June 3, 1941. R. C. AMIDON 2,243,850

KNITTING MACHINE AND METHOD

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Fig. 1.

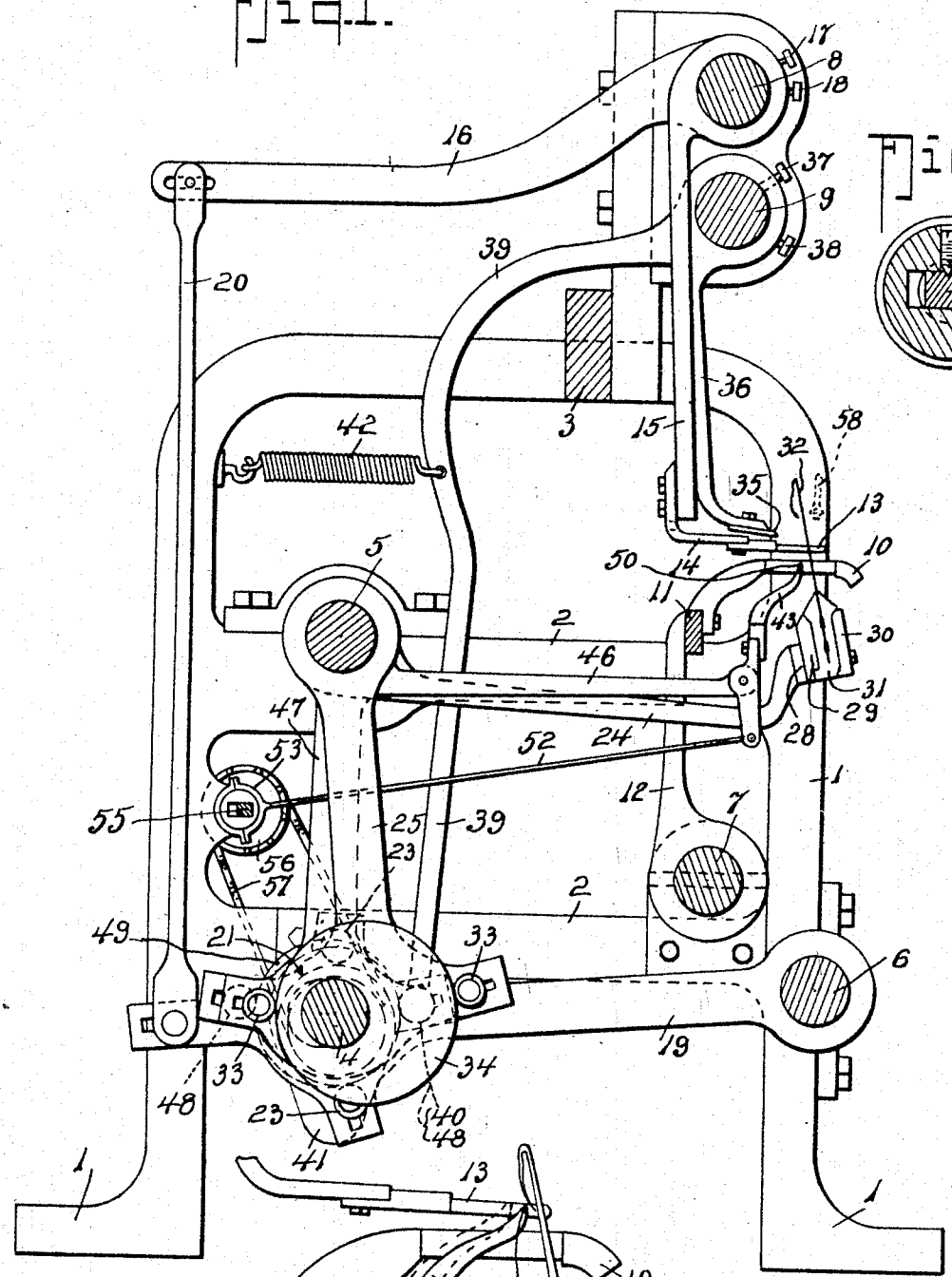


Fig. 5.

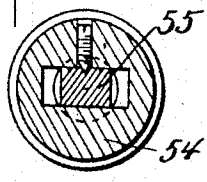
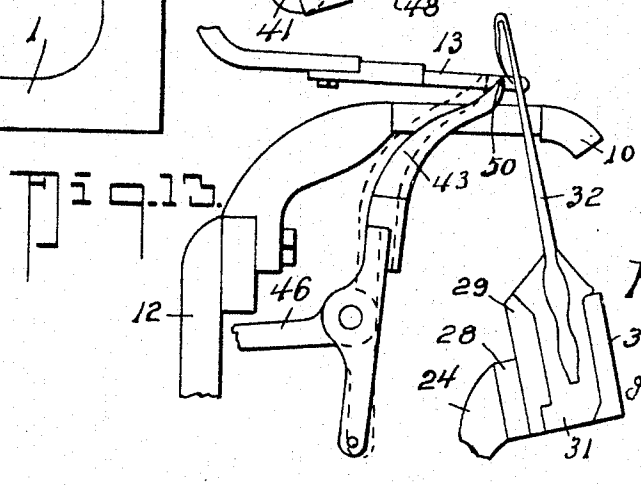


Fig. 13.



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KNITTING MACHINE AND METHOD

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Fig. 2.

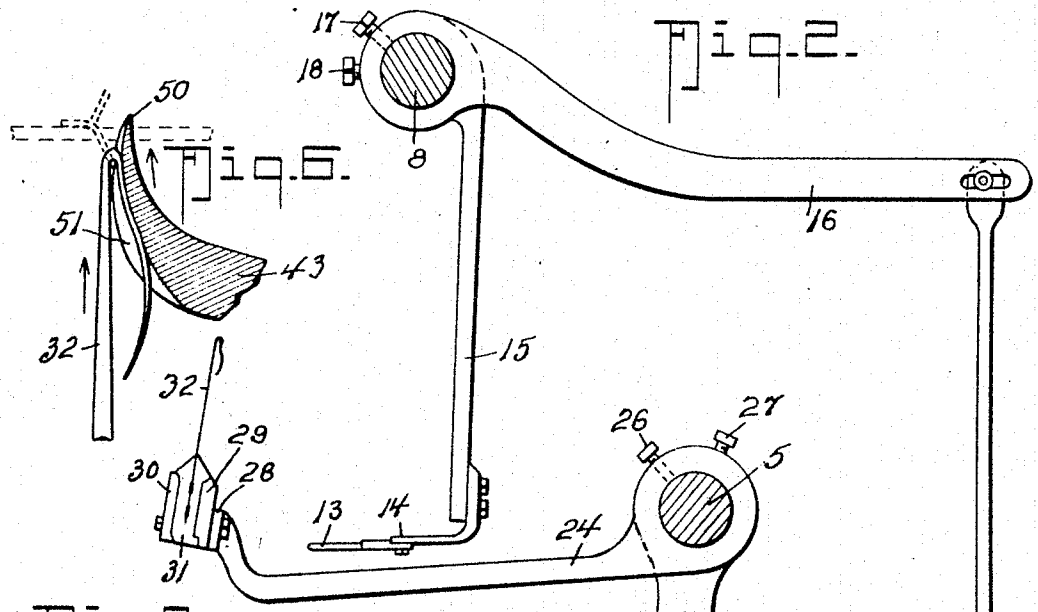


Fig. 6.

Fig. 7.

Fig. 3.

Fig. 4.

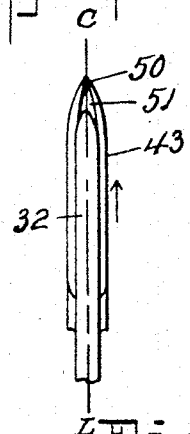
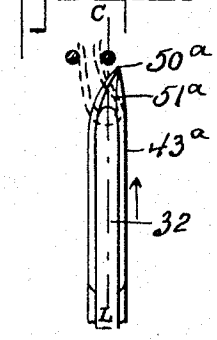
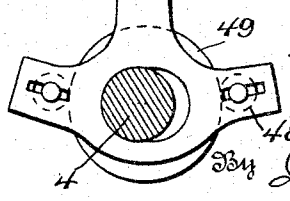


Fig. 8.





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KNITTING MACHINE AND METHOD

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Fig. 9.

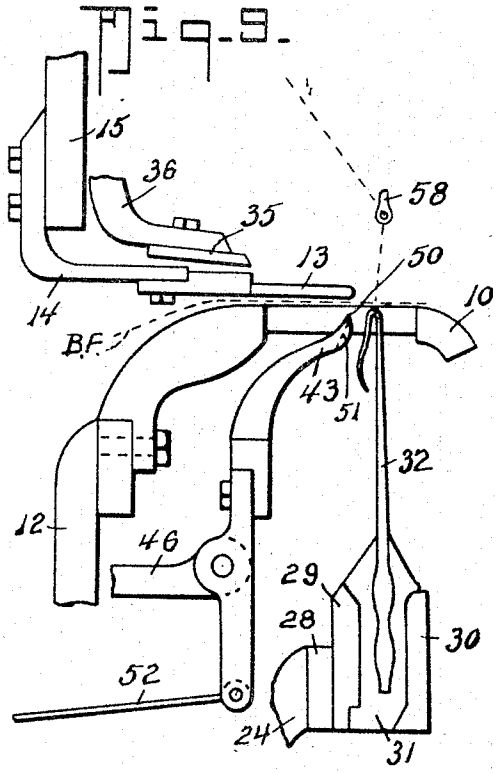


Fig. 10.

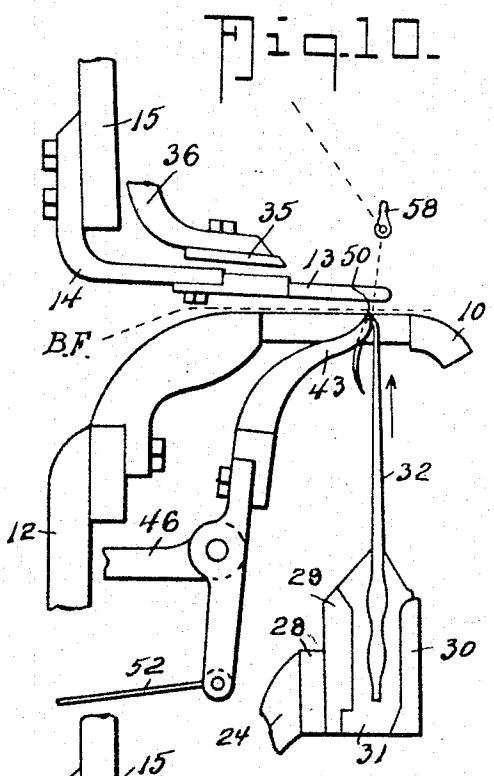


Fig. 11.

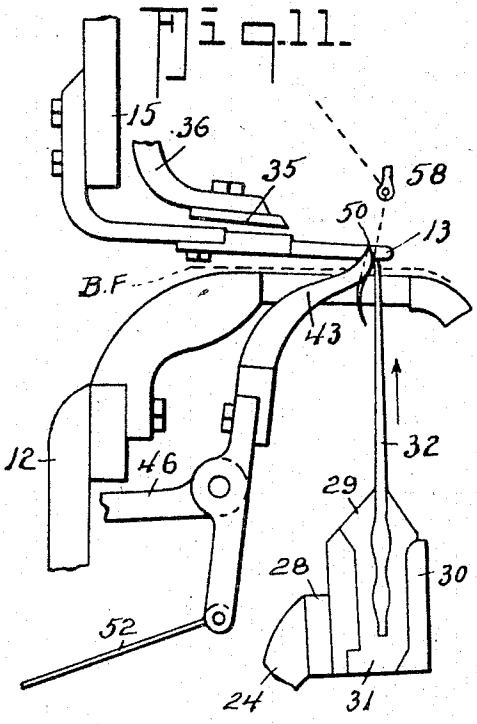
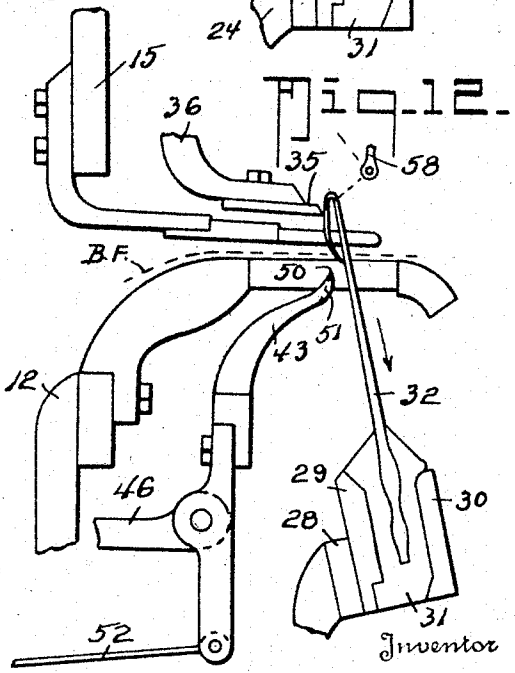


Fig. 12.



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Patented June 3, 1941 2,243,850

UNITED STATES PATENT OFFICE

2,243,850

KNITTING MACHINE AND METHOD

Roy C. Amidon, St. Johnsville, N. Y.

Application August 28, 1939, Serial No. 292,360

25 Claims. (Cl. 66—84)

My present invention, which relates to the art of knitting, has special relation to that branch of the art in which the knitting function is performed through a previously woven base fabric or other suitable sheet material.

The invention particularly has for an object to so improve the machine and method disclosed in my Letters Patent #2,136,368 of November 15, 1938, that relatively fine needles may be used to provide as many courses of knitting per inch as possible. Experience has shown that when a large number of fine needles per inch are employed, some of the needles occasionally bend or break, which of course makes it necessary to stop the machine to replace the damaged needles.

This bending or breaking of the needles may be caused by wear, or by knots in the thread, or by the weft threads of the base fabric being out of parallelism or out of step with the needles; my present invention, therefore, has for an object to provide means and a method of operation whereby such bending or breaking of the needles is practically eliminated and the strains heretofore encountered by the needles in penetrating the base fabric are eliminated.

Again, it is an object to provide a method and means of knitting through a base fabric in such a way as to effect openings in the fabric for the needles to pass through and to relieve the needles of their fabric-puncturing function.

Further, it is an object to provide a machine with automatically actuated awls that perform dual functions, i. e., that of opening passages in the base fabric for the needles and that of guiding the needles through the passages opened in the base fabric.

Again, it is an object to provide a machine with automatically actuated awls which, by a simple adjustment, may be caused to perform a third function, namely, that of a beard presser, thereby permitting the elimination of the usual beard presser bars that are usually located directly over the sinker-nibs.

A still further object is to provide a machine in which groups of the three-function-performing awls may in part be operated by adjustable means by which any one or more groups of awls may be deflected so as to eliminate, for a desired time, their third function when desired, as will more fully appear later.

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

To the attainment of the above objects and ends the invention still further resides in those novel features of construction, combination and arrangement of parts, all of which will be first fully described in the 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 cross section of a machine which embodies the present invention.

Fig. 2 is a detail elevation of one unit of sinker nibs and the actuating mechanism therefor.

Fig. 3 is a view similar to Fig. 2 of one unit of the needle bar and its needles, together with the mechanism for operating the same.

Fig. 4 is a detail elevation of one awl unit and its operating mechanism.

Fig. 5 is an enlarged detail section of the adjustable anchor shown in Figs. 1 and 4.

Fig. 6 is an enlarged detail section of an awl and, in elevation, the needle cooperating therewith to show how the awl opens a passage in the base fabric for the needle and guides it through.

Fig. 7 is a detail elevation looking from left to right in Fig. 6.

Fig. 8 is a view similar to Fig. 7, but showing a slight modification, later again referred to.

Fig. 9 is an enlarged diagrammatic elevation showing how the parts cooperate, this being the first or starting position.

Fig. 10 is a view similar to Fig. 9, but showing the parts in the second position.

Fig. 11 is a view similar to Figs. 9 and 10, but showing the parts in the third position.

Fig. 12 is a view similar to Figs. 9, 10 and 11, but showing the parts in the fifth position (Fig. 1 showing them in the fourth position).

Fig. 13 shows the parts in approximately the fifth position, when the awl is being used to perform its additional or third function (when one adjustable anchor is arranged to draw back one group of awls against the performance of their third function while the other awls are free to perform their third function).

Referring now to the accompanying drawings, in which like numerals and letters of reference designate like parts in all the figures, 1 represents the end frames of the machine, 2 the cross-bars thereof, and 3 a bar which connects the end frames 1 together.

Mounted in suitable bearings on the end frames 1 is a first motion shaft 4. Rock-shafts 5, 6, 8 and 9 are also mounted in suitable bearings and at suitable relative locations to perform properly their respective functions. To a fixedly mounted shaft 7 the sinker supports 12 are fas-

tened. These supports 12 (any desired number) carry the bar 11 to which the knock-over-sinkers 10 are attached.

The sinker-nibs 13 are carried by a bar 14 fastened to an arm 15 that is secured at 17 to the rock-shaft 8 (see Fig. 2).

The sinker-nibs 13 lie a distance above the knock-over-sinkers 10, sufficient to permit passage of the base fabric (designated in the drawings by a heavy dotted line B—F). An arm 16 is secured, at 18, to the rock-shaft 8 and connected by a rod 20 to the actuating lever 19. The lever 19 has a hole 22 for the shaft 4 to pass through and it carries adjustable cam-contact rollers 23 to engage the sinker-nib actuating cam 21, of suitable shape to effect the desired movements of the sinker-nib.

The needle-bar carrying arm 24 is secured at 26 to the rock-shaft 5 and carries the ears 28 to which the needle bar 29 is secured. The needles 32 (usually arranged in groups) are provided with a base for each group. The base 31 is suitably clamped between the needle bar 29 and the front clamp-plate 30.

The needles are operated in properly timed relation to the other elements by a cam 34 which acts on cam-contacting roller 33 carried by the operating arm 25 which is secured, at 27, to the shaft 5 (see Fig. 3).

As best shown in Fig. 1, a beard-presser bar 35 is secured to an arm or arms 36 fastened to the rock shaft 9. The beard-presser-operating arm 39 is also secured, at 37, to the shaft 9 and at its lower end it carries a cam-contacting roller 40 that is held in engagement with the beard-presser operating cam 41 by a spring 42, as shown.

By reference more particularly to Fig. 4 it will be seen that an arm (or arms) 46 is secured to the shaft 5 at one end, while an awl-bar carrying rocker 45 is hinged or pivoted to the other end of the arm 46. This awl-bar carrying rocker 45 carries the awl bar 44 on which the awls 43 (one for each needle 32) are mounted.

Up and down motion is given the awls to cause them to pierce the base fabric and return by means of an arm 47 secured to shaft 5 and operated by a cam 49 on the first motion shaft 4, the arm 47 being provided with suitable cam-contact rollers 48 adjustably mounted on the arm 47.

Each awl 43 is pointed, as at 50, and grooved as at 51 to receive its cooperating needle 23 (see Figs. 6 and 7). In order to cause the point of the awl to penetrate the base fabric and guard the needle in passing through, provision has been made to rock the rocker 45 toward the needle as the awl rises and away from the needle when the awls are in their initial or rest position. This is accomplished by connecting the rocker 45, through a light rod 52, which may be strapped at 53, to the adjustable anchor 54 which comprises a grooved disc suitably connected, adjustably, on a shaft 55 driven in properly timed relation from the first motion shaft 4 by sprocket and chain connection 56—57, or other suitable means. When the anchor cams 54 are held concentric with the shaft 55 all awls work in unison to perform all three of their functions, but when the cam 54 for one of the groups of awls is adjusted to a certain eccentric position the awls of that group are relieved of their third function and the needles come down with closed or opened beards, accordingly as to whether the beard presser 35 is used or not.

The base fabric B—F is fed through the machine from left to right in Fig. 1, from a suitable roll support (not shown) step-by-step, by a suitable take-up means (not shown, but see my patent aforesaid).

The knitting threads are passed to their respective needles through the thread guides 58, as in my previous machine.

Operation

Assume that the machine is to operate with the beard-presser bar 35 in use and the awls are to perform their first two functions only. With the parts positioned as in Fig. 9 (first position) the sinker nibs are advanced over the points of the awls 43 and needles 32 (Fig. 10).

The awls and needles now rise together, the awls rocking over from position, Fig. 9, to position, Fig. 10, with the points 50 of the awls in advance of the tops of the needles and with the beards in the grooves 51 of the awls.

Continuing upward, the awls pierce the base fabric B—F while the needles follow through to the position of Fig. 11. From the position of Fig. 11 the needles continue upward to pick up thread from the guides 58. The awls having performed their two-fold function, recede to their first position. The recessional movement of the awls may be timed to begin as soon as the ends of the needles have passed through the base fabric, or it may be delayed and needles and awls may be timed to begin their recessional movement at the same time.

As the needles come down, the beard presser 35 closes the beard while it passes through the loop and the base fabric (see Fig. 12).

When, however, the awls are to perform the three functions, the awls will be timed not to recede until the needles are lowered enough for their beards to again enter the grooves 51 and be pressed closed (see Fig. 13), whereupon the awls and needles return simultaneously to their first positions (Fig. 9).

From the above it will be seen that in using the awls as a means of puncturing or opening up needle passages in the base fabric, the same may be used as beard pressers by changing the motion in a manner such that the awls will be left in the position of having penetrated the base fabric and the points of the awls left within or slightly above the sinker nibs. The needle beards in the downward movement of the needles will contact their awls (which are now beard pressers) to close the beards to pass through the previously formed loops of the knitted stitch. No difficulty will be experienced in passing the beards through the base material for the reason that the awls hold the base material open and the closed needle beards have only to pass through the yarn loops of the knitted stitch.

As before intimated, the timing may also be so arranged that after the needles have contacted the awls and beards are closed within the grooves of the needles, the motion of the awls may proceed downward in timed relation to the needle motion. In this way the needles contact the awls and awls and needles proceed in the downward motion; therefore there is no rubbing of the beards within the awl grooves and wear on the needles is reduced to a minimum.

As before indicated, selected awls may also be so actuated as to have imparted to them a slight backward movement from the needle beards which will permit the needles to complete their courses and not discharge the loops of the previously knitted stitch; this backward motion, al-

lowing the needles to pass through the base fabric and not close the beards, need be very slight and therefore will not open the base fabric to the extent that the awl will not penetrate a new portion of the base material on its next upward movement.

When desired, the beard presser **35** may be arranged in separate selected sections and separate actuating cams for each section may be provided so that by proper cam adjustment certain sections of pressers may be rendered inactive, leaving the corresponding needles' beards open on the down strokes of the needles.

By these methods of adjustment and operation of the machine, many ornamental effects may be obtained, not heretofore found possible in a composite fabric.

While straight pointed awls **43** may be used and found satisfactory with certain sizes of needles and base fabric, yarn, etc., in order to ensure the opening of the base fabric between the same two weft threads all along the line, I prefer to employ awls as shown in Fig. 8. Thus, if a weft thread should lie directly in the center line C—L over the awl (Fig. 8), it will be deflected to the proper side of the awl and needle, and "hit or miss" action will be avoided.

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.

What I claim is:

1. The method of making a composite sheet of material in a knitting machine of the type which employs knock-over-sinkers, sinker-nibs and bearded knitting needles; said method consisting in passing a base sheet between the knock-over-sinkers and the sinker-nibs during the knitting operation of the machine, and piercing the base sheet to provide needle passages in advance of the needles' entry into the base sheet.

2. The combination with a flat knitting machine which includes bearded knitting needles, knock-over-sinkers, sinker-nibs, beard pressers, thread guides, means to pass a previously formed base sheet in the outgoing direction of the knitting between said knock-over-sinkers and said sinker-nibs, and means to operate said needles, knock-over-sinkers, sinker-nibs and beard pressers to effect the known knitting operation; of means to pierce the base sheet to provide needle passages in advance of the needles entering the base sheet.

3. The combination with a flat knitting machine which includes bearded knitting needles, knock-over-sinkers, sinker-nibs, beard pressers, thread guides, means to pass a previously formed base sheet in the outgoing direction of the knitting between said knock-over-sinkers and said sinker-nibs, and means to operate said needles, knock-over-sinkers, sinker-nibs and beard pressers to effect the known knitting operation; of means to pierce the base sheet to provide needle passages in advance of the needles entering the base sheet, said piercing means comprising awls and means to operate the same in timed relation to the other elements of the machine.

4. In a knitting machine the combination with knock-over-sinkers, sinker-nibs, bearded knitting needles and beard pressers, the knock-over-sinkers and sinker-nibs being spaced apart for passage of a base sheet between them, of means for piercing the base sheet in advance of the entry of the needles into the base sheet to provide needle passages for the needles, and means to effect the cooperative action of the aforesaid parts for purposes described.

5. In a knitting machine the combination with knock-over-sinkers, sinker-nibs, bearded knitting needles and beard pressers, the knock-over-sinkers and sinker-nibs being spaced apart for passage of a base sheet between them, of means for piercing the base sheet in advance of the entry of the needles into the base sheet to provide needle passages for the needles, and means to effect the cooperative action of the aforesaid parts for purposes described, said base sheet piercing means comprising awls.

6. In a knitting machine the combination with knock-over-sinkers, sinker-nibs, bearded knitting needles and beard pressers, the knock-over-sinkers and sinker-nibs being spaced apart for passage of a base sheet between them, of means for piercing the base sheet in advance of the entry of the needles into the base sheet to provide needle passages for the needles, and means to effect the cooperative action of the aforesaid parts for purposes described, said base sheet piercing means comprising awls with needle receiving and guiding grooves.

7. In a knitting machine the combination with knock-over-sinkers, sinker-nibs, bearded knitting needles and beard pressers, the knock-over-sinkers and sinker-nibs being spaced apart for passage of a base sheet between them, of means for piercing the base sheet in advance of the entry of the needles into the base sheet to provide needle passages for the needles, and means to effect the cooperative action of the aforesaid parts for purposes described, said beard pressers comprising means operating in the space between the elements of said knock-over-sinkers and said sinker-nibs.

8. In a knitting machine the combination with knock-over-sinkers, sinker-nibs, and bearded knitting needles, the knock-over-sinkers and sinker-nibs being spaced apart for passage of a base sheet between them, of combined beard pressers and sheet piercing means for piercing the base sheet in advance of the entry of the needles into the base sheet to provide needle passages for the needles, and means to effect the cooperative action of the aforesaid parts for purposes described, said beard pressers comprising means operating through the spaces between the elements of said knock-over-sinkers and said sinker-nibs.

9. In a knitting machine, a frame, a set of knock-over-sinkers mounted on said frame, a set of sinker-nibs, means to move said sinker-nibs above and parallel to said knock-over-sinkers, a set of bearded needles movable up and down through the spaces between the elements of said knock-over sinkers and said sinker-nibs, beard pressers also operating in said spaces, means to actuate the aforesaid parts in timed relation to effect a knitting operation, there being a space between said knock-over-sinkers and said sinker-nibs through which a base sheet may be passed, a combined base sheet piercing and beard pressing means also operating in said spaces between the elements, and means to actuate the aforesaid parts in timed relation to effect a knitting operation through the base sheet.

10. In a knitting machine, a frame, a set of knock-over-sinkers mounted on said frame, a set of sinker-nibs, means to move said sinker-nibs above and parallel to said knock-over-sinkers, a set of bearded needles movable up and down through the spaces between the elements of said

knock-over-sinkers and said sinker-nibs, there being a space between said knock-over-sinkers and said sinker-nibs through which a base sheet may be fed, combined with a base sheet piercing and needle guiding means, and means to operate the aforesaid elements in harmony to effect the knitting operation through said base sheet.

11. In a knitting machine, a frame, a set of knock-over-sinkers mounted on said frame, a set of sinker-nibs, means to move said sinker-nibs above and parallel to said knock-over-sinkers, a set of bearded needles movable up and down through the spaces between the elements of said knock-over-sinkers and said sinker-nibs, there being a space between said knock-over-sinkers and said sinker-nibs through which a base sheet may be fed, combined with a base sheet piercing, needle guiding and beard pressing means, and means to operate the aforesaid elements in harmony to effect the knitting operation through said base sheet.

12. In a knitting machine, wherein is provided knock-over-sinkers and bearded knitting needles movable lengthwise up and down in the spaces between the elements of the knock-over-sinkers, a combined awl and needle guide operating through said spaces.

13. In a knitting machine, wherein is provided knock-over-sinkers and bearded knitting needles movable lengthwise up and down in the spaces between the elements of the knock-over-sinkers, a combined awl, needle guide and beard presser operating through said spaces.

14. In a knitting machine, stationary knock-over-sinkers, movable sinker-nibs cooperating therewith and spaced above the same to leave a passage for a base sheet over the knock-over-sinkers, vertically movable bearded needles operating in the spaces between said knock-over-sinkers and said sinker-nibs, in combination with means to form passages through the base sheet in advance of the needles' movement into and through the base sheet.

15. In a knitting machine, stationary knock-over-sinkers, movable sinker-nibs cooperating therewith and spaced above the same to leave a passage for a base sheet over the knock-over-sinkers, vertically movable bearded needles operating in the spaces between said knock-over-sinkers and said sinker-nibs, in combination with means to form passages through the base sheet in advance of the needles' movement into and through the base sheet, said means comprising vertically movable awls.

16. In a knitting machine, stationary knock-over-sinkers, movable sinker-nibs cooperating therewith and spaced above the same to leave a passage for a base sheet over the knock-over-sinkers, vertically movable bearded needles operating in the spaces between said knock-over-sinkers and said sinker-nibs, in combination with means to form passages through the base sheet in advance of the needles' movement into and through the base sheet, said means comprising vertically movable awls having needle guarding and guiding provisions.

17. In a knitting machine, stationary knock-over-sinkers, movable sinker-nibs cooperating therewith and spaced above the same to leave a passage for a base sheet over the knock-over-sinkers, vertically movable bearded needles operating in the spaces between said knock-over-sinkers and said sinker-nibs, in combination with means to form passages through the base sheet in advance of the needles' movement into and through the base sheet, said means comprising awls, a carrier for the awls, and means to cause selected awls to act also as beard pressers.

18. In a knitting machine, stationary knock-over-sinkers, movable sinker-nibs cooperating therewith and spaced above the same to leave a passage for a base sheet over the knock-over-sinkers, vertically movable bearded needles operating in the spaces between said knock-over-sinkers and said sinker-nibs, in combination with means to form passages through the base sheet in advance of the needles' movement into and through the base sheet, said means comprising awls, a carrier for the awls, and means to cause selected awls to act also as beard pressers, said awls having needle guarding and guiding provisions.

19. In a knitting machine, stationary knock-over-sinkers, movable sinker-nibs cooperating therewith and spaced above the same to leave a passage for a base sheet over the knock-over-sinkers, vertically movable bearded needles operating in the spaces between said knock-over-sinkers and said sinker-nibs, in combination with means to form passages through the base sheet in advance of the needles' movement into and through the base sheet, said means comprising awls, an articulated carrier for the awls, and means to operate said carrier to move the awls longitudinally.

20. In a knitting machine, stationary knock-over-sinkers, movable sinker-nibs cooperating therewith and spaced above the same to leave a passage for a base sheet over the knock-over-sinkers, vertically movable bearded needles operating in the spaces between said knock-over-sinkers and said sinker-nibs, in combination with means to form passages through the base sheet in advance of the needles' movement into and through the base sheet, said means comprising awls, an articulated carrier for the awls, and means to operate said carrier to move the awls longitudinally and rock the same toward and from the needle beards.

21. In a knitting machine, stationary knock-over-sinkers, movable sinker-nibs cooperating therewith and spaced above the same to leave a passage for a base sheet over the knock-over sinkers, vertically movable bearded needles operating in the spaces between said knock-over-sinkers and said sinker-nibs, in combination with means to form passages through the base sheet in advance of the needles' movement into and through the base sheet, said means comprising awls, an articulated carrier for the awls, and means to operate said carrier to move the awls longitudinally, said carrier comprising pivoted arms, members pivoted to said arms and to which members said awls are secured, means to oscillate said pivoted arms, anchors and rods connecting said pivoted members to said anchors.

22. In a knitting machine, stationary knock-over-sinkers, movable sinker-nibs cooperating therewith and spaced above the same to leave a passage for a base sheet over the knock-over-sinkers, vertically movable bearded needles operating in the spaces between said knock-over-sinkers and said sinker-nibs, in combination with means to form passages through the base sheet in advance of the needles' movement into and through the base sheet, said means comprising awls, an articulated carrier for the awls, and means to operate said carrier to move the awls longitudinally, said carrier comprising pivoted arms, members pivoted to said arms and to which

members said awls are secured, means to oscillate said pivoted arms, anchors and rods connecting said pivoted members to said anchors, and means to adjust selected anchors to cause certain awls to function as beard pressers while others do not function as such.

23. In a knitting machine, the combination with mechanism including needles for knitting through a base sheet, of means operating in advance of the needles to open needle passages through the base sheet.

24. In a knitting machine, the combination with mechanism including needles for knitting through a base sheet, of means operating in advance of the needles to open needle passages through the base sheet while the base sheet is being passed through the machine.

25. In a knitting machine, the combination with mechanism including needles for knitting through a base sheet, of means operating in advance of the needles to open needle passages through the base sheet, said means including sheet penetrating needle guards, having means to guide the active ends of the needles into the needle passages.

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