March 17, 1964 HIDEAKI HIROMATSU 3,124,946

KNITTING MACHINE

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Fig. 1

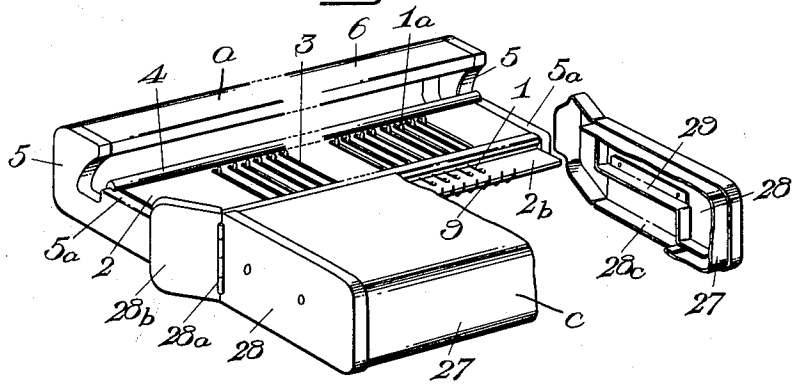
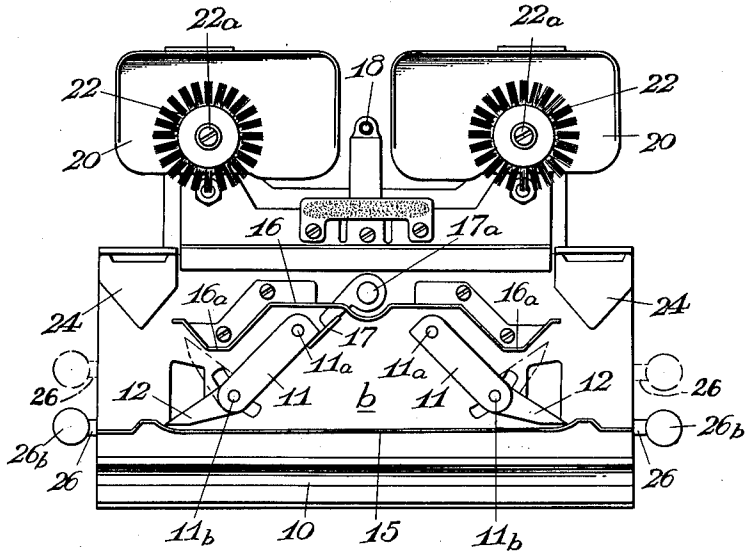


Fig. 2



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Fig. 3

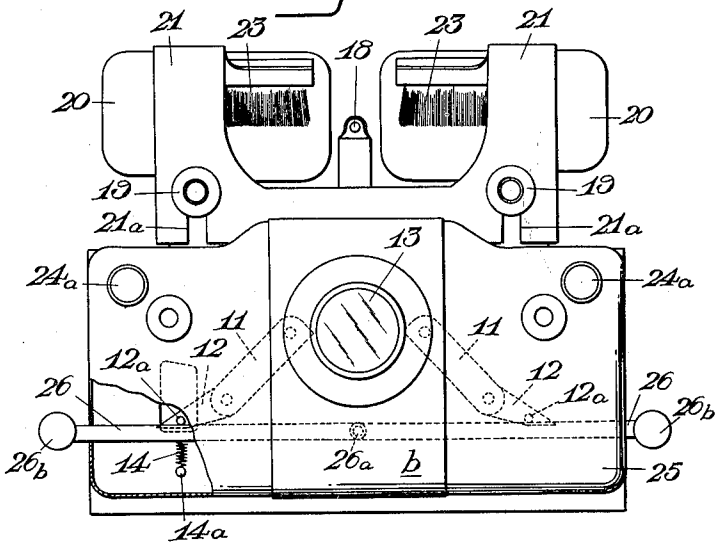


Fig. 4

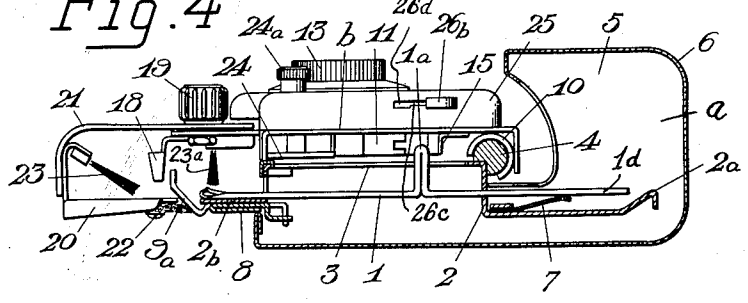
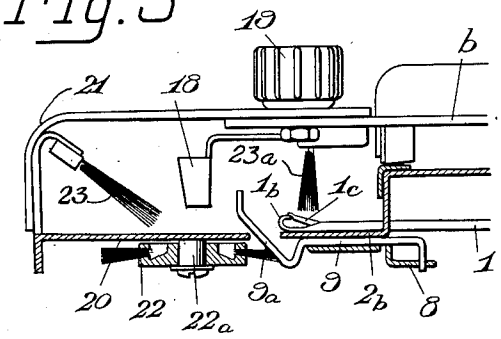


Fig. 5



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Fig. 6

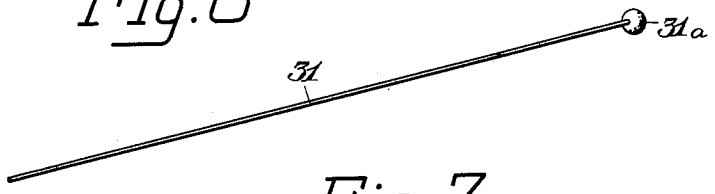


Fig. 7

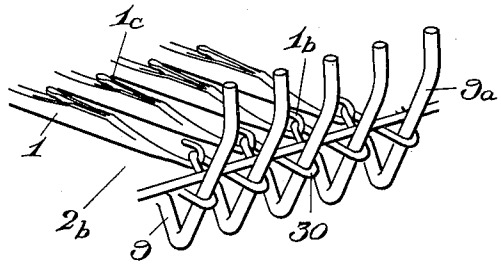


Fig. 8

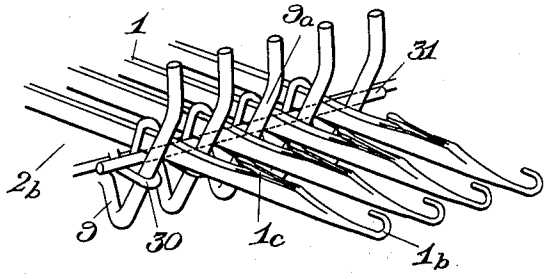
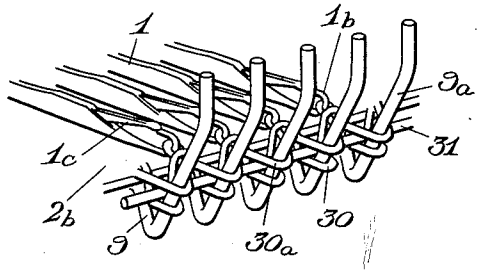


Fig. 9



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Fig. 10

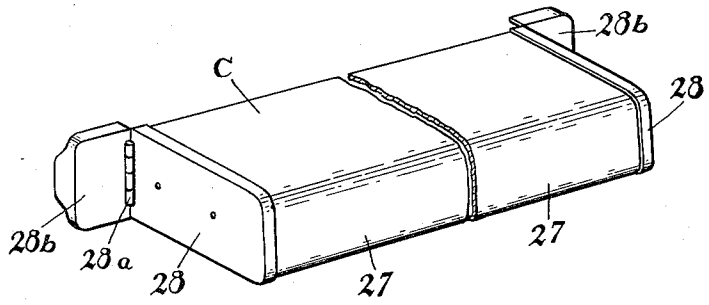
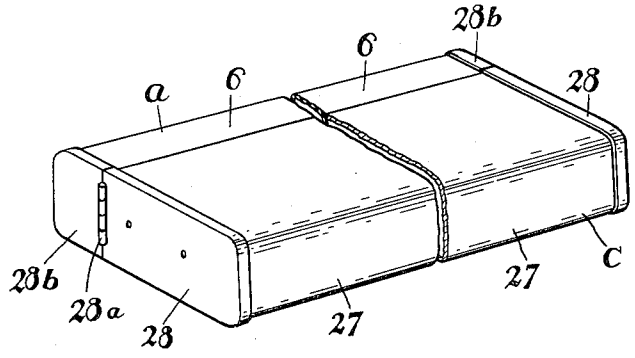


Fig. 11



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United States Patent Office 3,124,946 Patented Mar. 17, 1964

3,124,946

KNITTING MACHINE

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Filed May 17, 1960, Ser. No. 29,630
3 Claims. (Cl. 66—60)

The present invention relates to a knitting machine.

It is one object of the present invention to provide a knitting machine, which produces a knit cloth consisting of complete stitches without using weights or sinkers in the setting process of the knitting operation.

It is another object of the present invention to provide a knitting machine, which eliminates the necessity of weights suspended from a knit cloth during the knitting operation, and this results in preventing the knit cloth from being excessively pulled and the yarns from being damaged due to the weights suspended from the knit cloth.

It is a further object of the present invention to provide a knitting machine, which includes a cover which may be secured with ease to the main body of the knitting machine and which covers the main body extending from its front surface to its upper surface. Furthermore, in the case of transporting the knitting machine, during interruption of the knitting operation, the cover body is put on to the main body of the knitting machine, so that a knit cloth may be tightly held between the cover and the main body of the knitting machine, thereby preventing the loss of the knit cloth.

It is still another object of the present invention to provide a knitting machine, wherein, in case the carriage is prevented from moving due to intertwining of the yarns during the knitting operation or other obstacles, an inspecting means is provided which takes the pressure members off the carriage, lifts the carriage and moves the carriage independently of the knitting needles.

It is yet another object of the present invention to provide a knitting machine, which is equipped on both sides of a cam track of the carriage with two top cams, each of the top cams having two sloping portions which meet with each other at a point and are capable of setting at either an upper or a lower position. By setting the top cams at the lower position, the butts of the knitting needles, which are in their inoperative position, will be brought into their operative position, with the result that the knitting of a variety of patterns is made easier.

With these and other objects and advantages of the present invention in view, which will become apparent in the following detailed description, the present invention will be clearly understood in conjunction with the accompanying drawings, in which:

FIGURE 1 is a fragmentary perspective view of a knitting machine in relation to a cover thereof;

FIG. 2 is a bottom plan view of a carriage;

FIG. 3 is a top plan view of the carriage;

FIG. 4 is a sectional side view of the main body of the knitting machine provided with the carriage;

FIG. 5 is a fragmentary sectional side view of the main body as shown in FIG. 4, shown at enlarged scale;

FIG. 6 is a perspective view of the setting bar which is used in the setting operation;

FIGS. 7, 8 and 9 are perspective views showing the setting operation;

FIG. 10 is a fragmentary perspective view of the cover, showing the lids of the cover in their open position; and

FIG. 11 is a fragmentary perspective view of the cover attached to the main body of the knitting machine, showing the lids of the cover in their closed position.

Referring now to the drawings, and in particular to

FIGS. 1 to 5, a main body is provided with a plurality of knitting needles 1, each of which has a butt 1*a*, which may slide in a plurality of slots 3 provided in parallel relation to each other on the upper surface of a needle board 2, and a butt 1*a* projects upwardly through each of the slots 3.

The needle board 2 is provided at its rear portion with a rod-like guide rail 4 and on its left and right sides with side plates 5, each of the latter including a portion 5*a* with its substantially aligned upper surface of the needle board 2. A cover 6, which covers the needle board 2 at its bottom and behind its back, is secured to the side plates 5.

The needle board 2 is provided with an upwardly and backwardly sloping portion 2*a*, which limits the rearward movement of the knitting needles 1 by engagement of their rear ends 1*d* with the portion 2*a* of the needle board 2, when the knitting needles 1 are fully retracted (FIG. 4).

A thin plate spring 7 mounted on the needle board 2 presses against the knitting needle 1, whereby the knitting needle 1 is prevented from sliding freely. Secured to a board 8 mounted on a front flat portion 2*b* of the needle board 2 are stationary pins 9 (FIG. 5), each of the latter being bent downwardly and then extending in an upward and forward direction forming its front end portion 9*a*, which is spaced from the front edge of the front flat portion 2*b* by substantially 2 to 4 mm.

A carriage *b* is capable of moving along the guide rail 4 mounted on the needle board 2 by means of a fitting sleeve 10 which engages slidably the guide rail 4. The carriage *b* is provided on its inner surface with knitting cams 11 facing each other, the front end of each of the knitting cams 11 being pivotally secured to the inner surface of the carriage *b* by means of a hinge pin 11*a* and its rear end being hinged on a rockable cam 12 by means of a hinge pin 11*b*, so that the stitches of a knit cloth may be properly adjusted by turning a dial 13 provided on the upper surface of the carriage *b* due to the displacement of the hinge pins 11*b*.

Since the tips of the rockable cams 12 are in contact with a rear stopper 15 by means of springs 14, one of which is shown only, each of the springs 14 being mounted between a pin 12*a* of the rockable cam 12 and a pin 14*a* of the carriage *b*, the knitting cams 11 guide the butts 1*a* of the knitting needles 1 during the knitting operation, as will be described hereinafter.

The rear stopper 15 is a wall projected downwardly from the inner surface of the carriage *b*. Retracting the butts 1*a* of the knitting needles 1 to their rearmost position in their slots 3 by any conventional means, the butts 1*a* are received in the space between the fitting sleeve 10 and the rear stopper 15, with the result that the knitting needles 1 are rendered inoperative, and the butts 1*a* of the knitting needles 1 are advanced from their inoperative position by a finger or an independently prepared needle comb, so that the knitting needles 1 will be brought into their operative position again.

A cam track 16 is projected downwardly from the inner surface of the carriage *b* behind the foremost position of the butt 1*a* of the knitting needle 1 in a slot 3. The tip of a rotary cam 17 turnable about a pin 17*a* is in engagement with the inner side 11*c* of either knitting cam 11. In accordance with the above stated structure, the butt 1*a* of the knitting needles 1 is guided by the rockable cam 12, advanced along the knitting cam 11, guided by the rotary cam 17 during rotation of the latter, brought into engagement with another knitting cam 11 and guided backward along the latter, to push on against another rockable cam 12, the latter being pulled backwards by a spring 14, with the result that it gets out of the carriage *b*.

The carriage *b* is provided on its front with a yarn

carrier 18 which serves the purpose of feeding yarn to a hook 1*b* of an advanced knitting needle 1. Pressure members 20 are secured to the carriage *b* by means of bolts and nuts 19 which connect a pressure member plate 21 of each pressure member 20 with the carriage *b*, each pressure member plate 21 being provided with a notch 21*a* into which the bolt 19 fits. In accordance with this structure, the pressure members 20 may be easily taken off the carriage *b* by loosening the nuts 19. Rotary brushes 22 are rotatably supported on the bottom surface of the pressure members 20 by means of pins 22*a*, and since the rearmost portion of each rotary brush 22 projects into the space between the front end portions 9*a* of the stationary pins 9, a knit cloth may be pushed into this space during the knitting operation. A brush 23, which is secured to each pressure member plate 21, serves the purpose of opening a latch 1*c* of a knitting needle 1 when an advancing knitting needle 1 is brought into engagement with the brush 23, resulting in safe feeding of yarn to the hook 1*b* of the knitting needle 1. A brush 23*a*, which is secured to each pressure member plate 21 behind the yarn carrier 18 in such a manner that the lower end of the brush 23*a* serves the purpose of preventing upward swinging of the hook end of a moving knitting needle 1.

The carriage *b* is further provided on both sides of the cam track 16 with top cams 24, each of which has two sloping sides which meet each other at a predetermined point. Each top cam 24 may be set at its upper or lower position by means of a knob 24*a*, namely, in case of setting the cam at its upper position, it will not actuate the butt 1*a* of the knitting needle 1 for movement of the latter, while in case of setting the top cam 24 at its lower position, it may actuate the butt 1*a* of the knitting needle 1 located in the foremost position in the slot 3 to move it backwardly to a position behind the cam track 16. The butt 1*a* of the knitting needle 1 will be further retracted by means of a projecting head 16*a* of the cam track 16, and as the butt 1*a* of the knitting needle 1 moves forward along either knitting cam 11, the butt 1*a* of the knitting needle 1 will be brought into engagement with the brush 23, resulting in opening the latch 1*c* of the knitting needle 1.

Operating levers 26 are swingably connected to a cover plate 25 of the carriage *b* by means of a pin 26*a*. In case of moving forwardly a knob 26*b* provided at the end of the levers 26, one of the operating levers 26 will push forwardly the pin 12*a* of a rockable cam 12, resulting in disengaging the tip of the rockable cam 12 from the rear stopper 15.

The lever 26 slides in a slot 26*c* (FIG. 4) in the side wall of the carriage *b*, which slot 26*c* forms a widened portion 26*d* to constitute an arresting position for the lever 26. The latter is movable in the slot 26*c* into the widened portion 26*d*, in which position the lever 26 is arrested thereby retaining simultaneously the cam 12 in its rocked position against the force of the spring 14. The rocked position of the cam 12 and the displaced position of the lever 26 with its knob 26*b* is shown in point-dotted lines in FIG. 2. In the rocked position of the cam 12, the knitting needle 1 is not guided along the knitting cam 11 and the rotary cam 17, but it only slides back and from laterally in the carriage *b* in the free space created between the cam 12 and the rear stopper 15, so that it is rendered inoperative. Thus the position of the cam 12 determines the operative and inoperative movement, respectively, of the knitting needles 1.

In case of knitting a variety of patterns, it is required to feed yarn to only some predetermined hooks 1*b* of the knitting needles 1, and the knitting operation will be successfully completed by the present knitting machine.

A cover body *c* is provided with a main member 27, which serves the purpose of covering the front and the top of the main body *a* of the knitting machine, and with side plates 28 secured to both sides of the main member 27 of the cover body *c*. Each side plate 28 is provided with a flange 28*c* and a holder 29, both serving the purpose of jointly fitting on tightly to the portion 5*a* of each side plate 5 of the main body *a* of the knitting machine. Each side plate 28 is also provided with a lid 28*b* secured thereto by means of a hinge 28*a*. After fitting the side plates 28 to the portions 5*a* of the side plates 5, the lids 28*b* may be put on to the back portion of each side plate 5 and may be fastened to the main body *a* of the knitting machine by means of a buckle (not shown).

In accordance with the present structure, a knit cloth may be held tightly between the cover 6 of the main body *a* of the knitting machine and the main member 27 of the cover body *c*, thereby preventing the loss of the knit cloth in case of transportation of the knitting machine.

The operation of the knitting machine is performed in the following manner:

After taking off the cover body *c* from the main body *a* of the knitting machine by opening the lids 28*b*, yarn is laid in the yarn carrier 18 of the carriage *b* and the butts 1*a* of the knitting needles 1, required to make a knit cloth of a desired stitch, are advanced in their slots 3 from their retracted inoperative position to their operative position by a finger or an independently prepared needle comb. By moving the carriage *b* under these conditions, the knitting needles 1 will be advanced. As the knitting needles 1 are advanced in such manner that has been previously described, the latches 1*c* of the knitting needles 1 will be brought into engagement with the brushes 23, resulting in opening the hooks 1*b* of the knitting needles 1, and a length of yarn 30 laid in the yarn carrier 18 will be fed to the hooks 1*b* of the knitting needles 1. Then the knitting needles 1 are retracted, resulting in stretching the yarn 30 zigzag between the hooks 1*b* of the knitting needles 1 and the front end portions 9*a* of the stationary pins, as shown in FIG. 7.

Then a long setting bar 31 with a knob 31*a* at its end will be placed on the yarn 30 stretched zigzag between the hooks 1*b* of the knitting needles 1 and the front end portions 9*a* of the stationary pins 9. Thereafter, the knitting needles 1 are advanced for a short distance, yet enough to mount the tips of the knitting needles 1 on the setting bar 31. Then, upon the actuation of the carriage *b*, the knitting needles 1 alone will be advanced, the setting bar 31 preventing the zigzag stretched yarn 30 from moving forward, as shown in FIG. 8. The knitting needles 1 will receive a length of yarn 30*a* and then will be retracted. During their backward movement, they will pass through the zigzag stretched yarn 30, resulting in forming loops, as shown in FIG. 9.

When moving the carriage *b* again, the knitting needles 1 will be advanced, but the loops of the yarn 30*a* are prevented from moving forward, because the yarn 30 is interknitted with the setting bar 31. During the forward movement of the knitting needles 1, their latches 1*c* will pass through the loops of the yarn 30*a*. Thus, the knitting operation will be repeated successively, and consequently the setting bar 31 will slide down along the front end portions 9*a* of the stationary pins 9 during each of the operations. Since each stationary pin 9 is provided at its end with the hook-like portion capable of receiving a knit cloth, the knitting operation may be repeated long enough to make a knit cloth comprising several courses. Thereafter, the setting bar 31 will be pulled out from the knit cloth and the setting process is finished.

Upon completion of the setting process, the yarn 30 in the first course will be released from the stationary pins 9. Thereafter, upon repeating the reciprocating motion of the carriage *b*, the knit cloth will be suspended in front of the needle board 2 of the main body *a* of the knitting machine, the knit cloth being suspended from the hooks 1*b* of the knitting needles 1 only by loops newly

formed in the uppermost course of the knit cloth, and, on the other hand, the rotary brushes **22** attached to the bottom surface of the pressure members **20** act to push the knit cloth into each space between the front end portions **9***a* of the stationary pins **9**, so that the knit cloth will be pushed downwardly. Thus, when the knitting needles **1** are advanced, the knit cloth will not only be prevented from moving forward jointly with the moving knitting needles **1**, but also be prevented from its upward shifting, because of the presence of the downwardly pushing force. When the knitting needles **1** are advanced, their latches **1***c* will pass through the loops and their hooks **1***b* will receive the yarn, whereby the knitting operation will be repeated. Furthermore, the plate spring **7** is in engagement with each knitting needle **1**, thereby preventing the knitting needle **1** from its free forward sliding by means of a braking action, so that the knit cloth will be prevented from shifting upwardly. As above mentioned, the knitting operation will be successfully performed without suspending weights from the knit cloth.

In case that the movement of the carriage *b* is interfered with during the knitting operation, due to, for instance, intertwining of the yarns, the pressure members **20** may be taken off the carriage *b* by loosening the nuts **19** and disengaging the notches **21***a* of the pressure member plates **21** from the bolts. Since according to the present structure, the fitting sleeve **10** of the carriage *b* is mounted turnably on the guide rail **4**, the front portion of the carriage *b* may be lifted about the guide rail **4**, rendering inoperative the knitting cams **11** and the rockable cams **12** on the butts **1***a* of the knitting needles **1**. Thus, by freely moving the carriage *b* to the left or to the right, an operator may inspect easily, how the yarns are intertwined and return the knit cloth into normal position.

Furthermore, in case of setting the top cams **24** at their lower position in such a knitting operation, that the butts **1***a* of some knitting needles **1** are in their inoperative position or their foremost position in the slots **3**, the top cams **24** will actuate the butts **1***a* of the knitting needles **1** to move them backwardly behind the cam track **16**, with the result that the knitting needles **1** are moved into their operative position.

If desired the setting bar **31** may be replaced by other equivalent members, such as a string.

While I have disclosed one embodiment of the present invention, it is to be understood that this embodiment is given by example only and not in a limiting sense, the scope of the present invention being determined by the objects and the claims.

I claim:

1. A knitting machine comprising
a main body,
a carriage slidably mounted on said main body,
a cover releasably secured to said main body,
said main body including a needle board,
a plurality of stationary pins mounted parallel relative to each other along the front edge of said needle board, and bent downwardly and then upwardly and forwardly to form a sloping front end portion,

a plurality of knitting needles slidably mounted on said needle board for movement between a withdrawn and advanced position and including hooks at their front end,
said front end portions of said stationary pins and said knitting needles being adapted to stretch knitting yarn between said stationary pins and said knitting needles by operation of said carriage,
a setting bar disposed between said hooks of said knitting needles and said front end portions of said stationary pins and adapted to be placed on the first stretched course of said knitting yarn,
said knitting needles moving forwardly and backwardly over said setting bar, and said setting bar being pulled out in axial direction upon completion of the required number of courses for finishing the knit cloth,
a plate spring mounted on said needle board for each of said knitting needles and pressing against the latter,
pressure members secured to the front portion of said carriage, and a rotary brush rotatably mounted on the bottom surface of each of said pressure members, and said rotary brushes moving the knit cloth into spaces defined between said front end portions of said stationary pins, and to push down the knit cloth by cooperation between said rotary brushes and said stationary pins.

2. The knitting machine, as set forth in claim 1, which includes
a rod-like guide rail secured to the back of said needle board,
said carriage having a fitting sleeve slidably mounted on said rod-like guide rail, and
pressure members removably secured to the front portion of said carriage.

3. The knitting machine, as set forth in claim 1, which includes
a cam track projecting downwardly from the inner surface of said carriage,
top cams disposed on said carriage on both sides of said cam track,
each of said top cams having two sloping portions meeting each other at a point, and
means for securing said top cams in an upper and a lower position.

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