to.

Fig. 25 is a diagrammatic view of a portion of a fabric such as may be knit by using a single thread through the eye of each needle.

Fig. 26 is a diagrammatic view of a portion of a fabric such as may be knit by using single threads in the thread guides and using the slot parts of the needles.

Fig. 27 is a diagrammatic view of a portion of a fabric such as may be knit by using two threads per needle, one through the eye and one through the guide in cooperation with the slot part of the needle simultaneously.

In the drawings, in which like numerals and letters of reference indicate like parts in all the figures, 1 represents the right end frame standard, 2 the left end frame standard, and 3 the intermediate frame standards of which there may be one or more according to the width of the

machine. These standards are connected by brace rods 4 and brace tubes 5 into a rigid frame structure.

Extending the full width of the machine and secured to the intermediate standards 3 by bolts 115 (Fig. 4) and to the end frames 1 and 2 by end bolts 116 (Fig. 1), is a main supporting bar 6 to the back of which, at suitable intervals, brackets 7 are attached. The brackets 7 carry bars 8 which support the stationary guides 9. The guides 9 have their blades provided with longitudinal slots 10 and slots 11 which serve to ease the loops around the awls in the upward movement. The blades may also have needle guides 114 (Fig. 16) if desired.

Mounted on the intermediate standards 3 are brackets 12 which have bearings for the cam shaft 13 and rock-shafts 14, 15 and 16. The brackets 7 have bearings for the looper rock-shaft 17 to which a suitable number of arms 19 are secured. The arms 19 carry, adjustably, pins 21 which slide in holes in arms 20 that are secured to the looper bar 18, and also have pins 22 operating in holes in arms 19. In this way arms 19 carry the looper bar 18 while permitting endwise movement of the same, as will later more fully appear. The looper blade units 23 are secured to the bar 18 (see Figs. 4 and 19). Each unit 23 comprises a predetermined number of looper blades 24 whose ends are formed into hooks 25, which hooks have inclined edges 26 (see Fig. 23) to permit the thread to be drawn off the hooks on the up-stroke of the needles.

The looper bar 18 is moved bodily forward and backward by means of one or more arms 27 and cams 30, the arms 27 having cam-engaging rollers 28 and adjustable means 29 therefor.

A spring 31 holds the roller 28 to its cam.

32 designates the awl-carrying bar which is pivotally carried at 37 on arms 36 that are secured to shaft 14 (Fig. 5).

Awl units 33 are suitably secured to the bar 32 and each unit has a predetermined number of awls 34. The awls are grooved at 35 to receive and guide the needles. The awls are raised and lowered by a cam 38 which engages rollers 39 on the arm 36.

The members 34 perform several functions, namely, they serve as awls for penetrating base fabric when knitting through the same; they serve as guides for the needles, and they serve as loop holders. When knitting without a base fabric the members 34 need not be penetrating awls, as then they need serve only as loop holders and/or needle guides.

Secured to the bar 32 is a short arm 40 to which one end of a connecting rod 42 is adjustably connected; the other end of the rod 42 is adjustably connected to one arm of a rocking lever 41 which is mounted on shaft 16 and has a cam-engaging roller 44 on its other arm to cooperate with the awl bar rocking cam 43. A spring 45 connects arm 40 with lever 41 and keeps roller 44 in engagement with cam 43.

Referring now more particularly to Fig. 4, it will be seen that 46 indicates the needle bar slideway in which the needle bar 47 has endwise movement. The slideway 46 is carried by a suitable number of arms 52 secured on shaft 15 and operated by a suitable cam 53 that engages adjustable rollers 54 on levers 52.

The needle bar 47 carries the needle units, each of which comprises a block 48 having a predetermined number of needles 49.

The needles used in this machine are of the sewing machine needle type, i. e., they are not bearded, but have simple eyes 50, and slots 130. Above the eyes 50 the shanks of the needles are cut away or thinned on one side as at 51 (Figs. 17 and 18) for cooperation with the looper hooks (see Fig. 12).

The looper hooks 25 may, in one position (Fig. 16A), lie in a slot 10 of a blade of the guide 9 so as not to interfere with the proper action of the adjacent needle.

The needle bar 47 is shifted endwise to shift the needles at the proper times by means of a lever 62 (Figs. 1 and 3) which is mounted pivotally on a shaft 65 held rigidly in brackets 64 and operated by a pattern wheel 67. The lever 62 has a sliding abutment 63 against which a push rod 60 abuts. The rod 60 is slidably held in a suitable bearing on the end frame 1 and has a head 61 to slidably abut the head 59 on the end of the needle bar 47. A spring 117 serves to keep the parts 59, 61 and 60, 63 in contact at all times while another spring 118 keeps lever 62 in contact with pattern wheel 67. The pattern wheel 67 is mounted on a shaft 66 rotatably journalled in bearings in brackets 64.

The looper carrying bar 18 is shifted lengthwise by means of a lever 55, also pivoted on shaft 65 and operated by a cam wheel 119. Bar 18 has a rod 56 connected to it, which rod 56 has its free end projected into a hole in lever 55 where it is held by means of a spring 58 and an adjustable stop 57 (see Fig. 3). Wheel 119 is fixed to shaft 66.

Power is applied to the shaft 66 by means of a gear 70 on the cam shaft, which meshes with a gear 69 on a sleeve that also has a sprocket 68 and is loosely mounted on shaft 65. Sprocket 68 drives a chain which passes over another sprocket 68 fixed on shaft 61.

Shaft 13 is driven in any suitable way, as, for example, by pulley and belt 71 (Fig. 3).

Referring now particularly to Figs. 2 and 3, it will be seen that 72 and 73 are the woven-cloth-feeding rolls and their shafts. The shafts are operated by a reducing sprocket and chain drive 74 from a ratchet wheel 76 on a stub shaft 75. Step-by-step motion is imparted by means of a pawl-carrying lever 78, pivoted at 79 and operated by a cam 80 against which the roller on the lever 78 is held by a spring 81. A back check pawl 77 also engages ratchet wheel 76.

82 represents the cloth-wind-up roll and shaft, which shaft is journalled in end bearing brackets 97. A drum 83 is loose on shaft 82, while a ratchet 84 is fast on the shaft. A pawl 85 on the drum engages the ratchet 84.

The drum 83 is turned by means of a cable 86, one end of which is anchored at 90 to the drum and the other end is attached to a lever 87, pivoted at 88 and operated by the cam 80. The lever 87 is held in engagement with the cam by a suitable spring 89.

Tension on cable 86 is effected by a second cable 93 anchored at 94 to the drum and connected to a spring 92 which is adjustably anchored to a bracket 91. A second ratchet 95 is secured to roll shaft 82 and an arm 98 carries a back check pawl 96 for engaging ratchet 95 (Fig. 2).

99 is a hand wheel shaft having a sprocket and chain connection 100 with cam shaft 13, the chain passing over an idler sprocket 101.

Brackets 102 support the thread spool shaft 104 in bearings 103, a suitable tension device 105 being provided (Fig. 2).

Brackets 106 carry thread-guide spring-loaded rollers 107, best shown in Figs. 1, 2 and 3. It will be seen that each end standard 1, 2 has a support 108, 108, respectively, for the shaft of the woven base fabric roll.

The support 108 on standard 1 is fixed, while support 108 on standard 2 is pivoted at 109 and has a slot 110 over a stop pin 111. The standard 2 has an opening sufficiently large to permit insertion of the roll of base fabric through it when support 108 is swung down out of the way.

A spring-loaded, adjustably held cable 112 passes around the base fabric roll shaft 113 to tension the same (Fig. 2) as well as to hold support 108 against swinging on its pivot.

Referring now more particularly to Figs. 1, 5 and 20, it will be seen that upon the awl carrying bar 32 is suitably secured (by any desired means) a bar 121 having a dove-tail groove in which is slidably mounted a second bar 122 having a dove-tail to fit the dove-tail groove of the bar 121 so that bar 122 may be slid or racked in a direction parallel to the axis of pivot 37.

The bar 122 also has one or more transverse dove-tail grooves in its upper face. These grooves extend at right angles to the groove of bar 121 so that a bar 123, which has transverse dove-tails to fit the transverse grooves of bar 122, may be slid toward and from the needles 49, as will later be clearly understood.

Suitably secured to the bar 123 are thread guide units 124 which are provided with eyes through which the thread T' passes.

The bar 123 is advanced and retracted in any suitable way, as for example, by means of a rod 126 connecting an arm 125 on the bar 123 with a thread guide operating lever 127 that is mounted on the shaft 16 and is operated by a suitable cam or eccentric 128 on shaft 13. A spring 129 connects the bar 123 with the lever 127 (see Fig. 5).

The bar 122 (and consequently the bar 123 and thread guides 124) is shifted or racked by any suitable means, as for example, a lever 131 is pivoted to shaft 65 and is operated by a pattern wheel 132 on shaft 66, a spring 118 being also connected to the lever 131 (see Fig. 3). The lever 131 carries a sliding head 136 (similar to the head 63) against which a push rod 135 engages. The rod 135 has a head 134 to engage the slide head 133 on the end of the thread racking bar 122, a spring 137 maintaining contact between the parts 133, 134 and 135, 138.

The bracket 102 has an extension 102^a which carries the shaft 104^a of the roll of thread T, a suitable adjustable tension device 105^a being provided for roll T.

The needle 49 is provided with a slot 130 in addition to the eye 50 (see Figs. 17 and 18).

Operation

My machine will accomplish several purposes. First, it may be used as a single thread machine, using the needle with the thread through eye 50, and operated to knit either through a base fabric or without the base fabric; second, it may be used as a single thread machine, using the needle with the thread placed in the slot 130 by the thread guide 124 and operated to knit either through a base fabric or without the base fabric; third, it may be used as a two thread machine, using the eye 50 of the needle with one thread, and the slot 130 with a second thread guided by the thread guide 124, and operated to knit either through a base fabric or not, as desired.

I shall now describe the operation of the machine as a single thread machine using the thread guides 124 and the slot parts 130 of the needles, only.

Referring now particularly to Figs. 8 to 14, inclusive, let us assume that the machine is in operation. The needles reciprocate up and down rapidly, into and out of the stationary guides 9, and are shifted or racked according to the pattern provided.

The movements of the needles are continuous, i. e., without substantial periods of dwell at any point in the paths of movement of the same, thus increasing the speed of the machine over that which can be obtained in machines where periods of dwell must occur in the operation of the needles.

Furthermore, since sinker nibs and beard pressers are eliminated from the machine, the up and down strokes of the needles can be very materially shortened over those which take place in machines of the Tricot type. Hence this is an important factor in increasing the speed at which the machine can be operated, and consequently increasing the output.

Beginning at the instant when the awl has moved down into the guide 9 (Fig. 8) and is carrying a loop from a previously operated needle, it will be seen that when the awl has reached the position shown in Fig. 8, it will dwell in this position while the needle is moving down into the groove 35 of the awl 34 and through loop *i* (Fig. 8). As the needle moves down from the position shown in Fig. 8 (highest position) to the position shown in Fig. 9, the thread guide 124 will advance the thread into the slot 130 where it will be caught by the needle and carried down through the loop *i* (Fig. 10). After the needle has passed the thread T' through the loop *i*, the awl rises from the guide 9 to the upper limit of its stroke (Fig. 11) while the needle is still going down.

While the needle and awl are passing from the position of Fig. 8 to that of Fig. 10 the looper 24 is moving from the position shown in Fig. 8 to its forward position (Fig. 10) where it dwells while the needle moves through the position of Fig. 10 to that shown in Fig. 11.

After the slot 130 of the needle has passed the looper hook, the looper begins its return or backward stroke (Fig. 12) to catch the thread and pull it into the form of a loop. As soon as the hook of the looper has passed back of the needle, the awl moves down again into the guide (Fig. 13), whereupon the looper moves laterally in back of the awl to carry the thread about the awl and form the loop. The needle, now moving on its return stroke (Fig. 13), allows the thread to slip from the hook of the looper and also itself disengages the thread. After the needle has passed up through the loop and out of the guide and has returned to its uppermost position, the thread guide is racked to thread the needle for the next adjacent chain loops.

The awl, in passing from the position of Fig. 10 to that of Fig. 11, frees the previously formed loop *i* (Fig. 8) which is now caught by the needle (Fig. 11) and the awl tilts away from the needle (Fig. 12) so as not to interfere with that loop as the awl is moved down again (Fig. 13) ready to receive the next loop i^2 (Fig. 14).

The provision of the slots 11 in the guide blades allows the loops to clear the guides and pass up the awls as they straighten out on the finish of

the upstroke of the needles in passing from the position of Fig. 14 back to that of Fig. 8.

While the hook of the looper is pulling the thread to form the loop (Fig. 13), the eye and slot end of the needle is braced against the pulling force by means of the braces or abutments 114 on the blades of the guides (Figs. 16, 16A).

When knitting to produce the composite fabric, the base fabric *w* (Fig. 4) is fed in timed relation to the movements of the needles, the awls and the thread guides, by means heretofore described.

When the machine is operated as a single thread machine, the thread is passed through the eyes 50 of the needles and the guides 124 run idle. The movements of the needles, awls and loopers remain the same as before in forming the stitch. In Fig. 15 is shown a needle with a thread passing through the eye 50. The position corresponds to that of Fig. 12 in the cycle of operation.

When the machine is to be used as a two bar or two thread machine, one thread T is passed through the eye of the needle and the other thread T' is passed through the eye of the guide 124 and picked up in the slot 130 of the needle at each down stroke, both threads being carried down through the previously formed loop by the needle.

When the machine is used as an ordinary knitting machine (i. e., without the base fabric feature), some way should be provided to hold the cloth down so the needles will pass up out of the loops without tightening or drawing the loops. This may be accomplished in a number of ways, one of which is indicated in Fig. 24. In that construction I place one or more taut rods or wires 120 above the guides 9. Piano wires may be used and anchored at their ends to the side frames in any suitable way.

In Fig. 25 is shown how the fabric is knit when the machine operates as a single-thread-per-needle machine without a base cloth, and the eyes 50 of the needles being used. Fig. 26 shows how the fabric is knit when the machine operates as a single-thread-per-needle machine, without a base cloth, and the slots 130 of the needles being used. Fig. 27 shows the composite fabric knit by using dual threads per needle and knitting through a woven base fabric.

While I have referred to the members 34 as "awls," when using the machine as a simple knitting machine, i. e., without the use of a base fabric, these members need not be pointed so as to serve as puncturing elements, but may simply function as loop holders during the process of forming the loops.

From the foregoing description, taken in connection with the accompanying drawings, it is thought that the construction, operation and advantages of the invention will be clear to those skilled in the art to which it relates.

What I claim is:

1. In a knitting machine, needles having thread receiving slots, thread guides for placing the thread in the needle slots, awls, loopers, stationary guides for receiving and guiding said needles, said awls and said loopers, and means to operate said thread guides, said needles, said awls and said loopers in timed relation to effect a knitting operation.

2. In a knitting machine, needles having thread receiving slots, thread guides for placing the thread in the needle slots, loop holders, loopers, stationary guides for receiving and guiding said needles, said loop holders and said loopers, and means to operate said thread guides, said needles, said loop holders and said loopers in timed relation to effect a knitting operation.

3. In a knitting machine, needles having closed eyes and open slots, thread guides for placing threads in said slots as the needles move past the guides in one direction, loop holders, stationary guides of parallel spaced-apart walls between which the needles and loop holders are movable, loopers operating in the spaces between the walls of the stationary guides, means for reciprocating said needles into and out of the stationary guides, means to move said loop holders in cooperation with the needles into and out of said stationary guides, means to operate said loopers to carry the threads about the loop holders while they are within the stationary guides, and means to operate said thread guides to place the thread in the slots of passing needles in their travel toward the stationary guides.

4. In a knitting machine, a set of needles, each having an open slot, a set of loop holders, a set of thread guides, means to mount the aforesaid parts for cooperative movement, a set of stationary guides including spaced parallel walls, means to move said needles and said loop holders into and out of said stationary guides, a set of loopers operating in the spaces between the walls of said stationary guides, and means for effecting the operation of said loopers, said needles, said needle guides and said loop holders in timed relation to effect a knitting operation.

5. In a knitting machine, a set of needles, each having an open slot, a set of loop holders, a set of thread guides, means to mount the aforesaid parts for cooperative movement, a set of stationary guides including spaced parallel walls, means to move said needles and said loop holders into and out of said stationary guides, a set of loopers operating in the spaces between the walls of said stationary guides, and means for effecting the operation of said loopers, said needles, said needle guides and said loop holders in timed relation to effect a knitting operation, each of the needles also having a closed eye continuously to carry a second thread.

6. In a knitting machine, needles having both a closed eye and an open thread-receiving slot, movable thread guides for guiding threads to the open slots of the needles, loop holders having needle guiding grooves, stationary guides having spaced walls between which the needles and loop holders may operate; loopers operable in said guides between the walls thereof, and means to operate the aforesaid parts in cooperative relation to effect the knitting operation.

7. In a knitting machine, needles having both a closed eye and an open thread-receiving slot, movable thread guides for guiding threads to the open slots of the needles, loop holders having needle guiding grooves, stationary guides having spaced walls between which the needles and loop holders may operate; loopers operable in said guides between the walls thereof, means to operate the aforesaid parts in cooperative relation to effect the knitting operation, said loop holders comprising awls, and means to pass a base fabric over the stationary guides during the knitting operation whereby the knitting takes place through the base fabric.

8. In a knitting machine, needles having thread-receiving slots, movable combined needle guides and loop holders, thread guides for placing thread in the slots of the needles, stationary

guides having spaces to receive the needles and the combined needle guides and loop holders, loopers operating in said spaces for looping thread from the needles around the combined needle guides and loop holders, and means to operate the aforesaid parts in timed relation and sequence to effect a knitting operation.

9. In a knitting machine, in combination, stationary guides having slots to receive needles, needles having open thread-receiving slots and being mounted to reciprocate into and out of said guides, movable needle guides cooperative with the needles and entering the stationary guides in advance of the needles, thread guides for placing thread in the needle slots as the needles approach said movable needle guides, loopers operating in the slots of the stationary guides for looping the thread from the needles around the movable needle guides when they are in said stationary guides, and means for operating said needles, said thread guides, said movable needle guides and said loopers in timed relation to effect the knitting operation.

10. In a knitting machine, in combination, stationary guides having slots to receive needles, needles having open thread-receiving slots and being mounted to reciprocate into and out of said guides, awls cooperative with the needles and entering the stationary guides in advance of the needles, thread guides for placing thread in the needle slots as the needles approach said awls, loopers operating in the slots of the stationary guides for looping the thread from the needles around the awls when they are in said stationary guides, and means for operating said needles, said thread guides, said awls and said loopers in timed relation to effect the knitting operation.

11. In a knitting machine, the combination with a set of needles, each having a thread-receiving slot, a stationary guide having parallel walls spaced apart, into which spaces the needles are operated, a set of movable needle guides also operable in said spaces, means for reciprocating the needles and movable needle guides into and out of said stationary guide, means to place a thread in each needle slot on the in-strokes of the needles, means for looping the threads from the needles around the movable needle guides while the needles and movable needle guides are projected into the stationary guide, and means for timing the reciprocations of the needles and their guides whereby the movable needle guides will enter the stationary guide in advance of the needles.

12. In a knitting machine, the combination with a set of needles, each having a thread-receiving slot, a stationary guide having parallel walls spaced apart, into which spaces the needles are operated, a set of movable needle guides also operable in said spaces, means for reciprocating the needles and movable needle guides into and out of said stationary guide, means to place a thread in each needle slot on the in-strokes of the needles, means for looping the threads from the needles around the movable needle guides while the needles and movable needle guides are projected into the stationary guide, and means for timing the reciprocations of the needles and their guides whereby the movable needle guides will enter the stationary guide in advance of the needles, said movable needles guides comprising grooved awls in which grooves the needles lie as they pass into the stationary guide.

13. In a knitting machine, the combination with a set of needles, each having a thread-receiving slot and a thread-carrying eye, a stationary guide having parallel walls spaced apart, into which spaces the needles are operated, a set of movable needle guides also operable in said spaces, means for reciprocating the needles and movable needle guides into and out of said stationary guide, means to place a thread in each needle slot on the in-strokes of the needles, means for looping the threads from the needles around the movable needle guides while the needles and movable needle guides are projected into the stationary guide, and means for timing the reciprocations of the needles and their guides whereby the movable needle guides will enter the stationary guide in advance of the needles.

14. In a knitting machine, the combination with a set of needles, each having a thread-receiving slot and a thread-carrying eye, a stationary guide having parallel walls spaced apart, into which spaces the needles are operated, a set of movable needle guides also operable in said spaces, means for reciprocating the needles and movable needle guides into and out of said stationary guide, means to place a thread in each needle slot on the in-strokes of the needles, means for looping the threads from the needles around the movable needle guides while the needles and movable needle guides are projected into the stationary guide, and means for timing the reciprocations of the needles and their guides whereby the movable needle guides will enter the stationary guide in advance of the needles, said movable needle guides comprising grooved awls in which grooves the needles lie as they pass into the stationary guide.

15. In a knitting machine, the combination with a set of needles, each having a thread-receiving slot, a stationary guide having parallel walls spaced apart, into which spaces the needles are operated, a set of movable needle guides also operable in said spaces, means for reciprocating the needles and movable needle guides into and out of said stationary guide, means to place a thread in each needle slot on the in-strokes of the needles, means for looping the threads from the needles around the movable needle guides while the needles and movable needle guides are projected into the stationary guide, means for timing the reciprocations of the needles and their guides whereby the movable needle guides will enter the stationary guide in advance of the needles, said movable needle guides comprising grooved awls in which grooves the needles lie as they pass into the stationary guide, and means for passing a base sheet over said stationary guide, said needle and movable guide-reciprocating means being timed so that the movable guides open passages for the needles through the base sheet.

16. In a knitting machine, needles having thread receiving slots, thread guides for placing the thread in the needle slots, awls, loopers, stationary guides for receiving and guiding said needles, said awls and said loopers, means to operate said thread guides, said needles, said awls and said loopers in timed relation to effect a knitting operation, and means for passing a base sheet over said stationary guide, said needle and awl operating means being timed so that the awls open passages for the needles through the base sheet.

17. In a knitting machine, needles having both a closed eye and an open thread-receiving slot, movable thread guides for guiding threads to the open slots of the needles, loop holders

having needle guiding grooves, stationary guides having spaced walls between which the needles and loop holders may operate; loopers operable in said guides between the walls thereof, means to operate the aforesaid parts in cooperative relation to effect the knitting operation, and means to knock over the needles while they are out of the stationary guides and free of the knit loops.

18. In a knitting machine, needles having both a closed eye and an open thread-receiving slot, movable thread guides for guiding threads to the open slots of the needles, loop holders having needle guiding grooves, stationary guides having spaced walls between which the needles and loop holders may operate; loopers operable in said guides between the walls thereof, means to operate the aforesaid parts in cooperative relation to effect the knitting operation, and means to knock over the movable thread guides.

19. In a knitting machine, needles having both a closed eye and an open thread-receiving slot, movable thread guides for guiding threads to the open slots of the needles, loop holders having needle guiding grooves, stationary guides having spaced walls between which the needles and loop holders may operate; loopers operable in said guides between the walls thereof, means to operate the aforesaid parts in cooperative relation to effect the knitting operation, means to knock over the needles while they are out of the stationary guides and free of the knit loops, and means to knock over the movable thread guides.

20. In a knitting machine, a stationary guide having spaced walls, needles each having an eye for constantly carrying a thread and a slot for periodically picking up a thread and carrying it into the stationary guide, movable needle guides, loopers having blades with hook portions operable in said spaces, thread guides for placing threads in the slots of the needles, and means for operating the needles, the movable needle guides, the thread guides and the loopers to effect a knitting operation.

21. In a knitting machine, a stationary guide having spaced walls, needles each having an eye for constantly carrying a thread and a slot for periodically picking up a thread and carrying it into the stationary guide, movable needle guides, loopers having blades with hook portions operable in said spaces, thread guides for placing threads in the slots of the needles, means for operating the needles, the movable needle guides, the thread guides and the loopers to effect a knitting operation, said operating means including means for moving the needles and the movable needle guides into and out of said spaces, means for rocking said movable needle guides to clear the needles at times, means to move the looper blades along and crosswise of said spaces, and means to rack the needles and the needle guides according to a given pattern.

22. In a knitting machine, stationary needle guides of parallel spaced plates between which the needles may operate, needles having thread receiving slots, movable needle guides, thread guides and loopers, means to operate the same, the needle operating means comprising rocker arms, a needle-bar slideway secured to and carried by said arms, a needle bar in said slideway, said needles being mounted on said needle bar, means for rocking said arms to effect movement of the needles into and out of said stationary guides, and means to move said needle bar in said slideway to rack the needles while they are out of the stationary guides.

23. In a knitting machine, stationary needle guides having slots, needles having thread-receiving slots, thread guides for placing threads in said needle slots, movable needle guides, loopers having blades operable in said stationary guide slots, means to operate the same, said operating means including a carrying bar for said movable needle guides, rocker arms on which said bar is pivotally mounted, the movable needle guides being mounted on said bar, means to rock said arms to effect movement of said movable needle guides into and out of said stationary guides, and means to rock said bar on its pivot.

24. In a knitting machine, stationary needle guides having slots, needles having thread-receiving slots, thread guides for placing threads in said slots, movable needle guides, loopers having blades operable in said stationary guide slots, means to operate the same, said operating means including a carrying bar for said movable needle guides, rocker arms on which said bar is pivotally mounted, the movable needle guides being mounted on said bar, means to rock said arms to effect movement of said movable needle guides into and out of said stationary guides, and means to rock said bar on its pivot, said last named means comprising a lever, means to rock said lever, and a connection between said lever and said bar, by virtue of which as said lever is rocked on its pivot said bar will be rocked on its pivot.

25. In a knitting machine, stationary needle guides having slots, needles having thread-receiving slots, thread guides for placing threads in said slots, movable needle guides, loopers having blades operable in said stationary guide slots, means to operate the same, said operating means including a carrying bar for said movable needle guides, rocker arms on which said bar is pivotally mounted, the movable needle guides being mounted on said bar, means to rock said arms to effect movement of said movable needle guides into and out of said stationary guides, means to rock said bar on its pivot, and means to mount said thread guides on said bar.

26. In a knitting machine, stationary needle guides having slots, needles having thread-receiving slots, thread guides for placing threads in said slots, movable needle guides, loopers having blades operable in said stationary guide slots, means to operate the same, said operating means including a carrying bar for said movable needle guides, rocker arms on which said bar is pivotally mounted, the movable needle guides being mounted on said bar, means to rock said arms to effect movement of said movable needle guides into and out of said stationary guides, means to rock said bar on its pivot, said last named means comprising a lever, means to rock said lever, and a connection between said lever and said bar, by virtue of which as said lever is rocked on its pivot said bar will be rocked on its pivot, and means to mount said thread guides on said bar.

27. In a knitting machine, stationary needle guides having slots, needles having thread-receiving slots, thread guides for placing threads in said slots, movable needle guides, loopers having blades operable in said stationary guide slots, means to operate the same, said operating means including a carrying bar for said movable needle guides, rocker arms on which said bar is pivotally mounted, the movable needle guides being mounted on said bar, means to rock said arms to effect movement of said movable needle guides into and out of said stationary guides, means to rock said bar on its pivot, and means to mount said thread

guides on said bar, said mounting means including means permitting movement of the thread guides toward and from the needles and racking of the same.

28. In a knitting machine, stationary needle guides having slots, needles having thread-receiving slots, thread guides for placing threads in said slots, movable needle guides, loopers having blades operable in said stationary guide slots, means to operate the same, said operating means including a carrying bar for said movable needle guides, rocker arms on which said bar is pivotally mounted, the movable needle guides being mounted on said bar, means to rock said arms to effect movement of said movable needle guides into and out of said stationary guides, means to rock said bar on its pivot, said last named means comprising a lever, means to rock said lever, and a connection between said lever and said bar, by virtue of which as said lever is rocked on its pivot said bar will be rocked on its pivot, and means to mount said thread guides on said bar, said mounting means including means permitting movement of the thread guides toward and from the needles and racking of the same.

29. In a knitting machine, stationary needle guides having slots, needles having thread-receiving slots, thread guides for placing threads in said slots, movable needle guides, loopers having blades operable in said stationary guide slots, means to operate the same, said operating means including a carrying bar for said movable needle guides, rocker arms on which said bar is pivotally mounted, the movable needle guides being mounted on said bar, means to rock said arms to effect movement of said movable needle guides into and out of said stationary guides, means to rock said bar on its pivot, means to mount said thread guides on said bar, said mounting means including means permitting movement of the thread guides toward and from the needles and racking of the same, and means to operate said thread guides' mounting means to effect the movements thereof which means includes a slideway on said guide carrying bar, a second bar mounted to slide in said slideway for thread guide racking purposes, and a third bar slidably mounted on said second bar for movement of the thread guides toward and from the needles, and means to operate said second and third bars.

30. In a knitting machine, stationary needle guides having slots, needles having thread-receiving slots, thread guides for placing threads in said slots, movable needle guides, loopers having blades operable in said stationary guide slots, means to operate the same, said operating means including a carrying bar for said movable needle guides, rocker arms on which said bar is pivotally mounted, the movable needle guides being mounted on said bar, means to rock said arms to effect movement of said movable needle guides into and out of said stationary guides, means to rock said bar on its pivot, said last named means comprising a lever, means to rock said lever, and a connection between said lever and said bar, by virtue of which as said lever is rocked on its pivot said bar will be rocked on its pivot, means to mount said thread guides on said bar, said mounting means including means permitting movement of the thread guides toward and from the needles and racking of the same, and means to operate said thread guides' mounting means to effect the movements thereof which means includes a slideway on said guide carrying bar, a second bar mounted to slide in said slideway for thread guide racking purposes, and a third bar slidably mounted on said second bar for movement of the thread guides toward and from the needles, and means to operate said second and third bars.

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