The present invention relates to improvements in Raschel warp knitting machines and, more particularly, to a novel combination of latch needles not heretofore used in Raschel warp knitting machines.

It is the principal object of the present invention to overcome these disadvantages of knitting needles used in Raschel warp knitting machines and to provide a latch needle of superior operating quality.

This object is accomplished by lengthening the bill in relation to the bight of the needle hook, the bill length being at least three times the bight and not exceeding the bight length.

In one embodiment of the invention, the lengths of the bill and the latch of the needle are about equal and the length of the bill is about five to seven times the width of the latch.

The objects, features and advantages of the invention will be more fully described in the following detailed description of prior art Raschel machine knitting needles and certain preferred embodiments of the Raschel machine latch needle of this invention, taken in conjunction with the drawing wherein

FIGS. 1 and 2 show the structure and operation of latch needles in known Raschel machines;

FIGS. 3 and 4 illustrate two embodiments of a Raschel machine latch needle according to the invention;

FIGS. 5 and 6 show the operation of the latch needles of the invention as compared to the operation illustrated in FIGS. 1 and 2; and

FIG. 7 schematically illustrates a conventional Raschel warp knitting machine combined with latch needles according to the invention.

As shown in FIGS. 1 and 2, the yarns from the outermost guide bars run to the latch needle in a strongly inclined section in Raschel warp knitting machines which have several guide bars to form the knitted design. The distance from the yarn guide 2 to the needle shank 4 of latch needle 1 is relatively short so that the yarn 6 frequently slides off the already opened latch 5 whereby knitting defects occur. The latch is pivoted at 5' on the check of the needle and the needle hook is indicated at 3.

As is further illustrated in FIG. 2, if the yarn 6a does not slide off the latch 5, it does not move up from the bottom 7 of the latch fast enough because of the above-described oblique path of the yarn. Therefore, the latch 5 severs the yarn 6 when it is closed by the previously formed loop 8.

An additional disadvantage of this type of needle with a small hook is the fact that the end of the bill of the knitting needle comes into the range of the yarn guide when an oblique pull is exerted on the needle whereby the bill is broken off by the yarn guide because of the relative motions of the needles.

FIG. 3 illustrates a latch needle used in a Raschel machine according to the invention to overcome all of the above disadvantages. As shown, the needle 1a consists of a shank 4a and a hook whose bill 3a has the length 13 and whose bight 3b has the overall width 9. Latch 5a is pivoted on the needle shank 10a and has the length 11. The length 13 of bill 3a is about thrice the bight 9 of the needle hook. The lengths 11 of the latch and 13 of the bill are about equal.

FIG. 4 illustrates a somewhat differently dimensioned knitting needle 1b, wherein the length 13 of the bill 3b is approximately five times the bight 9 of the needle hook.

On the other hand, the length 11 of the latch 5b is about the same as the hook length 13. The needle latch is pivoted on the needle shank at 10' and the length of the hook in relation to the bight to the length of the latch may be widely varied as long as it is at least about three times its bight and does not exceed the length of the latch.

Minor deviations from dimensions are possible if the needle still accomplishes the advantageous results of the present invention.

I have found the preferred length of the needle hook to be about seven times the bight of the hook and about equal to the length of the latch.

The operation of the needle 1a, as compared to needle 1 of FIG. 1, is exemplified in FIG. 5. As can be seen, the distance of upper end 12 of the needle from shank 4a below latch 5a is considerably increased so that the yarn 6b have a much less inclined path from needle 1a to yarn guide 2 than in case of the known short-hooked needles 1 used in Raschel machines with several needle bars. This will prevent the sliding off of the yarn from the opened latch and, furthermore, as shown in FIG. 6, the yarn 6b moves outside the range of bottom 7a of the latch so that it will not be cut by the latch 5b as it is closed by loop 8b.

Also, the yarn guide 2 will no longer break off the hook of the latch needle 1a since the tip of the hook is positioned considerably lower than in known Raschel machine needles so that it is not contacted by the eye in the yarn guide 2.

FIG. 7 is a schematic side elevation, partly in section, of a conventional Raschel warp knitting machine whose latch needles 16 have the above-mentioned dimensions, such as illustrated in FIGS. 3 and 4, for instance.

As is well known, a Raschel machine is supported on a housing 61 enclosing a chamber 62 holding the power source and motion transmitting means (not shown) for actuating the knitting operation in a conventional manner, many suitable actuating means being known and one such means being shown, for instance, in my copending application Serial No. 753,978, filed August 8, 1958, now Patent No. 3,008,514.

The needle bar 63 is bolted at 18 to cylinder 19 which is glideably reciprocable in cylinder 20. Cylinder 20 is fixedly mounted in tubular support 21 which is bolted at 22 to housing 61. A gasket 24 seals off the rims of cylinders 20 and 21. Bolts 14 fix the needle bed 15 to the needle bar 63, bed 15 carrying latch needles 16 with their latches 17, these needles having the dimensions claimed herein.

As shown, the vertical guide cylinder 21 has a widened bottom portion 25 in registry with an opening 23 in housing 61 to permit a push rod 26, acted upon the actuating means in housing 61, to be connected to connecting rod 27 by means of a nut 28. Connecting rod 27 engages the pin 30 which is fixedly held in place by the bearing flanges 29 extending outwardly from the piston cylinder 19. In this manner, a vertical motion imparted to push rod 26...
will vertically reciprocate piston cylinder 19 and the latch needles 16 carried thereon. Support 21 also carries an upwardly directed arm 31 which supports trick plate 32 at its upper end. The trick plate is stationary. Furthermore, the bearing 33, which is mounted on support 21, has pivotally journaled therein an arcuate arm 34 carrying the bar 35 with its latch detent webs 36.

The arcuate arm 34 is actuated by means of lever 37 linked to push rod 38 which extends into the chamber of housing 61 and is actuated by the means therein in a manner well known per se and forming no part of the present invention, cam means being provided to coordinate the motions of the various knitting elements in the desired cycle.

The pivotal lever 39 is journaled to support 21 intermediate its ends, for instance at the widened portion 25, and is actuated by the same cam means in chamber 62 according to the knitting cycle, push rod 40 being operably engaged by the cam means. As shown, the lever 39 has a row of holes to make it possible to adjust the pivot connection between connecting rod 41 and lever 39, the pivot being demountably fixed in any of the holes in the lever. Connecting rod 41 is adjusatably linked with its other end to lever 42, this lever also having a series of holes for the demountable attachment of the connecting rod pivot 43 therein. In this manner, the linking of connecting rod 41 to levers 39 and 42 may be adjusted so as to shorten or lengthen the effective lengths of the levers.

The other end of lever 42 engages shaft 45 which is journaled in side walls 46 of the machine. The downwardly extending web 47 is fixed to shaft 45 and carries the arcuate member 50 having shoulders 48 and 49. As is well known, the support member 50 carries the members 51 which are glidable in a direction perpendicular to the plane of the drawing and have the yarn guides 53 mounted thereon, as well as the yarn guides 52 for producing the knitted design.

The structure and operation of the illustrated Raschel machine is entirely conventional, except for the dimensions of the latch needles used therein, and requires, therefore, no further explanation.

The combination of latch needles of the indicated dimensions with a Raschel warp knitting machine makes it possible to have a relatively steep yarn path from the latch needles to the yarn guides while the latches are relatively short. In this manner, low denier yarns may be knitted at high speed since the steep yarn path prevents the yarn loops from gliding off the downwardly pivoted latches as well as from being clamped between the closing latch and the needle shank near the latch pivot when the latch needle is moved down again. Finally, it eliminates the danger of the latch needle bit being seized and torn off by the yarn guide because the free hook end of the latch needles remains always outside the range of the eye of the yarn guides.

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