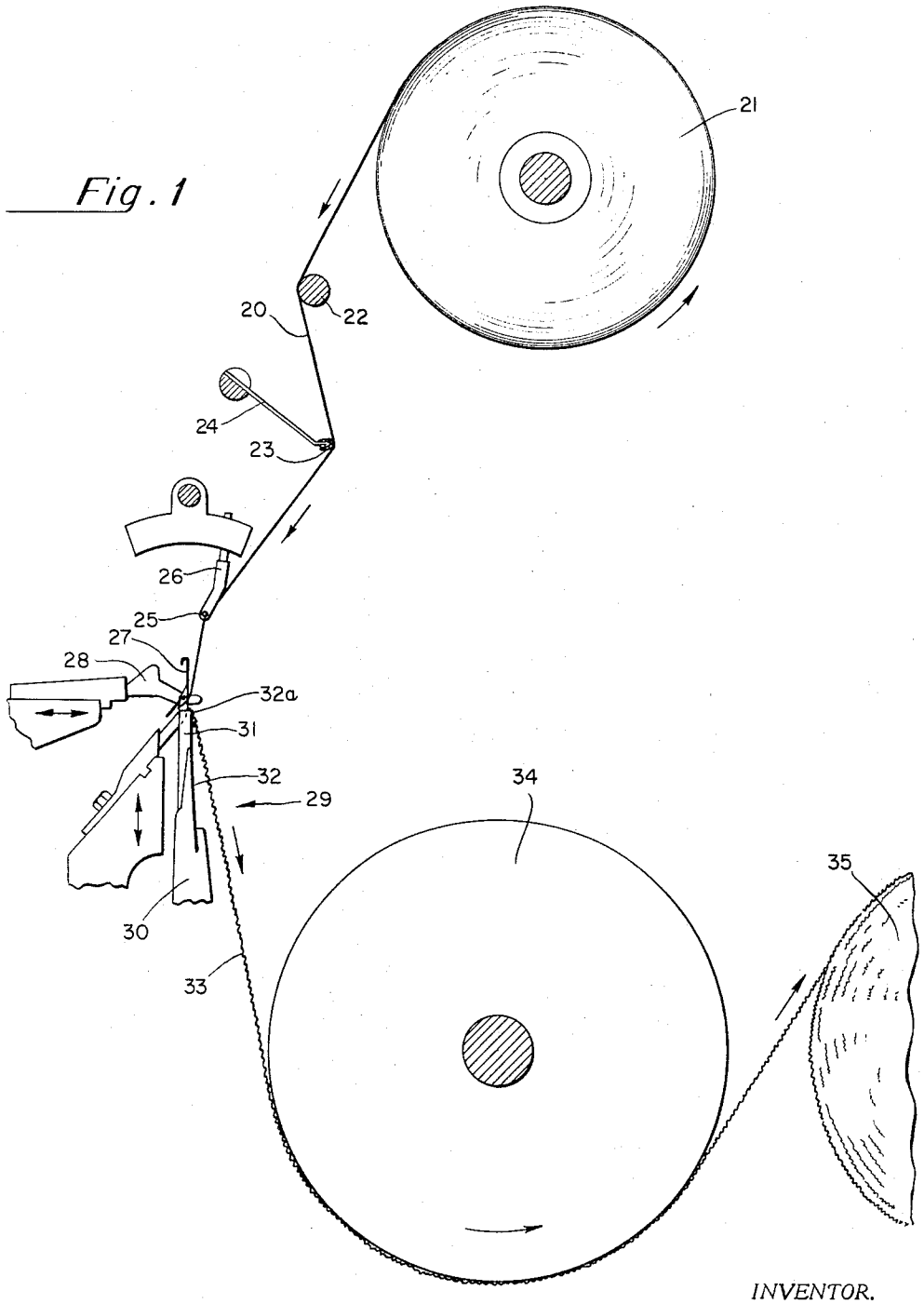
Oct. 15, 1968 W. L. DIEHL 3,405,543

KNOCK-OVER BLADE STRUCTURE FOR WARP KNITTING MACHINES

Filed June 14, 1966 3 Sheets-Sheet 1

Fig. 1



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Fig. 2
PRIOR ART

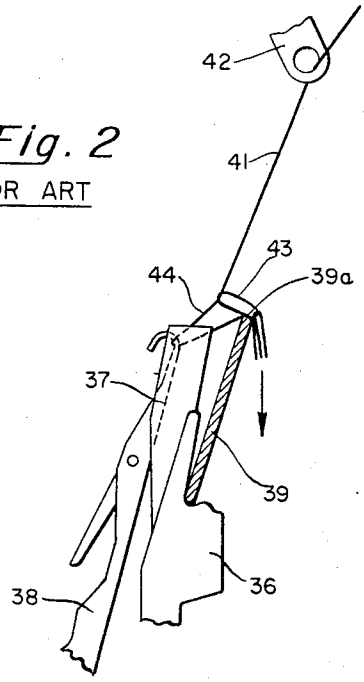
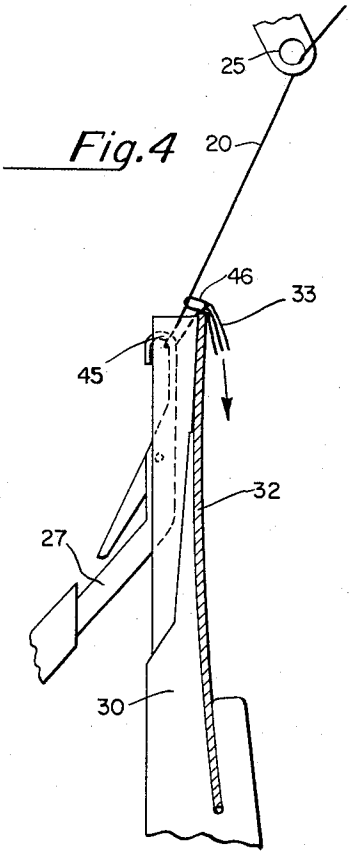


Fig.4



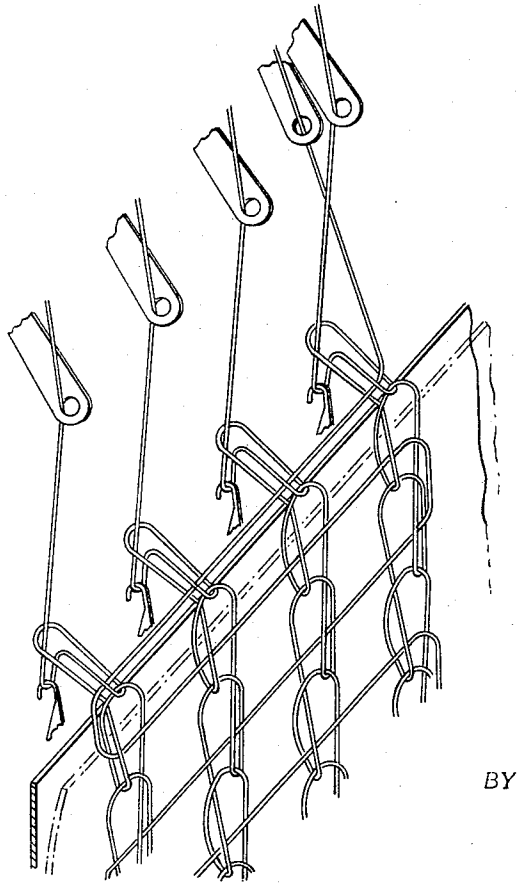


Fig.3

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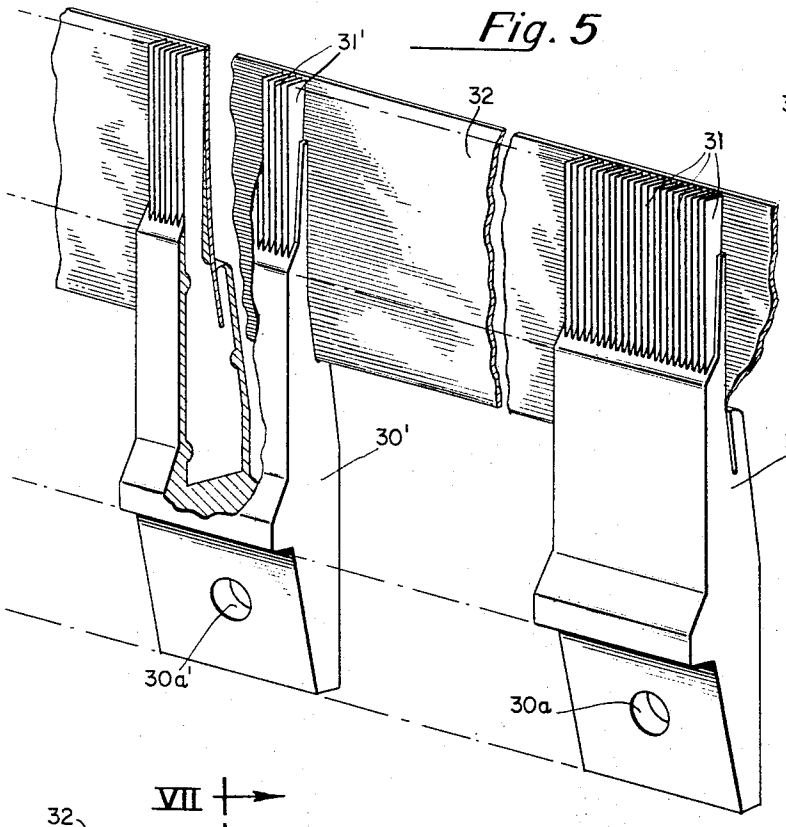
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KNOCK-OVER BLADE STRUCTURE FOR WARP KNITTING MACHINES

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Fig. 5



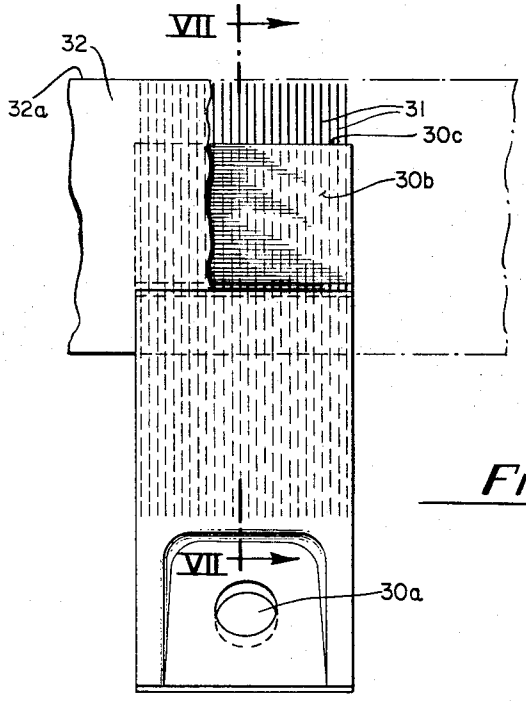


Fig. 6

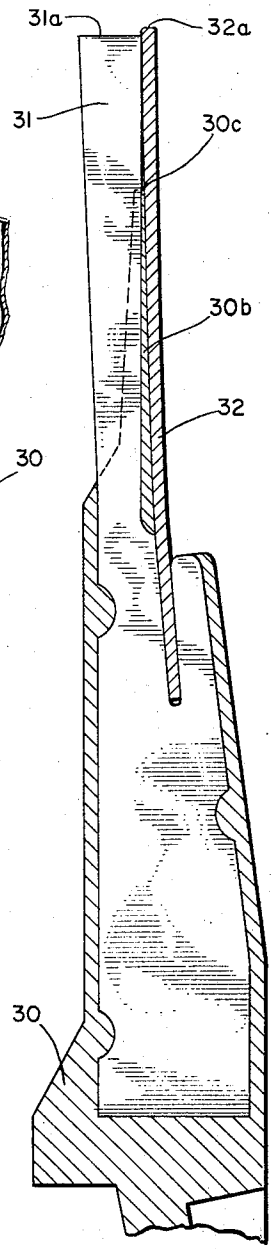


Fig. 7

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United States Patent Office 3,405,543 Patented Oct. 15, 1968

3,405,543

KNOCK-OVER BLADE STRUCTURE FOR WARP KNITTING MACHINES

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Filed June 14, 1966, Ser. No. 557,550
1 Claim. (Cl. 66—86)

ABSTRACT OF THE DISCLOSURE

An immovable thin knock-over band suitable for the production of closely knit fabric made on high speed warp knitting machines.

This invention relates to an improved knock-over blade structure for Raschel and other types of warp knitting machines.

More particularly, the improved structure of the present invention makes it possible to knit very fine or tight stitches closely adjacent each other in the warp chain at extremely high operating speeds.

In order to understand how the present apparatus attains these objectives, and the drawbacks of the prior art, reference will now be had to the drawings wherein:

FIG. 1 is a schematic view in side elevation showing the general features of a warp knitting machine, including needle bed, warp beam and take-up rolls that are utilized in connection with this invention;

FIG. 2 is a side elevation in partial section showing a knock-over band structure of the prior art;

FIG. 3 is a perspective view of a knock-over blade structure illustrating a knock-over band of the prior art;

FIG. 4 is a side elevation in partial section showing the needle bed structure of the present invention;

FIG. 5 is a perspective view of the structure according to the invention, with certain parts broken away and others in section, taken from the front of the needle bed;

FIG. 6 is an elevational view of the structure according to the invention, with certain parts shown in section, taken from the rear of the needle bed; and

FIG. 7 is an enlarged sectional view in side elevation showing more details of the novel structure of the present invention.

Initially, reference will be had to FIG. 1 which shows schematically various important operating elements of a Raschel machine to which this invention is applied. Thus, the warp yarn **20** is shown being drawn from the usual warp beam **21** over a diversion bar **22**, over the yarn strip **23** of a pivotable tension arm **24**, through the eyelet **25** of the usual movable guide **26** which, through well known motions, serves to lap the yarn **20** about the needles **27** prior to stitch formation.

As shown in FIG. 1, the machine is also equipped with the usual sinkers **28** which pass between the needles to hold the stitches below the latches of the needles as the needles ascend. This machine is also equipped with a needle bed generally indicated as **29** which includes a body portion **30** and trick blades **31** which form slots for accommodating the vertical movement of the needles **27**. The top edges of the trick blades **31** cooperate in stitch formation by separating the stitches in the manner well known in the art.

The needle bed structure **29** shown in FIG. 1 also includes a knock-over band **32**. The details of this band **32** will be explained subsequently, but for the present it is sufficient to note that the top edge **32***a* of the band is positioned approximately at the top edge of the trick blades **31** so as to provide a surface over which the cast off stitches are drawn or "knocked over" as the

fabric **33** is taken up in a conventional manner by beams **34** and **35**.

In order to understand the advance made by the present invention, it is appropriate at this point to refer briefly to devices which in the past have been used in an attempt to knit tight stitches on warp knitting machines of this type. In passing, it might be mentioned that this is an objective which those skilled in the art have long sought to attain.

Thus, for example, on early machines attempts were made to form fine stitches by decreasing fabric take-up tension. However, this resulted in the tight stitches binding about the hook and latch of the needles to the point where cast-off could not be completed. Because the needles thus carried these stitches as they ascended, tension became excessive and the warp thread broke.

In modern times, one of the most commonly used needle bed structures has employed a pivotable band at the rear of the tricks to assist in knock-over of cast-off stitches. This arrangement is described in Noe U.S. Patents Nos. 2,749,729 and 2,749,730. Although this type of arrangement does facilitate knock-over to a degree, it encounters limitations when the production of tight stitches at high speeds is desired.

To illustrate the latter point, the arrangement shown in the aforesaid patents has been illustrated in FIGS. 2 and 3 of the present drawings. This type of needle bed structure employs a body portion **36** and vertical trick blades **37** for the guidance of needles **38**. As best shown in FIG. 2 this prior structure also employs a pivotable knock-over band **39** having a knock-over edge **39***a*. Thus, incoming yarn **41** is wrapped about the needles **38** by the usual guide **42** and drawn through a previous stitch **43**. As shown in FIGS. 2 and 3, the previous stitch **43** has already been cast off the needles **38** and is resting upon the edge **39***a* of the pivotable knock-over band **39**.

To understand the drawbacks of the above prior art structure, it is important to realize that when the old stitch **43** was cast off the needles **38**, the fabric take-up tension momentarily became greater than the tension on the incoming yarn **41**. At this point, however, the take-up tension does not serve to pull the stitch **43** over the edge **39***a* of the knock-over band **39** because the frictional resistance between the stitch **43** and the edge **39***a* is greater than the resistance of the band **39** to movement. As a result, the band **39** swings outwardly carrying with it the stitch **43**. This action, in turn, enlarges stitch **43** as shown in FIG. 2 by robbing yarn **41** via a new loop **44** which is in the process of being drawn by the needles **38**. As explained in Patent No. 2,749,730, the stitch **43** is subsequently reduced in size, but only by yarn robbing in the reverse direction, i.e. as the needle descends further it increases the tension on the yarn which comprises cast off stitch **43** and as a result yarn is taken from said stitch **43**. As this happens, the stitch **43** not only decreases in size but also carries band **39** back toward the trick blades **37**. Thus, even at this point, the stitch **43** is not knocked over edge **39***a*. In fact, the knockover of stitch **43** is not completed until the needle with the new loop **44** rises to clearing position.

From the above general summary of the knitting operation which takes place in connection with the prior art needle bed structure shown in FIGS. 2 and 3, it will be understood that the use of a pivoting band or like device consumes a relatively great amount of time to complete the knock-over of the stitches and is accompanied by yarn robbing in both directions, the sawing motion of which is not only wearing on the guides and other knitting instrumentalities and upon the yarn itself, but which consumes valuable time, thus limiting the operating speed of the knitting machine.

To overcome the above defects and to provide Raschel and other warp knitting machines with a capability of satisfactorily knitting very tight stitches at extremely high operating speeds, I have invented the novel structure shown in detail in FIGS. 4–7.

FIGS. 4–7 show (steel) trick blades **31** which are cast into blocks such as **30** and **30'** shown in FIG. 5. For purposes of clarity of illustration, only two of such blocks **30** and **30'** have been shown in FIG. 5 and dot-dash lines have been used to indicate that similar blocks are normally present in side-by-side relationship. The blocks **30, 30'** are provided with holes **30*a*, 30*a'*** through which bolts are inserted for fastening the blocks to the usual bar (not shown) which extends lengthwise of the machine.

As shown best in FIG. 7, the trick blades **31** are cast in block **30** in such a manner that the rear of the blades **31** are backed by a portion **30*b*** of the casting. The portion **30*b*** terminates along an edge designated as **30*c*** as indicated in FIG. 6.

Inserted under tension into an angled slot in block **30** is a knock-over band **32**, the top edge **32*a*** of which is positioned approximately at the top edges **31*a*** of the trick blades **31**. Preferably, the band **32** is spring steel and is pressed into the slot in the block **30** under tension and in a curved condition so that its upper portion is constantly biased under spring pressure toward the rear of the trick blades **31**. This, of course, together with the concave curvature of the band in a direction away from the trick blades, and the angled arrangement of the slot upwardly toward the trick blades, prevents the band **32** from swinging backwards during the knock-over process.

Using the needle bed of the present construction, it is possible to form very tight stitches and cast such stitches over edge **32*a*** in a continuous operation, i.e. without intermediate enlargement and contraction of stitch size, at very high speeds. This is illustrated in FIG. 4 where the incoming yarn **20** is shown having been drawn through the cast-off old loop **46**. In contrast with the pivoting type of blade used in the prior art, the knockover band **32** of the present invention does not swing backwards when the fabric take-up tension, which is indicated by the arrow in FIG. 4, pulls the fabric **33** downwardly. Thus, the

cast-off stitch **46** is not permitted to enlarge in the manner shown in FIG. 2, but is in fact tightened to an increased extent as it is pulled over the edge **32*a*** of the knock-over band **32** in a continuous movement.

It is to be clearly understood that the terms and expressions used herein are employed as terms of description, and not of limitation, and that there is no intention in using such terms and expressions to exclude any equivalents of the apparatus described. It is also to be clearly understood that what is specifically shown and described herein represents a preferred embodiment only of the invention, and that various changes and equivalents may be resorted to without departing from the principles of the invention or the scope of the claim hereof. Accordingly, it is intended to claim the present invention broadly, as well as specifically, as indicated in the appended claim.

The following is claimed:

1. Needle bed structure for warp knitting machines comprising a plurality of spaced-apart generally vertically disposed trick blades providing open ended needle slots at the front and each having a side edge at the rear and a stitch separating edge at the upper end of the needle slots, a metallic block having said trick blades embedded therein, said trick blades and said block being formed with relatively deep slots providing a continuous lengthwise extending slot angled upwardly towards the rear edges of said trick blades, and an immovable thin spring steel band having its lower portion press-fitted into said lengthwise extending slot and having a curvature to bias the same against said rear edges, said band having a top edge extending slightly above the stitch separating edges of said trick blades to provide a knock-over edge for the needle bed structure.

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