July 19, 1938. V. LOMBARDI 2,124,305

KNITTING NEEDLE AND METHOD OF USE

Filed March 8, 1937 2 Sheets-Sheet 1

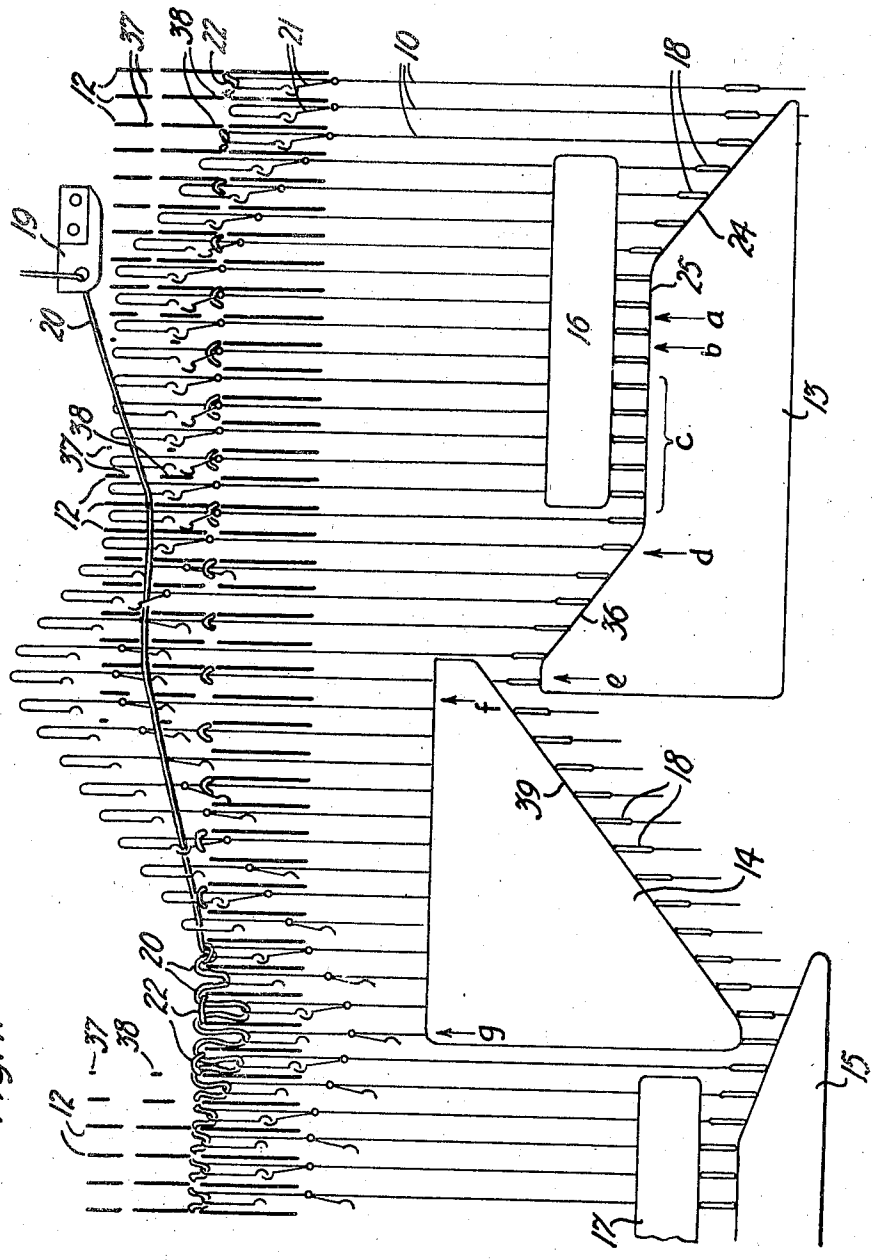


Fig. 1.

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Fig. 2b.

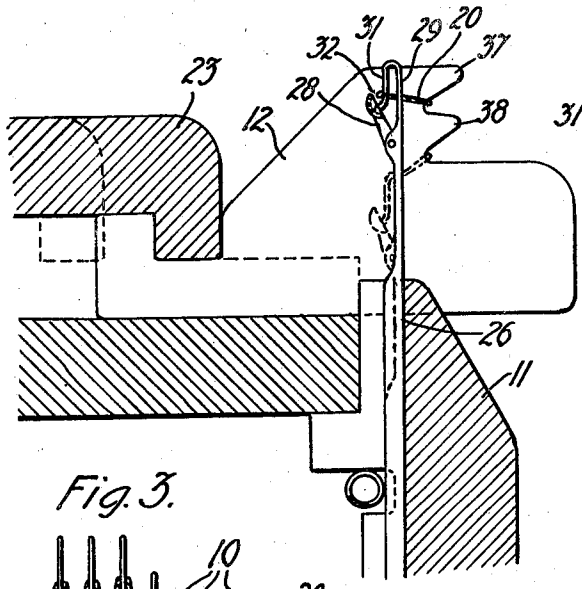


Fig. 2a.

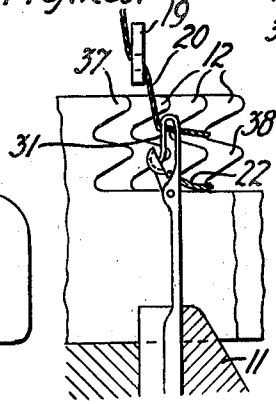


Fig. 2c.

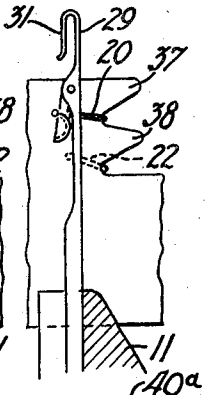
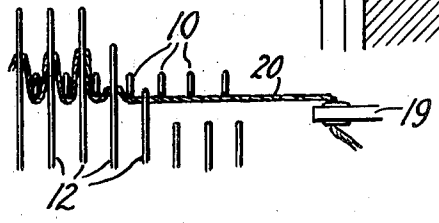


Fig. 3.



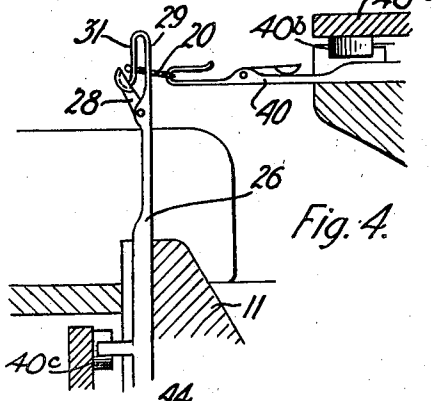


Fig. 4.

Fig. 5.

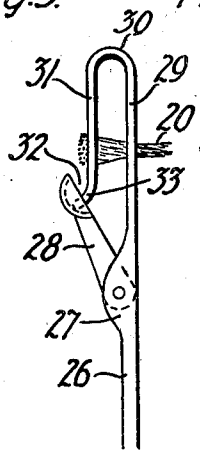


Fig. 6.

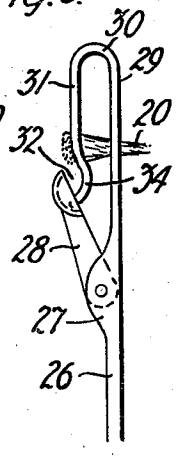


Fig. 7.

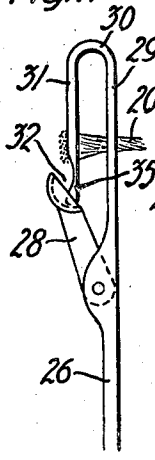


Fig. 8.

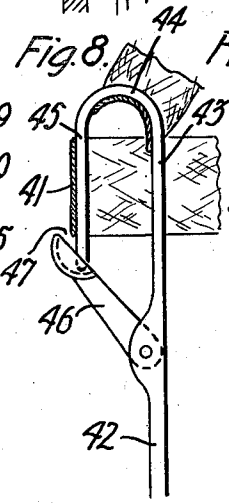
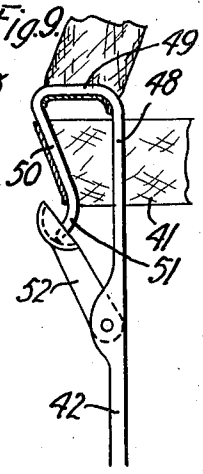


Fig. 9.



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Patented July 19, 1938

2,124,305

UNITED STATES PATENT OFFICE

2,124,305

KNITTING NEEDLE AND METHOD OF USE

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Application March 8, 1937, Serial No. 129,558

14 Claims. (Cl. 66—8)

This invention relates to improvements in knitting machines and has particular reference to a knitting needle and associated parts, and the method of using the same.

An object of the invention is to control the feeding of a yarn to a latched type needle especially suitable for use in fine gauge knitting machines, by utilizing a portion of the needle to positively guide a yarn fed thereto, during advancement of the needle, into a position in which said yarn will enter the hook of the needle when the latter is retracted.

Another object is to insure the entrance of guided yarn into the hook of the needle by exerting a pull upon said yarn to tauten the same against the portion of the needle which is used to guide the yarn.

A further object is to utilize the yarn being guided by a needle preparatory to its entrance into the hook of the latter, to open the latch of said needle when said latch is closed during certain operating conditions of the needle.

The above and other objects will appear more clearly from the following detailed description, when taken in connection with the accompanying drawings, which illustrate preferred embodiments of the inventive idea; but it will be expressly understood that said drawings are employed merely for purposes of illustration and not to define the limits of the invention, reference being had to the appended claims for this purpose.

In the drawings:

Figure 1 is a diagrammatic view of a portion of a knitting machine illustrating a sequence of operation in accordance with the present invention, the pivoted latch needles embodying features of this invention being slightly turned from the normal positions which they actually assume in order that the operations thereof may be better understood.

Figure 2*a* is a fragmentary elevation, partly in section, illustrating certain operations in the feed of a yarn to one of the needles with the latter in one stage of its advancement.

Figure 2*b* is a similar view showing the needle at a further point in its advancement, the dotted lines indicating the position of the needle after it has caught the yarn and has been fully retracted.

Figure 2*c* is a similar view showing the needle at an advanced position wherein the new yarn has been guided to a position in which it will enter the hook of the needle upon retraction of the latter.

Figure 3 is a fragmentary diagrammatic top plan view showing the relation of the parts as illustrated in Figure 2*a*.

Figure 4 is a view similar to Figure 2*b* showing the manner in which a new yarn is drawn against the guiding portion of the needle by means of a dial needle, instead of the sinker illustrated in the latter figure, and

Figures 5 to 9, inclusive, are elevations of various modified forms of a pivoted latch needle constructed in accordance with the invention.

Briefly, the accomplishment of the above objects in connection with a needle of the pivoted latch type is to provide the needle with a hook having a deep bight made by extending the bill of the needle hook to form an elongated yarn-guiding portion with which a yarn is engaged during a substantial part of the total range of advancement of said needle, or until the yarn is at a point in close proximity to the inner end of the shank of said hook. Should the latch of the needle be closed during said period of advancement, as for instance when the needle has not formed a loop at its previous operation, the guided yarn will become effective to open said latch by an initial engagement with the free end thereof. It is desirable to insure the engagement of the yarn with said guided portion of the hook, and its subsequent entrance into said hook when the needle is retracted. This may be done by exerting a pull upon the yarn so as to tauten the same against the guiding surface of said hook. To this end, use is preferably made of a separate instrumentality such as a sinker or a cooperating dial needle so controlled as to engage the yarn during its contact with said guiding surface, and exert a pull upon the same in the direction of feed of the fabric being knitted until the yarn is in position to enter the hook during retraction.

Referring more particularly to Figure 1, in which the knitting instrumentalities necessary to an understanding of the present invention are schematically shown, 10 indicates generally a series of cylinder needles of the pivoted latch type and embodying characteristic features of this invention. In the customary manner, these needles are disposed on the cylinder 11 (Figure 2) of a knitting machine between the sinkers 12 and are controlled by the usual cams 13, 14 and 15, and abutments 16, 17 which rotate to advance and retract the needles during a sequence of operation thereof by engagement of the cams with the butts 18 of the needles. A rotating yarn guide 19 of the usual type feeds a new yarn 20 to the needles preparatory to the formation of

loops in said yarn and the casting of said loops at the termination of said sequence of operation. Figure 1 shows, at the right hand end thereof, an arbitrary condition of the needles at the beginning of the sequence of operation, in which the latches of all of the needles are closed and the hook of each alternate needle has engaged a yarn 22 previously fed thereto. This particular condition of the needles will produce certain pattern effects in the fabric being knitted but it will be understood, of course, that such condition may be varied to obtain other patterns in the knitted fabric without departing from the spirit or scope of the present invention which resides primarily in the construction of the needle itself, the manner of feeding the yarn thereto, and the control of the needle and yarn during the knitting operation. In the position mentioned at the beginning of the sequence, the sinkers 12 are advanced by their control element 23 (Figure 2b) to engage the formed loops of certain of the needles and perform their usual function in the operation of knitting the fabric, and said sinkers remain in the advanced position until after the needles have been partially advanced by the surface 24 of the cam 13 from which the butts of the needles pass to the surface 25 of said cam as the latter rotates. During the engagement with said surface 25, the sinkers 12 are retracted and thereafter advanced again, preparatory to accomplishing one of the novel results of the present invention, as will hereinafter appear.

At this point, a detailed description of one of the needles which may be employed to carry out certain features of the invention will facilitate an understanding of the knitting operation, and more particularly the feeding of the yarn to the needle. By reference to the form of needle shown in Figure 5, which embodiment is also illustrated in Figures 1 to 4 inclusive, it will be seen that the needle comprises the usual shank 26 and cheek 27 to which is pivoted the latch 28 of known construction, except that said latch is shorter in length than that of the ordinary pivoted latch needle. From the cheek 27 extends the shank of the needle hook 29. Contrary to the usual formation of needle hook in which the extremity of the hook terminates contiguous to the bight thereof, the present hook has its bight 30 extended in the direction of the other end of the needle in substantial parallel relation to the shank of the hook, to provide an elongated bill 31. The length of this bill may be varied, but it is preferable to extend the same to a point at least approximating one-half the distance from the bight 30 to the pivot of the latch 28 so that the free extremity of the bill will be disposed adjacent the inner end of the shank of the needle hook. This elongated bill provides a yarn-guiding portion on the needle which is effective to positively guide the yarn 20 during a substantial portion of the period of advancement of the needle and preparatory to the entrance of said yarn into the hook 29 when the needle is retracted. Preferably, the exterior surface of said bill or guiding portion is utilized to so guide the yarn; and after said yarn has been fed to the needle and while the latter is being advanced, the yarn is drawn or tautened against said surface in a manner to later appear so that its continued engagement and consequent guidance will be insured until the yarn is in position to enter the needle hook. The latch 28, when in its closed position, also cooperates with the bill 31 in guiding the yarn into the hook when the latter has no previously formed loop therein, such as the second and each succeeding alternate needle shown at the right of Figure 1, and in such instances the new yarn being fed to the needle is utilized to open the latch by an initial engagement with the free end thereof as the needle advances. This phase of the guiding of the yarn and the opening of the latch is accomplished, as shown in all of the illustrated embodiments of the needle, by overlapping the free extremities of the latch and bill so that the same will combine to form an entrance 32 for the yarn. By reason of the length of the bill 31, the angle of the latch 28 relative to said bill is materially increased over that existing in the ordinary type of needle, thus proportionately increasing the effective width of said entrance, and, in order to insure that the latter will be at all times sufficiently wide to receive said yarn, the extremity 33 of the bill may be bent outwardly so that when the latch is engaged therewith said entrance will be made wider because of the increase in the angle of the latch.

The effective width of the entrance 32 may be increased in various other ways such as disclosed in Figures 6 and 7. In Figure 6, the desired result is attained by curving the extremity of the bill 31 inwardly as indicated at 34 to space the bill farther from the latch end; while in Figure 7, the material of the bill itself is reduced in thickness, as indicated at 35. In all of the forms illustrated, it is apparent that as the free end of the latch approaches the yarn 20 during advancement of the needle, said yarn will pass into the entrance 32 and engage said latch. Continued advance of the needle then causes the yarn to swing the latch toward its open position and, after passing the extremity of the hook 31, said yarn will be partially guided by the latch during the opening movement of the latter and will ultimately engage over the latch, as shown in Figure 2c, or contact with the shank of the hook 29, depending upon the degree of advancement of the needle. In either case, the yarn will be positioned to enter the hook upon retraction thereof.

Reverting now to Figure 1 and the previously described position of the needles in which the same have been partially advanced so that their butts are engaged between the abutment 16 and the surface 25 of the cam 13, each needle remains in this position until it is engaged by the surface 36 of said cam to be further advanced thereby. In this partially advanced stage, those alternate needles the hooks of which are engaged with a yarn 22 previously fed thereto, are in a position wherein said yarn contacts the inner ends of the latches preparatory to swinging the same to open position when the needle is further advanced by said surface 36. The other alternate needles whose hooks are not engaged with a yarn, also have their latches closed and, together with the first-named needles, are ready to have the new yarn 20 fed thereto by engagement of the yarn with the elongated bills 31 that act to guide said yarn to a position to enter the hooks during a subsequent operation. Upon being advanced to the position described, the control element 23 becomes effective to progressively retract the sinkers 12 to positions *a* and *b* indicated along the surface 25 of the cam 13. In the three right hand positions of the series indicated by the character *c*, the sinkers are fully retracted and in the next succeeding *c* position the sinker therein has again started to advance. The fully retracted and first advanced positions of the sinkers are indicated by the two positions thereof at the left of Figure 2*a*.

At approximately the period when the sinkers are fully retracted, the yarn feeder 19 has progressed in its movement to the right sufficiently to bring the yarn 20 into contact with the upper end of the bill 31 of the needle shown in Figure 2a and as the movement of the feeder 19 progresses said yarn will be guided downwardly a slight distance along the exterior surface of the bill 31 of each succeeding needle. At the fourth sinker position indicated in the group c, the sinker therein has been advanced to the second position from the left shown in Figure 2a, and in the next two sinker positions of group c the sinkers therein will be advanced to the third and fourth positions of Figure 2a. In the third position of the latter figure, which corresponds to the fifth position of group c in Figure 1, the sinker has advanced sufficiently for the inner end of its upper hook 37 to have engaged the yarn 20 directly behind the needle shown in Figure 2a and a pull is thereupon exerted upon the yarn in the direction of the feed of the fabric being knitted to tauten said yarn against the bill 31 and thus insure engagement therewith. Continued advance of the sinker to the sixth position of group c (Figure 1), and to the equivalent extreme right hand position of Figure 2a, maintains the yarn in its tautened condition and this condition continues until the sinkers are retracted, as will hereinafter more fully appear. The needle located between the sixth sinker of group c and the next succeeding sinker to the left, is one which has formed a loop from the yarn 22 and this yarn is indicated in Figure 2a as being positioned in the lower hook 38 of the right hand sinker and in position to open the latch of the needle behind the one shown in said figure.

The next needle to the left of group c, indicated at position d of Figure 1, is the same needle that is illustrated in Figure 2b. In this position, the needle has again started its advance by engagement of its butt with the cam surface 36 and this movement of the needle causes the yarn 20, now held taut by an advanced sinker, to be guided further along the bill 31 of the needle hook and toward the free end of the latch 28, with the yarn just about to pass into the entrance 32. The advance of the needle continues to position e (also shown in Figure 2c) and during this movement and until the latter position is reached, the yarn is maintained taut by the advanced sinkers. Also during this interval, loops 22 of alternate needles open the latches thereof and pass onto the shanks of said needles preparatory to the casting operation, while the yarn 20, engaging and being guided by the bills of the other needles, contacts the free ends of the latches of the latter needles to open the same, and then engages the latches substantially as shown in Figure 2c wherein the yarn is in position to enter the hook of each needle when the latter is retracted. Beyond position e, each needle contacts the surface 39 of the cam 14, whereupon retraction of the needle begins and continues until the low point of the cam 14 is reached. At the start of this retracting movement, as at position f, the sinkers are withdrawn and thereafter the yarn 20 enters the hook of each needle. At position g, each needle is fully retracted and those which carried a previously formed loop have their latches closed by reason of the casting of said loop, while the latches of the other needles have been opened by the yarn 20. When the cam 14 passes the fully retracted needle, the latter is engaged by the cam 15 to partially advance the needle and, at the same time, the sinkers 12 are again advanced to receive in their lower hooks 38, in the usual manner, the loops formed in the yarns, as shown in dotted lines in Figure 2b. Before the cam 13 again reaches the position shown in Figure 1 to initiate another sequence of operation, the open latches of the alternate needles shown at the left of said figure may be closed by any suitable means known in the art, whereupon the needles are ready for a repetition of the operation herein described.

Instead of employing the sinkers to control the tautening of the yarn against the hook bills 31, the same result may be accomplished by other means such as the dial needle 40 illustrated in Figure 4. In this instance, the needle 40 may be of the same type as the associated cylinder needles 10 and controlled, in a well-known manner, to engage its hook with the yarn 20 to tauten the latter during the intervals previously described in connection with the sinkers 12. A known method of so controlling said needle 40, is partially shown in Fig. 4 as including a rotating cam ring 40a having the cam 40b thereon which engages the butt of the needle to tighten the yarn against the bill 31 of the cylinder needle 26 which is likewise controlled by the cam 40c that raises said needle to open the latch 28 to thereby engage the yarn in the hook.

A needle of the type herein described may be employed in the knitting of flat ribbon-like yarns such as shown at 41 in Figures 8 and 9. In knitting with yarns of this kind, difficulty has been experienced heretofore in the engagement and retention of the relatively wide yarn by the hooks of the ordinary type of pivoted latch needles, such difficulty residing in the inability to avoid undue gathering or wrinkling of the yarn and its inadvertent detachment from the needle hook. The needles 42 of Figures 8 and 9 may embody some of the characteristic features of the needles 10. Thus in Figure 8, the hook 43 is provided with a curved bight 44 which is extended to form the yarn-guiding bill 45 somewhat similar to the bill 31 of the previously described needles. In order that the yarn 41, upon entering the hook, may be accommodated therein without undue wrinkling or gathering, the bight 44 is made of such width as to separate the bill 45 from the shank of the hook 43 a sufficient distance to permit the yarn to lie flatly against said bight and between said bill and shank during retraction of the needle. By increasing the distance between said bill and shank, the pivoted latch 46 has its angular relation to the needle shank correspondingly increased when it engages the extremities of said bill. As a consequence, the entrance 47 formed by the latch and bill is sufficiently wide to insure entry of the yarn 41 into the same when the needle is advanced.

In Figure 9, the needle shank 48 is again provided with a bight 49 which, in this instance, is flat as distinguished from the curved bight 44. Extending from the bight 49 and directed inwardly toward the needle shank is the yarn-guiding portion of the bill 50 having its free extremity 51 turned outwardly to widen the entrance between the same and the free end of the latch 52, this arrangement being the same as that disclosed in Figure 5. Again, as in Figure 8, the width of the bight 49 is such that the yarn in the hook may be accommodated therein in a substantially flat condition.

It will be obvious from the foregoing descrip-

tion that the method of knitting herein involved is not limited in its application to cylinder needles since the same method may be employed in conjunction with dial needles, as suggested in Figure 4, without departing from the spirit or scope of the invention.

What is claimed is:

1. In a knitting machine, a knitting needle of the pivoted latch type comprising a shank, a latch pivoted thereto, a hook on said shank having a bill engageable by a yarn fed to said needle and being of a length to guide said yarn during a substantial portion of the period of advancement of said needle, and means to tauten said yarn against said bill while the yarn is being guided.

2. In a knitting machine, a knitting needle of the pivoted latch type comprising a shank, a latch pivoted thereto, and a hook on said shank having a bill engageable by a yarn fed to said needle and being of a length to guide said yarn during a substantial portion of the period of advancement of said needle, and a sinker operable to maintain said yarn in a tautened condition while it is being guided by said bill.

3. In a knitting machine, a knitting needle of the pivoted latch type comprising a shank, a latch pivoted thereto, a hook on the end of said shank adjacent said latch and having a yarn-guiding portion engageable by the free end of said latch and of a length to guide a yarn during a substantial portion of the period of advancement of said needle and until the opening of said latch is initiated by engagement of the yarn therewith, said guiding portion and the free end of said latch combining, when the latter is closed, to form an entrance for said yarn into said hook, and said guiding portion having means cooperating with said latch to maintain said entrance of sufficient width to receive said yarn, and means to tauten said yarn against said guiding portion during said portion of the advancement of the needle.

4. In a knitting machine, a knitting needle of the pivoted latch type comprising a shank, a latch pivoted thereto, and a hook on the end of said shank adjacent said latch and having a yarn-guiding portion engageable by the free end of said latch and of a length to guide a yarn during a substantial portion of the period of advancement of said needle and until the opening of said latch is initiated by engagement of the yarn therewith, said guiding portion and the free end of said latch combining, when the latter is closed, to form an entrance for said yarn into said hook, and said guiding portion having its free extremity curved at a point contiguous to the free end of said latch so as to cooperate therewith to widen said entrance sufficiently to receive said yarn, and means to tauten said yarn against said guiding portion during said portion of the advancement of the needle.

5. In a knitting machine, a plurality of needles of the pivoted latch type having elongated hook bills constituting guiding surfaces for a yarn being fed to said needles, means to advance and retract said needles to form loops in said yarn and to engage said surfaces therewith during a substantial period of the advancement of the needles, and means operable during such advancement to exert a pull upon said yarn so as to positively retain the same in engagement with said guiding surfaces.

6. In a knitting machine, a plurality of needles of the pivoted latch type having elongated hook bills constituting guiding surfaces for a yarn being fed to said needles, means to advance and retract said needles to form loops in said yarn and to engage said surfaces therewith during a substantial period of the advancement of the needles, and sinkers each having a pair of hooks thereon, one of said hooks engaged with a previously formed loop on a needle during advancement of the latter and said sinker, and the other hook engaging said yarn, during said advancement, to tauten the same against the guiding surface of an adjacent needle.

7. In a knitting machine, groups of cylinder and dial needles of the pivoted latch type having elongated hook bills forming guiding surfaces for a yarn being fed to said needles, means to advance and retract said needles to form loops in said yarn, and means to operate one of said groups of needles during a substantial portion of the advancement of the other group to tauten said yarn against the guiding surfaces of the latter group.

8. In a knitting machine, groups of cylinder and dial needles of the pivoted latch type having elongated hook bills forming guiding surfaces for a yarn being fed to said needles, means to advance and retract said needles to form loops in said yarn, and means to operate said group of dial needles to tauten said yarn against the guiding surfaces of said cylinder needles during a substantial portion of the advance of the latter needles.

9. In a knitting machine, groups of cylinder and dial needles of the pivoted latch type having elongated hook bills forming guiding surfaces for a yarn being fed to said needles, means to advance and retract said needles to form loops in said yarn, and means to retract one of said groups of needles during a substantial portion of the advancement of the other group of needles to tauten said yarn against the guiding surfaces of the latter group.

10. The method of knitting with a needle of the pivoted latch type having a long hook, which comprises utilizing a surface of the hook of said needle, during advancement thereof, to guide a yarn fed thereto to a position wherein said yarn will enter the hook during retraction of said needle, and employing an instrumentality other than the needle to tauten said yarn against said surface during the period in which the yarn is being guided.

11. The method of knitting with a needle of the pivoted latch type having a long hook, which comprises utilizing an exterior surface of the hook of said needle, during advancement of the latter, to guide a yarn fed thereto into a position to enter said hook, and feeding said yarn to other means cooperating with the needle to tauten said yarn against said surface during the period in which the yarn is being guided.

12. The method of knitting a fabric with needles of the pivoted latch type having a long hook, which comprises feeding a yarn from a yarn feed movable relative to said needles onto an outer surface of the hook of one of said needles, utilizing said surface to guide said yarn toward the free extremity of said hook during advancement of said needle, opening the latch of said needle with said yarn, and exerting a pull upon said yarn in the direction of feed of the fabric being knitted so as to tauten the yarn against said surface and position the same to enter said hook after the free extremity of the

latter has passed said yarn during advancement of the needle.

13. The method of knitting with a needle of the pivoted latch type having a hook with a deep bight, which comprises feeding a yarn to a surface of the hook of said needle while the latter is held in a stationary position, utilizing said surface to guide said yarn during subsequent advancement of the needle, and tautening said yarn against said surface while the yarn is being guided.

14. The method of knitting with a plurality of needles of the pivoted latch type each having a hook with a deep bight, which comprises feeding a passing yarn to a surface of the hook of each of said needles, utilizing said surface to guide said yarn to a position where it will enter said hook during retraction of the needle, and tautening said yarn against the said surfaces of the various needles while the yarn is being guided.

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