

[54] **APPARATUS FOR INSERTING WEFT
THREAD BUNCHES INTO WEFT THREAD
STORAGE DEVICES IN WARP KNITTING
MACHINES**

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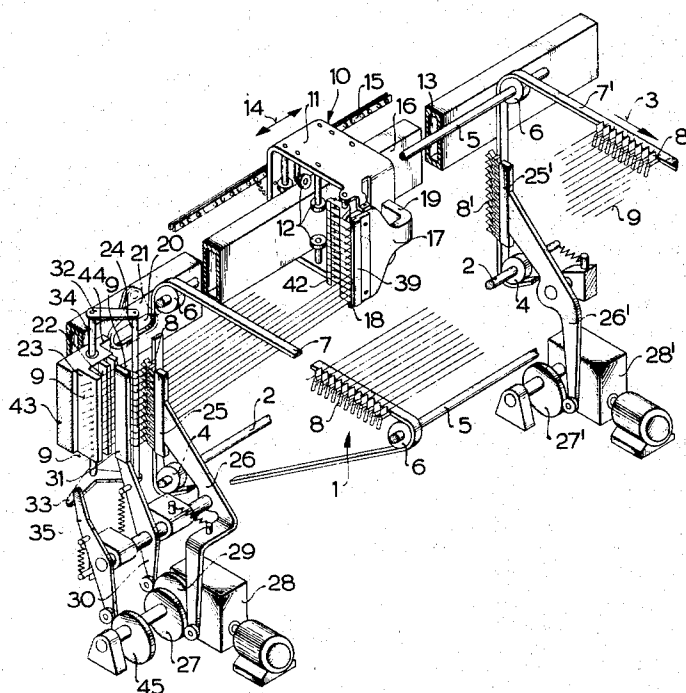
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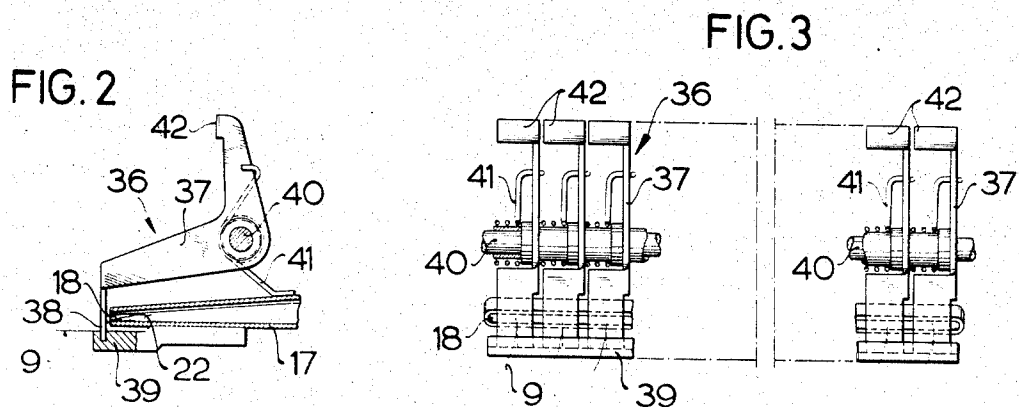
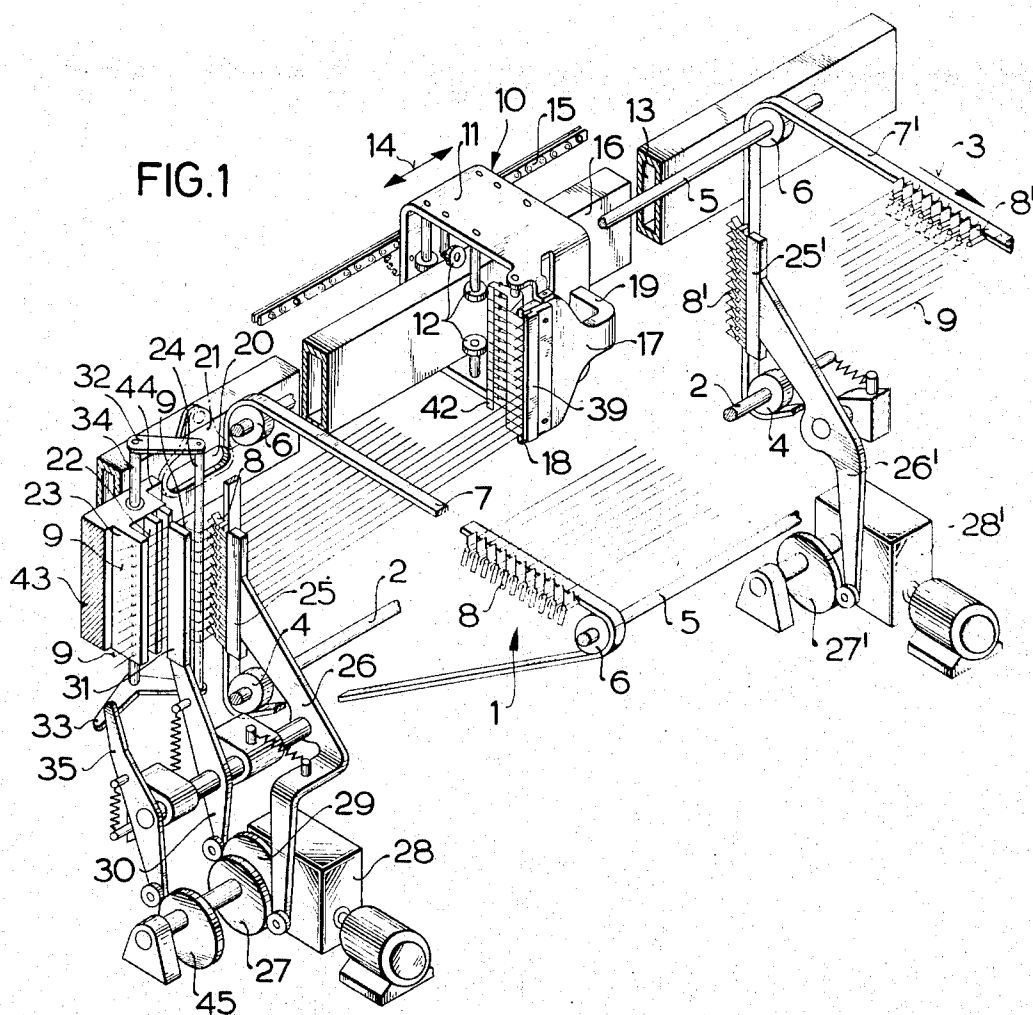
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[57] **ABSTRACT**

Apparatus for inserting bunches of weft threads into a weft thread storage device in a warp knitting machine includes means for making the weft threads ready, and a weft thread drawing-off device including a suction nozzle displaceable over the width of a fabric web being warp knitted by the machine, and means for actuating the suction nozzle to align the ends of the weft threads made ready by the readying means and to seize the weft thread ends as well as draw off the seized weft threads and insert them into the weft thread storage device.

6 Claims, 3 Drawing Figures





APPARATUS FOR INSERTING WEFT THREAD BUNCHES INTO WEFT THREAD STORAGE DEVICES IN WARP KNITTING MACHINES

The invention relates to apparatus for inserting bunches of weft threads into weft thread storage devices in warp knitting machines by means of a drawing-off device which reciprocally travels or revolves over the width of the fabric web.

In apparatus of this general type, the weft thread storage devices accept weft threads which have been drawn-off in accordance with the width of the knitted material, and pass them on to the knitting tools. By the drawing-off and insertion of a weft thread bunch formed of several threads, the drawing-off speed for the weft threads can be reduced in proportion to the number of the threads, and a considerably lower stressing of the weft fed material can be achieved for an optimum knitting speed that remains constant.

Through the German Non-Prosecuted Published Application 1,938,046, a warp knitting machine has become known which has a weft thread storage device into which several weft threads are insertable simultaneously. For this purpose, the machine includes continuously revolving thread guide members which are provided with thread guiding means. The thread guiding means are formed of clamp-like leaf spring elements, which grip and draw off the make-ready starting ends of the weft thread supply. However, reliable gripping of thread trailing ends of starting ends by means of such clamps is extremely difficult and demands an accurately oriented guidance of the thread length to be gripped up to the immediate vicinity of the clamp opening. For this reason, the length of thread to be gripped must always be kept very short, which is accompanied by the danger that a weft thread easily slips out of the clamp during the drawing-off process and causes faults in the knitwear.

It is accordingly an object of the invention to eliminate these shortcomings of the heretofore known apparatus of this general type and to provide an apparatus for inserting bunches of weft threads which grips or seizes rapidly and reliably with one drawing-off device, a multiplicity of thread starting ends which have been made ready in a simple manner.

It is a further object of the invention to provide such apparatus whereby the weft threads which have been seized by the thread starting ends thereof are drawn off with similar reliability over any desired width of material and are passed on to the holding elements of a thread storage device.

With the foregoing and other objects in view, there is provided, in accordance with the invention, apparatus for inserting bunches of weft threads into a weft thread storage device in a warp knitting machine comprising means for making the weft threads ready, and a weft thread drawing-off device comprising a suction nozzle displaceable over the width of a fabric web being warp knitted by the machine, and means for actuating the suction nozzle to align the ends of the weft threads made ready by the readying means and to seize the weft thread ends as well as draw off the seized weft threads and insert them into the weft thread storage device.

In accordance with other features of the invention, the suction nozzle is either reciprocally displaceable or revolvable over the width of the fabric web.

In accordance with a further feature of the invention, the suction nozzle is provided with at least one slot-shaped intake opening with which a thread clamping device is associated. A drawing-off device that is equipped in this manner is capable of aligning by means of the suction nozzle all of the present, randomly suspended thread ends in direction toward the intake opening of the suction nozzle prior to seizing them. It is accordingly unnecessary to align exactly the thread ends which are held ready outside the weft thread storage device, and to keep them in readiness with accurately measured short ends. As mentioned hereinbefore, the suction nozzle may be provided, for this purpose, with at least one slot-like intake opening. The length of the slot can be selected advantageously so that it corresponds to the width of the bunch of weft threads that are to be seized. The suction nozzle may, however, also be equipped with individual slot-shaped or circular openings, so that a separate opening is associated with each thread end, respectively, of the bunch of weft threads. The thread clamping device at the intake opening of the suction nozzle affords the possibility in each of the embodiments of fixing all of the seized threads at predetermined mutual spacing and to retain them reliably during the drawing-off process.

The variety of possible patterns producible in warp knitting machines may be considerably increased, as is generally known, by introducing into the bunch of weft threads the most varied types of threads. In addition, completely varied bunches of weft threads can also be interchanged after each drawing-off operation, as is necessary, for example, with a four-color change for producing cloth with check patterns. In each of the foregoing cases, it is especially important to tightly hold the individual weft thread of any selected yarn number and composition reliably, as it is drawn off across the width of the knitted material. In order to achieve the foregoing and, in accordance with a further feature of the invention, the thread clamping device comprises individually displaceable thread clamps. With a thread clamping device of such construction, even the existence of an irregularity within the individual thread will not cause the thread starting end to slide out of the suction nozzle. The device for inserting the weft thread groups into weft thread magazines in warp knitting machines according to the invention can be coordinated with the most varied devices for drawing off or laying out weft threads. Thus, for example, it is readily possible to substitute the device according to the invention for the revolving thread guide means in the warp knitting machine which had been mentioned as exemplary of the state of the art in the introduction to the specification of the instant application. If the weft threads are drawn off by a reciprocating drawing-off device instead of on a revolving path, in accordance with yet another feature of the invention, which is especially advantageous, the suction nozzle is couplable in the vicinity of the thread starting ends with a profile tube, which supports the drawing-off device and is connected to a suction producer. The profile tube, which is connected to the suction producer, and subjected to suction air, may be formed of a tube having a rectangular cross section and can be provided, in the vicinity of the reversal point of the suction nozzle, and, in fact, at the side of the knitting machine at which the thread starting ends are held in readiness, with a free opening having dimensions which correspond to the dimensions of the open-

ing at the junction end of the suction nozzle. The free opening can, however, also be extended in the direction of the longitudinal axis of the profile tube for a short distance and can be formed like a slot. With the aid of such a device, the suction nozzle is subjected to a stream of suction air respectively at this free opening only or while passing by the section formed by the slot. The opening in the form of a slot has the further advantage that an adequately strong flow of suction air is built up in the suction nozzle even before it gets to the thread ends. Subjecting the suction nozzle to the necessary suction air flow, always occurs only if the suction nozzle is supposed to align and seize or grip the thread ends which have been made ready. During the subsequent drawing-off process applied to the bunch of weft threads, the free opening in the profile tube may be closed, so that suction air is used only during the selectively short period of aligning and seizing thread ends that have been made ready.

Other features which are considered as characteristic for the invention are set forth in the appended claims.

Although the invention is illustrated and described herein as embodied in apparatus for inserting weft thread bunches into weft thread storage devices in warp knitting machines, it is nevertheless not intended to be limited to the details shown, since various modifications and structural changes may be made therein without departing from the spirit of the invention and within the scope and range of equivalents of the claims.

The construction and method of operation of the invention however, together with additional objects and advantages thereof will be best understood from the following description of specific embodiments when read in connection with the accompanying drawing, in which:

FIG. 1 is a much simplified, perspective view of a weft thread storage device in combination with a reciprocably displaceable drawing-off device constructed in accordance with the invention;

FIG. 2 is a fragmentary enlarged side elevational view of FIG. 1 showing, in cross section, the front part of the intake or suction opening with a single thread clamp; and

FIG. 3 is a front elevational view of the intake or suction opening of the suction nozzle of FIG. 2 with a multiplicity of thread clamps.

Referring now to the drawings, and first particularly to FIG. 1 thereof, there is shown therein, the essential parts of a weft thread storage device 1 which is conventionally used with warp knitting machines. This weft thread storage device 1 is driven by a drive shaft 2 through conventional drive means. In addition to the drive shaft 2 with two drive wheels 4, guide shafts 5 with respective guide pulleys 6 are readily seen in FIG. 1. Around the drive wheels 4 and the guide pulleys 6, conveyor elements 7 and 7' are led, resilient retaining clamps 8 and 8', respectively, for the individual weft threads 9 being secured to the conveyor elements. During the knitting operation, the conveyor elements 7 and 7' move in accordance with the knitting speed in direction of the arrow 3 and pass the weft threads 9 in a conventional manner to the knitting tools of the warp knitting machine, which have been omitted from FIG. 1 in the interest of greater clarity.

In the illustrated embodiment of FIG. 1, a drawing-off device 10 is installed for seizing and making ready twelve weft threads simultaneously. Also in the interest

of greater clarity, all of the previously inserted weft threads are not shown, for this reason, on the conveyor element 7 and 7' but rather, only respective bunches of threads with 12 weft threads as well as an equal number of retaining clamps 8 and 8' at various points of the conveyor elements are illustrated. The drawing-off device 10 is formed of a carriage housing 11 which is guided and supported by rollers 12 and is reciprocably displaceable on the profile tube 13 in direction of the double-headed arrow 14. The reciprocable displacement is effected by a revolving chain drive known per se, of which a section of the upper run of a drive chain 15 is shown. Connected rigidly to the carriage housing 11 is a suction nozzle 17 which, in the illustrated embodiment of FIG. 1, has a slot-shaped free intake or suction opening 18, the form of which is more clearly shown in the enlarged view of FIG. 3. The junction or connection opening end 19 of the suction nozzle 17 extends through the front wall of the carriage housing 11 and abuts with slight pressure against the front sidewall 16 of the profile tube 13 with a flexible intermediate element, known per se, which is not visible in the figure. The junction opening 19 is located at the same level as that of the slot 20 relative to the longitudinal axis of the profile tube 13. The slot 20 is closed by a hinged flap 21 shown in phantom and is opened only when the junction opening 19 of the suction nozzle 17 travels into registry with the flap 21. The flap 21 closes automatically as soon as the junction opening 19 has left the vicinity of the slot 20. Profile tube 13 is continuously subjected to a flow of suction air from a blower known per se, the illustration of which has also been dispensed with, since it forms no part of the invention of this application.

Next to the slot 20 there is provided on the support part 43 a thread guide bar 23 through which the twelve weft threads 9 are fed. In FIG. 1, the drawing-off device 10 with the suction nozzle 17 and the weft thread bunch consisting of twelve weft threads 9, are shown traveling in direction toward the retaining clamps 8'. The weft threads 9 have already been inserted by an oscillating rod 24 into the retaining clamps 8 at the left-hand side of the weft thread storage device 1, as shown in FIG. 1. The retaining clamps 8 and 8', respectively, are opened and closed by pressure bars 25 and 25'. The pressure bars 25 and 25' are connected to levers 26 and 26', respectively, and are displaced by respective cams 27 and 27', the cams 27 and 27', in turn, being driven by transmissions 28 and 28' in proportion to the knitting and feeding speed for the weft thread storage device 10. The transmission 28 further displaces, through a cam 29, a lever 30 which is provided with a knife edge 31. The knife edge 31 severs the weft threads 9 after they have been inserted into the retaining clamps 8, so that new thread starting ends 22 are formed. The bunch of weft threads is swung into the retaining clamps 8, as hereinbefore mentioned, through the oscillating rod 24 which is secured by means of a strap 32 and an angle lever 33 to a shaft 34. The oscillating motion of the shaft 34 is produced by a cam 45 through a lever 35.

In FIG. 2, the free intake or suction opening 18 of the suction nozzle 17 is shown with a single thread clamp 36. The thread clamp 36 is formed of an angle lever 37 having a bent side tongue 38 which is pivotable therewith into a recess formed in a bar 39 and thereby imparting additional bends in the weft thread 9 which afford a reliable retention of the thread starting end 22.

The angle lever 37 is rotatably mounted on a continuous shaft 40 and is presetrssed by a wound torsion spring 41. When the drawing-off device 10 moves in direction toward the thread ends 22, the angled abutment face 42 of the angle lever 37 strikes against the abutment edge 44 of the support part 43 in FIG. 1 and thus opens the intake or suction opening 18 for the purpose of aligning and seizing the thread ends 22. After the bunch of weft threads have been drawn out beyond the retaining clamps 8', the weft threads 9 are inserted in a similar manner as at the feed-in side of the weft threads, in fact by means of an oscillating rod like the rod 24, into the retaining clamps 8'.

In FIG. 3, the slot shaped intake opening 18 is again shown particularly clearly as extending over the entire width of a bunch of threads. It is also apparent from FIG. 3 how the thread clamps 36 are disposed individually movably side by side.

The suction nozzle according to the invention can, of course, also be constructed for bunches of weft threads having more or less than twelve weft threads, respectively. If, for example, individual threads are to be presented separately in sequence to a weft thread storage device, the suction nozzle can also be reduced in size in the manner of a suction tube and can be equipped only with a single circular or slot-shaped discharge opening and a single thread clamp. Also such a nozzle shape can be associated in the aforedescribed manner to the afore-described drawing-off device or to a revolving drawing-off device. The possibility also exists, furthermore, to insert only every second or third weft thread with a suction nozzle for twelve weft threads, for example. The thread clamps which are not supposed to seize a weft thread, may remain closed continuously by providing suitable steps in the abutment edge 44, so that the respective thread ends which are to be seized are inserted reliably at correct spacing from one another.

I claim:

1. Apparatus for inserting a plurality of weft threads into a weft thread storage device in a warp knitting machine comprising: means for making the weft threads ready, and a weft thread drawing-off device provided with a suction nozzle formed with at least one slot-shaped intake opening, such nozzle being displaceable over the width of a fabric web being warped knitted by the machine and having such opening in cooperative working relationship with a plurality of individually movable thread clamps, and means for actuating said suction nozzle to align the ends of the weft threads to thereby seize the weft thread ends as well as draw-off the seized weft threads and insert them into the weft thread storage device.

2. Apparatus according to claim 1 wherein said suction nozzle is reciprocably displaceable over the width of the fabric web.

3. Apparatus according to claim 1 wherein said suction nozzle is revolvable over the width of the fabric web.

4. Apparatus according to claim 1 comprising a profile tube carrying said drawing-off device, said suction nozzle being coupled to said profile tube at a location at which starting ends of the weft threads are presentable, said profile tube being connectible to a section air source.

5. Apparatus according to claim 1, wherein said thread clamps are formed in the shape of an angular lever having a pivotable tongue disposed at its lower end to form additional bends at the thread ends for introduction into said nozzle.

6. Apparatus according to claim 5, wherein contact means are provided at the upper end of said angular lever being responsive to movement of said thread drawing-off device in the thread end direction, for energizing said nozzle to cause alignment and seizure of the thread ends.

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