April 11, 1939. M. C. MILLER 2,153,582

KNITTING MACHINE

Filed Feb. 12, 1935

Fig. 1

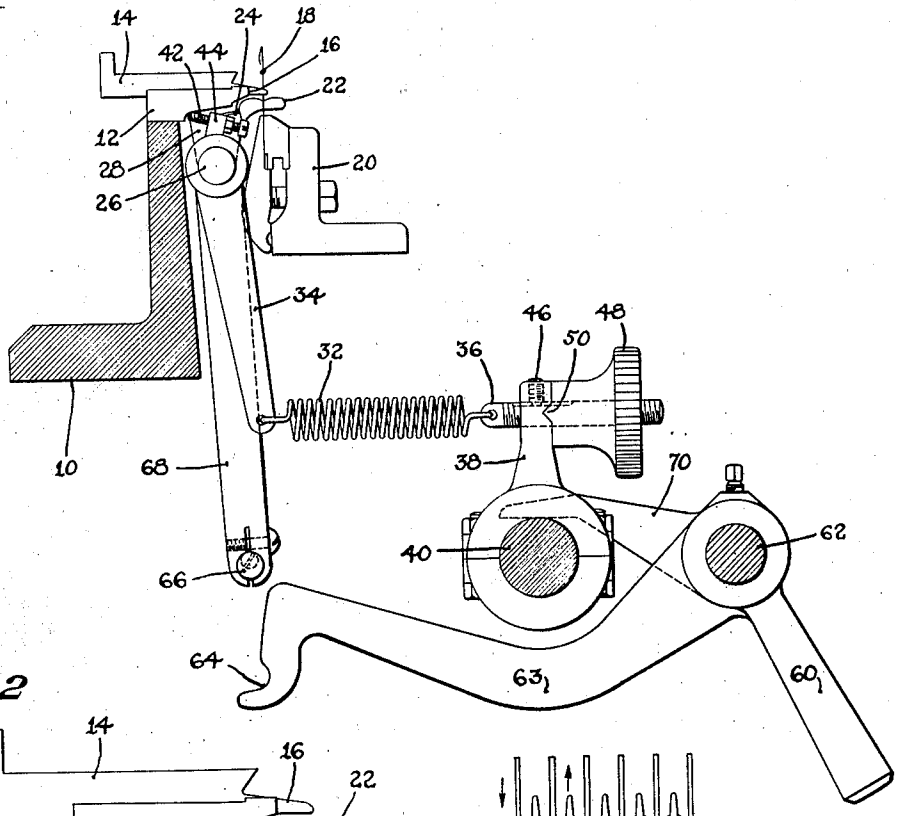
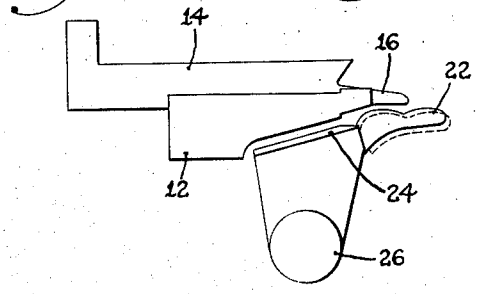


Fig. 2



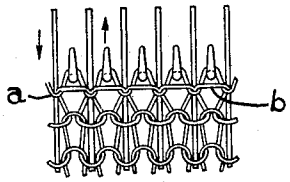


Fig. 3

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KNITTING MACHINE

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11 Claims. (Cl. 66—109)

The present invention relates to improvements in knitting machines, and more particularly to novel and improved knockover mechanism.

The invention is herein disclosed in a preferred form as embodied in a flat full-fashioned knitting machine, in which a series of spring-beard needles rigidly secured to a needle bar are moved horizontally and vertically with relation to a fixed press edge to draw down and press off the finished loops. Machines of this general description are preferably provided with yarn measuring sinkers and with knockover elements against which the loops are drawn to give them their final form. It is to be understood, however, that the several features of the present invention are not limited in their application to the particular type of machine described, but may be equally well applied to other types of machines, in which the needles are moved as a unit to draw down and knock over the newly formed loops against a knockover surface or edge.

It is a principal object of the present invention to provide a knockover assembly of a novel and improved construction and mode of operation, in which the knockover surfaces are arranged to move downwardly against a tensioning strain and toward the backs of the needles under the pressure of the yarn kinked thereon as the needles move downwardly to the knockover position, so that the loops are set against a tension instead of the usual fixed stop, and are at the same time carried to the backs of the needles to insure the proper positioning of these loops during the subsequent rising movement of the needles.

It is another object of the invention to provide a novel and improved knockover bit assembly in which the knockover surfaces are arranged as the needles reach their low knockover position, to move toward the backs of the needles to tension the yarn kinked thereon and carry the previously knitted course of loops certainly and accurately beyond the backs of the needles.

With these and other objects in view, as may hereinafter appear, a principal feature of the invention consists in the provision of a series of knockover elements mounted on a pivoted support arranged to permit the movement of the knockover surfaces from a normally raised position closely adjacent the sinker elements downwardly and toward the backs of the needles against a tensioning strain as the needles approach their extreme knockover position to tension and carry the loops to the backs of the needles.

The several features of the present invention consist also in the devices, combinations and arrangement of parts hereinafter described and claimed, which together with the advantages to be obtained thereby will be readily understood by one skilled in the art from the following description taken in connection with the accompanying drawing, in which Fig. 1 is a detail sectional view taken through one section of a flat full-fashioned knitting machine of ordinary description, only so much of the machine being shown as is necessary to illustrate the connection of the present invention therewith; Fig. 2 is an enlarged detail view of the sinker, press edge and knockover bit construction shown in Fig. 1; and Fig. 3 is a plan view illustrating the relative positions of the knockover bits and needles with relation to the fabric loops as the needles are moved inwardly toward the press edge at the knockover level.

Referring specifically to the drawing, Fig. 1 illustrates a number of the parts of a flat full-fashioned knitting machine of the Cotton type including the front rail 10 shown in section, which extends throughout the machine length, and has rigidly secured thereto a sinker supporting head 12 grooved to receive sinkers 14, and having formed at its forward end the stationary press edge 16. The machine is provided with the usual spring beard needles as indicated at 18 in Fig. 1, which are rigidly clamped in the usual needle bar 20, which is in turn mounted on a system of supporting arms and levers (not shown) for horizontal movements to draw down the loops. Inasmuch as the construction and mode of operation of the parts thus far described is old and well known in the art, no further description or illustration thereof is believed necessary.

There is also provided with the present construction, a series of knockover bits 22 which are constructed in the usual manner, and are rigidly mounted in a knockover bit bar 24 pivotally mounted to turn on a rod 26 which is pivotally mounted in bearings formed in downwardly extending lugs 28 formed on the sinker head 12. This method of supporting the knockover bits as thus far described, is well known in the art, and is believed to need no further illustration.

In machines of the type described, it is the usual practice to control the angular position of the shaft 26 from the main cam shaft of the machine, to secure the required setting of the height of the knockover bits during the operation of knocking over the newly formed loops. At another point in the knitting cycle, it is customary

to drop the knockover bits to a lower level to provide room for the insertion of the usual welt bar at the start of the welt portion of the fabric, the knockover bits, however, being returned to a predetermined stationary position for the operation of knocking over or finishing the loops. With the construction and mode of operation ordinarily employed, an extremely accurate setting of the knockover surfaces with relation to the extreme low position of the needles is required to insure the proper setting of the loops, without at the same time causing them to be overstrained or broken as the needles reach their extreme low knockover position. In order to insure the carrying of the newly formed loops to the backs of the needles and thus to clear the needles for the beginning of a new knitting cycle, the needle motion is arranged so that the needles are moved inwardly to a position closely adjacent the press edge **16** before being again raised to take new yarn. In order to cooperate with this needle movement, the knockover bits as usually constructed, are provided with a rising curve near the press edge of the machine, which operates as an additional drag on the loops engaging the knockover surfaces, and serves to insure the positioning of the loops to the backs of the needles regardless of variations in the length of loop. Inasmuch as the needle motion with the ordinary construction as above described, follows a fixed path with relation to a fixed knockover bit setting, the variations in the length of loop must be taken care of as the loops ride against the rising curve of the knockover bits, by a flexing of the needles during the inward movement of the needles toward the press edge above described, so that a very close setting of the parts is required, and only a relatively small variation in loop length can be permitted without interfering with the operation of the machine.

The applicant is familiar with attempts previously made to improve the construction and operation of knitting machines of this type, to secure an improved operation of the needles and knockover bits to knock over the newly formed loops without danger of injury to the yarn, as illustrated more particularly by the patent to Lieberknecht No. 1,923,985, dated August 22, 1933, in which the knockover bits are resiliently mounted for a vertical movement with the needles. The construction set forth in the Lieberknecht patent, however, contemplates the raising and lowering of the knockover bits through connections controlled from the main cam shaft of the machine, and does not provide any means beyond that normally provided for moving the loops to the backs of the needles.

In accordance with a principal feature of the present invention, the supporting mechanism for the knockover bits has been constructed and arranged to permit a movement of the knockover surfaces at a steep angle downwardly and toward the backs of the needles during the knockover operation in an arcuate path about the shaft **26** as a pivot, so that the newly formed loops are carried surely and certainly to the backs of the needles as the needles are lowered to their extreme knockover position, and are subsequently moved inwardly toward the press edge prior to the beginning of the next knitting cycle. With the construction illustrated, the knockover bits are held in a normally high position closely adjacent the under edge of the sinkers **14** by means of a tension spring **32** which is connected at one end to a downwardly extending lever arm **34** secured to the shaft **26**, and at its other end to an adjustable pin **36** supported in a lever **38** on a continuously oscillating shaft **40**. A stop screw **42** screw-threaded into an ear **44** formed on the hub of the lever **34**, and arranged for engagement with the under side of the sinker bed **12** to determine the position of the knockover bits **22**, serves to limit the rotational movement of the lever **34**, shaft **26** and knockover bits **22** under the pressure of the spring **32**, and thus serves to accurately determine the normal operating position of the knockover bits. In order to provide an adjustment of the strength of the spring **32**, the pin **36** is slidably mounted in the lever **38**, being keyed against rotation therein by means of a set screw **46**, and has threaded on its opposite end a manually operable nut **48**. A V-shaped projection **50** formed on the bearing surface of the nut **48** is arranged for engagement with a corresponding V-shaped notch in the corresponding bearing surface of the lever **38** to maintain the required adjustment of the parts. It is to be understood that the oscillatory movements of the shaft **40** have no effect on the operation of the device during the knockover operation of the machine, but represents merely a convenient part of the machine on which to mount the spring **32**.

The operation of the needles and knockover bits during the knockover operation to finish the newly formed loops and to carry these loops to the backs of the needles, may be described as follows:—

Starting with the parts in the position shown in Fig. 1, the subsequent downward movement of the needles to take the new yarn and to press off the old loops, follows the usual operation of this type of machine. The loops are then carried by an outward movement of the needles off of the ends of the sinkers onto the yarn engaging surfaces of the knockover bits **22**, which with the present construction are located in a relatively high position closely adjacent the under sides of the sinkers **14**. The continued downward movement of the needles to their extreme knockover position causes the newly formed loops to be tensioned against the knockover surfaces and acts to move the knockover bits **22** and bar **24** about the pivot **26** against the tensioning force of the spring **32**, so that the knockover surfaces and loops held thereon are carried downwardly and toward the backs of the needles in an arcuate path about the pivot **26**, while at the same time the needles are moved rapidly in a horizontal direction towards the press edge preparatory for the beginning of a new knitting cycle.

With the construction and mode of operation of the knockover mechanism above set forth, it will be seen that the movement of the knockover bits toward the backs of the needles combined with the rapid movement of the needles in their low position toward the press, causes the kinked portion of the yarn to be dragged over a considerably longer portion of the rising curve of the knockover surfaces than is possible with the usual stationary knockover bit construction of these machines, and at a more rapid rate, so that a sharp kinking of the yarn and the positioning of the previously formed loops to the backs of the needles is assured regardless of variations in the length of the needle loops. The angle of the rising curve is adjusted with relation to the pivot shaft **26**, so that the combined movements of the knockover bits and needles above described, serve to maintain a substantially uni-

form tensioning strain or drag on the kinked yarn against the knockover surfaces during this entire operation.

It will also be noted that the movement of the knockover bits above described is controlled entirely by the action of the fabric on the knockover surfaces at the time of knocking over, the extent of the movement being dependent entirely upon any variations which may exist in the lengths of the knitted loops from course to course. The construction illustrated, therefore, is automatically self-adjusting for substantial variations in loop length, and makes possible the entire elimination of the usual control mechanism for varying the setting of the knockover bits.

The manner in which the yarn kinked about the knockover surfaces by the downward movement of the needles is tensioned, and the previously knitted fabric loops drawn to the backs of the needles, is illustrated particularly in the somewhat diagrammatic Fig. 3 of the drawing. As indicated by the arrows, the needles at this time have reached their extreme downward position, causing the knockover bits to be moved downwardly and toward the backs of the needles to the dotted line position shown in Fig. 2, so that the yarn is sharply kinked about the knockover surfaces against the tensioning strain of the spring **32**. The needles are now moved rearwardly at an extremely rapid rate during the continued downward movement of the knockover bits **22** against the pressure of the spring **32**, so that the kinked portion of the needle yarn designated at *a* is drawn over a relatively long portion of the rising curve of the knockover bits to insure the proper kinking and positioning of the yarns. It will be noted from an inspection of Fig. 3, that the loops of the previously knitted course have been spread by the kinking of the needle yarn, so that the corners of these loops designated at *b* in Fig. 3, are drawn together in the apex of the kinked portion of the needle yarn kinks *a*. Under these conditions the corners of the loops *b* are actually engaged by and forced to the backs of the needles by the relative movements of the needles and knockover bits above set forth, thus insuring the proper operation of the machine.

In order to facilitate the insertion of a welt rake between the needles above the knockover bits and below the sinkers in accordance with the usual practice, at the beginning of a stocking, mechanism is herein disclosed under the control of the operator for positively moving the knockover bits **22** to the low position shown in dotted lines in Fig. 2. To this end a manually operable lever **60** is mounted on a rock shaft **62** which extends throughout the machine length, and is provided with a rearwardly extending arm **63** provided with a recess **64** arranged for engagement with an eccentric pin **66** supported on a downwardly extending arm **68** rigidly secured to turn with the shaft **26** and knockover bar **24**. The manually operable lever **60** is normally maintained in the raised position shown in Fig. 1, by the engagement of arm **70** secured to the rock shaft **62**, with the upper side of the shaft **40**. It will be understood that a separate arm **63** and cooperating lever arm is provided for each section of the machine. For convenience of operation, one or more manually operable levers **60** may be mounted on the rock shaft **62** at advantageous points along the length of the machine.

In starting a new operation upon the machine, the lever **60** is moved in a clockwise direction by the operator to engage the eccentric pin **66** in the notch **64** to position the knockover bits **22** in an abnormally low position to permit the insertion of the welt rake. The machine is then put in operation. The knockover bits **22** are preferably left in their low position during the knitting of several subsequent courses until enough fabric has been formed to enable the welt hooks to be held in position with the sinkers in line with the needles. As soon as the hooks have assumed this position, the operator again manually shifts the lever **60** to disengage the arm **63** from the eccentric pin **66**, permitting the knockover bits **22** to return to the normally high position shown in Fig. 1. The loops of the initial course will be reasonably well knocked over without the knockover bits in their normally high position, since the welt hooks during the knitting of these courses are close enough to the needles to enable the fabric take-up tension to properly clear the loops being formed, and also because the first few loops of the welt portion of the fabric are usually knitted quite loosely.

The invention having been described, what is claimed is:

1. In a knitting machine, the combination with yarn feeding and knitting devices including a series of movable needles, of a series of knockover elements having knockover surfaces formed thereon, supporting means for the knockover elements arranged to permit a movement of said knockover surfaces at a steep angle downwardly and toward the backs of the needles, and spring means to maintain said surfaces in a normally raised position arranged to provide a tensioning strain against the movement of the knockover surfaces downwardly and toward the backs of the needles with the kinked yarn held by the needle hooks.

2. In a flat full-fashioned knitting machine, the combination with a press edge and a series of spring-bearded needles movable with relation thereto to press off and to draw down loops, of a series of knockover elements, a pivotal support therefor arranged to permit a movement of the yarn engaging surfaces thereof about said pivot at a steep angle downwardly and toward the backs of the needles, and spring means to maintain said knockover elements in a normally raised position arranged to permit a downward movement of said knockover elements with the yarn kinked thereon at the time of knockover to tension said kinked yarn and cause the previously knitted course of loops to be positioned beyond the backs of the needles.

3. In a flat full-fashioned knitting machine, the combination with yarn feeding and knitting devices including a press edge, a series of needles movable en masse horizontally and vertically with relation thereto, and a series of sinkers, of a series of knockover elements, a pivotal support therefor arranged to permit movement of the yarn engaging knockover surfaces about said pivot at a steep angle downwardly and toward the backs of the needles, said knockover surfaces having a curved portion cammed to maintain a substantially uniform tensioning drag on the yarn kinked over said surfaces during the relative needle and knockover element movements at the time of knockover, and spring means for tensioning said surfaces closely adjacent the sinkers arranged to permit a downward movement of said knockover elements with the needles against said spring tension at the time of knockover to carry said

knockover surfaces and yarn kinked thereon in an arcuate path downwardly and to the backs of the needles.

4. In a flat full-fashioned knitting machine, the combination with yarn feeding and knitting devices including a press edge, a series of needles movable en masse horizontally and vertically with relation thereto, and a series of sinkers, of a series of knockover elements, a pivotal support therefor arranged to permit movement of the yarn engaging knockover surfaces about said pivot at a steep angle downwardly and toward the backs of the needles, and spring means for positioning said surfaces closely adjacent the sinkers arranged to permit a downward movement of said knockover elements with the yarn kinked thereon against said spring tension at the time of knockover to produce a compound movement of the knockover surfaces toward the backs of the needles and of the needles toward the press at the time of knockover, to tension the yarn kinked on the knockover surfaces to the backs of the needles.

5. In a flat full-fashioned knitting machine, the combination with yarn feeding and knitting devices including a press edge, a series of needles movable en masse horizontally and vertically with relation thereto, and a series of sinkers, of a series of knockover elements having yarn engaging surfaces, a pivotal support therefor located from the knockover surfaces at a substantial angle from the vertical line of needle movement to permit movement of the yarn engaging knockover surfaces about said pivot downwardly and toward the backs of the needles, spring means for positioning said surfaces closely adjacent the sinkers arranged to permit a downward movement of said knockover elements with the yarn kinked thereon against said spring tension at the time of knockover to tension said kinked yarn toward the backs of the needles, and means for adjusting the resistance of said spring means.

6. In a flat full-fashioned knitting machine, the combination with yarn feeding and knitting devices including a press edge, a series of needles movable en masse horizontally and vertically with relation thereto, and a series of sinkers, of a series of knockover elements having yarn engaging surfaces formed thereon, a pivotal support for said knockover elements located from the knockover surfaces at a substantial angle with the vertical line of needle movement to permit movement thereof downwardly with the needles, and spring means for positioning the yarn engaging surfaces of the knockover bits closely adjacent the sinkers arranged to permit a downward movement of the knockover elements under the influence of the yarn kinked thereon against said spring tension at the time of knockover.

7. In a flat full-fashioned knitting machine, the combination with yarn feeding and knitting devices including a press edge, a series of needles movable en masse horizontally and vertically with relation thereto, and a series of sinkers, of a series of knockover elements supported thereon, supporting means for said knockover elements to permit movement thereof downwardly with the needles between extreme high and resilient low knockover positions, spring means acting normally to position the yarn engaging surfaces of the knockover bits closely adjacent the sinkers arranged to permit a downward movement of the knockover elements under the influence of the yarn kinked thereon against said spring tension at the time of knockover, and manually operable means for moving said knockover surfaces to a predetermined low position against the pressure of said spring means.

8. In a flat full-fashioned knitting machine, the combination with yarn feeding and knitting devices including a seres of vertically movable needles and sinkers cooperating therewith, of a series of knockover elements having knockover surfaces formed thereon, a support for said knockover elements movable to raise and lower said knockover elements with relation to the sinkers between extreme high and resilient low knockover levels, a stationary stop surface engaging said support to positively limit the upward movement of the knockover elements in a normally stationary position closely adjacent the under side of the sinkers, and spring means for yieldingly maintaining said support and web holders against said stop arranged to permit a continuously yielding downward movement of said knockover elements under the influence of the yarn kinked thereon during movement of the needles to and from the knockover level to tension the newly knitted loops at the knockover and thereafter to return said knockover elements to their initial position.

9. In a flat full-fashioned knitting machine, the combination with yarn feeding and knitting devices including a seres of vertically movable needles and sinkers cooperating therewith, of a series of knockover elements having knockover surfaces formed thereon, a pivotal support for the knockover elements arranged to permit movement of the yarn engaging knockover surfaces about said pivot at a steep angle downwardly and toward the backs of the needles, a stationary stop surface engaging said support to positively limit the upward movement of the knockover elements in a normal stationary position closely adjacent the under side of the sinkers, and spring means constructed and arranged to tension the support and knockover elements against said stop and against the yarn kinked thereon by the needles so that the knockover elements are moved yieldingly downwardly with the needles and newly kinked yarn at the knockover, and are thereafter returned to their normal high position when released by the upward movement of the needles.

10. In a flat full-fashioned knitting machine, the combination with yarn feeding and knitting devices including a series of vertically movable needles and sinkers cooperating therewith, of a series of knockover elements having knockover surfaces formed thereon, a pivotal support for the knockover elements arranged to permit a movement of the yarn engaging knockover surfaces about said pivot at a steep angle downwardly and toward the backs of the needles, a stationary stop surface and a cooperating stop surface on the support to positively limit the upward movement of the knockover elements in a normal stationary position closely adjacent the under side of the sinkers, and means for relatively adjusting said stop surfaces to vary the stationary position of the knockover elements, and spring means constructed and arranged to tension the support and knockover elements against said stationary stop and against the yarn kinked on the elements by the needles so that the knockover elements are moved yieldingly downwardly with the needles and newly kinked yarn at the knockover, and are thereafter returned to their normal high position when released by the upward movement of the needles.

11. In a flat full-fashioned knitting machine, the combination with yarn feeding and knitting

devices including a series of vertically movable needles and sinkers cooperating therewith, of a series of knockover elements having knockover surfaces formed thereon, a support for said knockover elements movable to raise and lower said knockover elements with relation to the sinkers between extreme high and resilient low knockover positions, a stationary stop surface, a cooperating stop surface on the support to positively limit the upward movement of the knockover elements in a normal stationary position closely adjacent the underside of the sinkers, means for relatively adjusting said stops to adjust said stationary position of the knockover elements, spring means constructed and arranged to tension the support and knockover elements against said stationary stop and against the yarn kinked on the knockover elements by the needles so that the knockover elements are moved yieldingly downwardly with the needles and newly kinked yarn at the knockover and are thereafter returned to their normal high position when released by the upward movement of the needles, and means for adjusting the tension of said spring means.

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