May 26, 1964 A. KUBELKA ETAL 3,134,248

PNEUMATIC DEVICE FOR INSERTING WEFT THREADS IN WARP LOOPS OF WARP KNITTED FABRIC

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Fig. 1

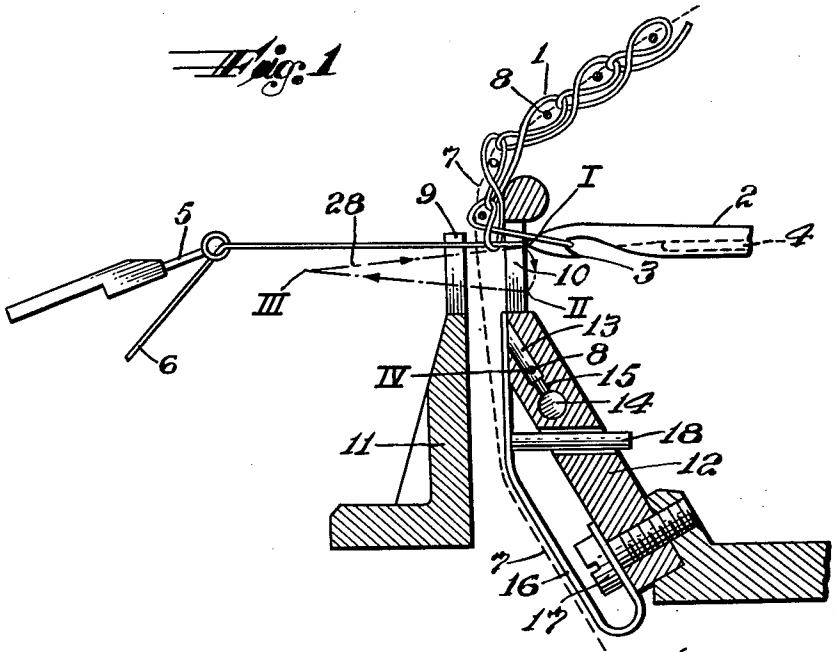
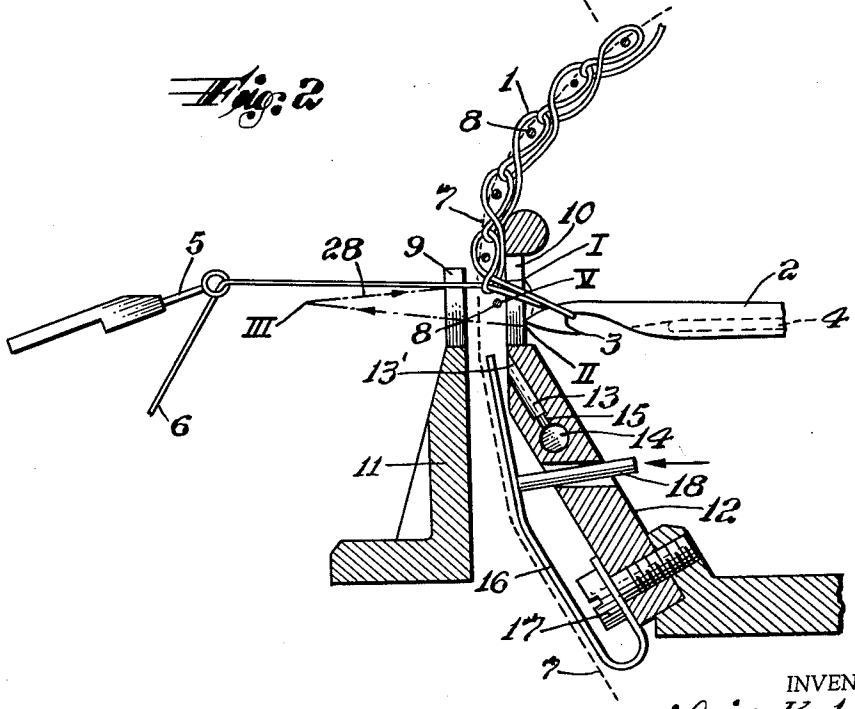


Fig. 2



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Fig. 3

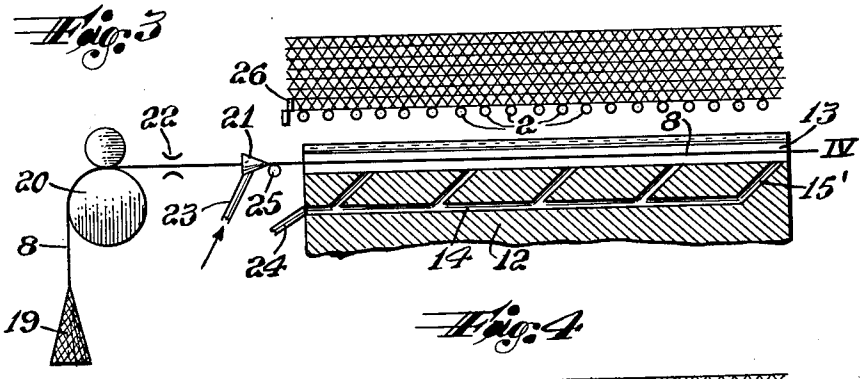


Fig. 4

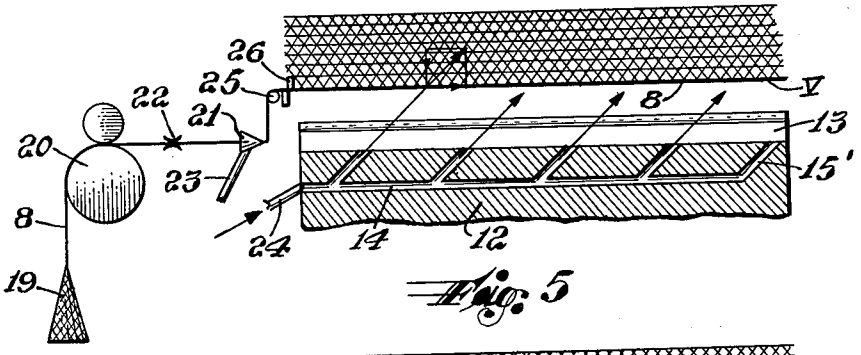


Fig. 5

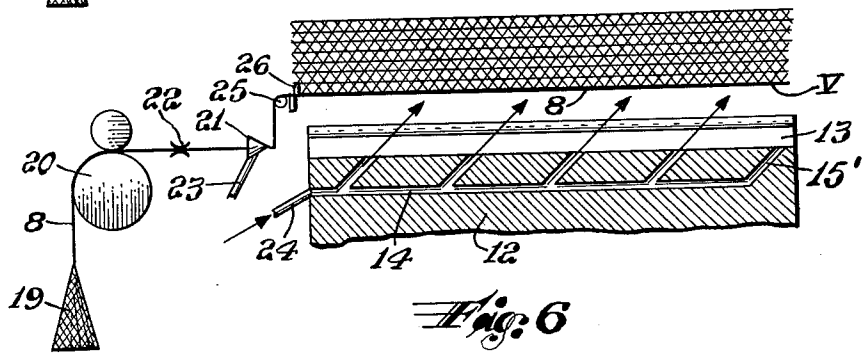
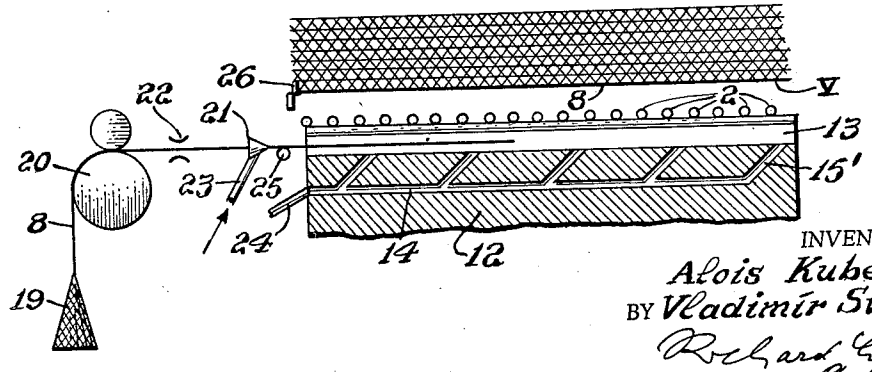


Fig. 6



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Fig. 7

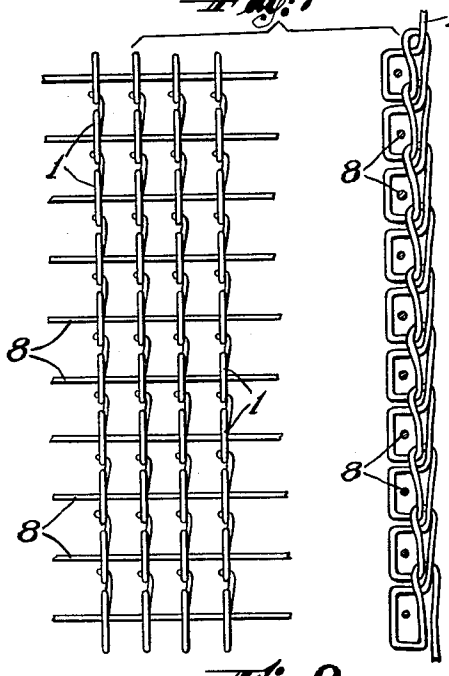


Fig. 8

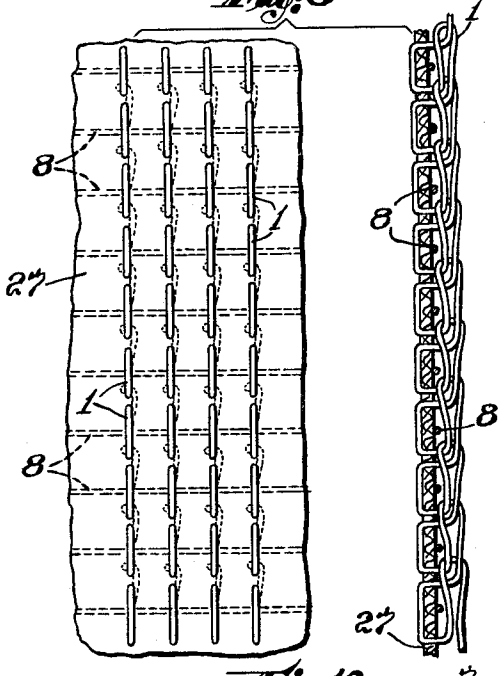


Fig. 9

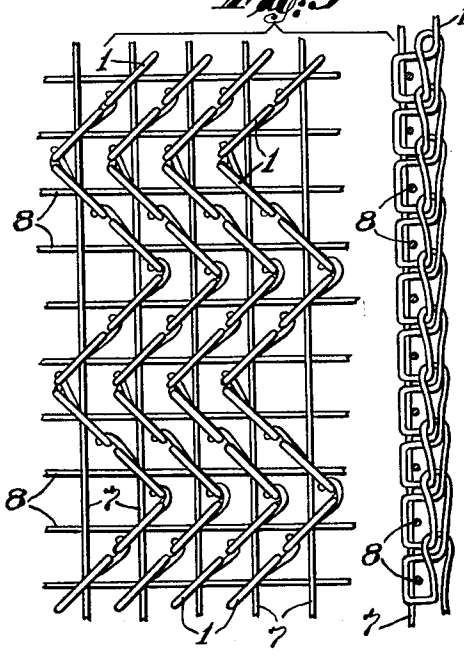
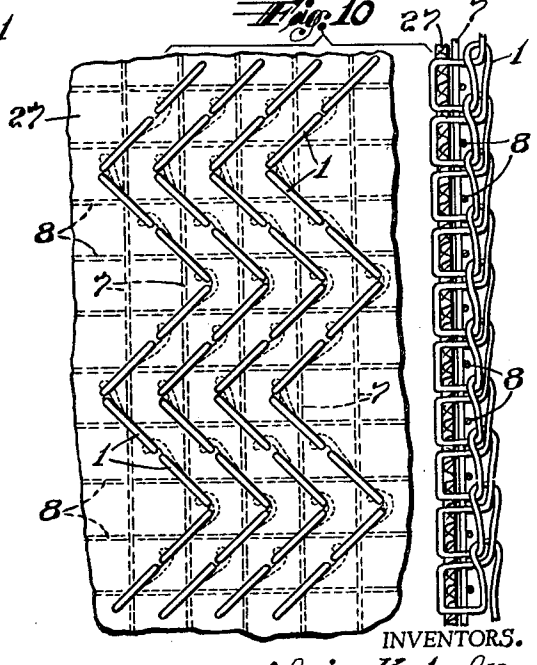


Fig. 10



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United States Patent Office 3,134,248 Patented May 26, 1964

3,134,248

PNEUMATIC DEVICE FOR INSERTING WEFT THREADS IN WARP LOOPS OF WARP KNITTED FABRIC

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Filed May 1, 1961, Ser. No. 115,844
5 Claims. (Cl. 66—125)

This invention relates to knitting machines, and more particularly to a device for inserting weft threads in warp loops of warp knitted fabric. In its more specific aspects this invention is concerned with improvements in the stitch bonding of non-woven fabrics.

It is known to reinforce non-woven fabrics by a plurality of continuous threads which form respective chains of stitches, the chains being elongated in the warp direction, and the stitches being somewhat similar to selvage stitches. The resulting stitch bonded non-woven fabrics have found applications in the apparel industry and for industrial purposes.

Such reinforced fabrics have been produced on flat frame warp knitting machines on which the chains of warp stitches are reinforced by inserted weft threads. The weft threads have been laid by a traversing carriage. Such carriages and other conventional means for laying weft threads require complex actuating mechanisms, and are rather slow.

The principal object of the invention is the elimination of the shortcomings of known weft inserting devices for warp knitting machines of the type described.

Another object is the avoidance of a traversing carriage or any other mechanical moving parts in the insertion of a weft thread over the width of a set of juxtaposed warp threads.

With these and other objects in view, the invention provides pneumatic means for inserting a weft thread into warp loops of a warp knitted fabric. The pneumatic means produce two streams of air. A first air stream is directed substantially perpendicular to the juxtaposed elongated warp threads. A second air stream is directed transversely of the first stream and either perpendicular or obliquely inclined thereto.

The first air stream may be released from a nozzle similar to the known nozzles employed on looms for traversing or laying threads, as disclosed in Patent No. 2,662,556 to Svaty, and for the same purpose. The second air stream is released from a system of conduits provided in a knocking-over member. The conduits are provided with a movable cover.

Other features and the attendant advantages of this invention will become apparent from the following detailed description of preferred embodiments when considered in conjunction with the annexed drawing in which:

FIG. 1 shows essential knitting instrumentalities of a warp knitting machine equipped with a weft thread inserting device of the invention, the apparatus being shown in side-elevational section and in a first operating position;

FIG. 2 shows the apparatus of FIG. 1 in a second operating position;

FIGS. 3 to 6 illustrate an apparatus closely similar to that of FIG. 1 in schematic front elevational section in a plane corresponding to the line A—A in FIG. 1, the apparatus being shown in four operating positions, those of FIGS. 3 and 6 substantially corresponding to the position illustrated in FIG. 1, and the operating positions illustrated in FIGS. 4 and 5 corresponding to FIG. 2.

FIG. 7 embraces a plan and a side view of a first knitted fabric produced by the apparatus of FIGS. 1 to 6;

FIG. 8 shows similar views of a fabric produced by

stitch-bonding a non-woven fabric by the threads of the knitted fabric of FIG. 7;

FIG. 9 includes a plan and a side view of another knitted fabric produced on the apparatus of FIGS. 1 to 6; and

FIG. 10 illustrates similar views of a stitch-bonded non-woven fabric in which the stitch bonding corresponds to the stitches of the fabric of FIG. 9.

Referring initially to FIG. 1, there are seen the knitting instrumentalities of a warp knitting machine of basically known type. A needle **2** having a hook shaped end **3** and a latch **4** takes an auxiliary warp thread **6** from a guide needle **5** and forms it into a chain **1** of warp stitches with a warp thread **7** inlaid. As seen from FIGS. 3 and 6, there are as many needles **2** as there are warp threads **6**, **7** and they are arranged for joint movement along a path of their hooked ends **3** indicated in FIGS. 1 and 2 by the chain-dotted line **28**. The stitches of the fabric are formed in a knitting area between two spacedly juxtaposed comb members from the chain **1**, the warp thread **7**, and a weft thread **8** in a manner that will become presently apparent.

One of the comb members consists of a stationary support **11** extending at right angles to the warp chains, and of a plurality of elongated blades **9**. The other comb member consists of a similar stationary support **12** and of elongated blades **10**. The blades **9** and **10** are aligned in such a manner as to provide interstices therebetween for the passage of needles **2** in a direction transverse of the direction of elongation of the blades.

A slot **13** extends over the entire length of the support **12** opposite the comb member **11**, **9**. Its orifice **13'** constitutes a long narrow jet nozzle inclined at an acute angle relative to the direction of movement of the warp threads **7** and aimed at the knitting area. In the position of the apparatus illustrated in FIG. 1, a weft thread **8** extends along the bottom of the slot **13**. A longitudinal bore **14** within the support **12** is parallel to the slot **13**, and communicates with the bottom of the slot by a plurality of connecting channels **15** in the manner better seen from FIGS. 3 to 6. The axes of the channels **15** are perpendicular relative to the direction of elongation of the bottom of slot **13** and of the weft thread **8** retained therein as shown in FIG. 1. In the modified embodiment of the invention illustrated in FIGS. 3 to 6, the axes of the channel **15'** are inclined obliquely relative to the direction of elongation of the weft thread **8**. In both modifications, the axes of the channels are aimed at the knitting area.

The longitudinal slot **13** in the support **12** is normally closed by a cover **16** of resilient sheet material. An elongated strip of the material is bent into a U-shape having two legs of different length. The shorter leg portion is fastened to the support **12** by screws **17**, whereby the longer leg portion is held over the orifice of the slot **13** by the resilience of the cover **16**. Pusher pins **18** arranged in respective passages of the support **12** abut against the longer leg portion of the cover **16** and lift the cover from the orifice of the slot **13** as shown in FIG. 2 when they are moved in the direction of the arrow seen there.

The apparatus shown in FIGS. 3 to 6 differs from that illustrated in FIGS. 1 and 2 only in the alignment of the channels **15'**, and certain other features common to both devices will now be described with reference to FIG. 3.

The weft thread **8** is drawn from a conical spool **19**, guided over a conventional measuring device **20**, between the jaws of a clamping device **22**, and then through a nozzle **21** known in itself. The nozzle **21** is connected to a non-illustrated valve-controlled source of compressed air such as a compressor or a central distributing system by a conduit **23**, and a conduit **24** similarly connects the bore **14** in the support **12** to a non-illustrated valve-con-

trolled source of air under pressure. The discharge opening of the nozzle 21 is aligned with the slot 13.

A lifting arm 25 is arranged adjacent the discharge opening of the nozzle 21 for moving a discharged portion of the weft thread 8 outward of the slot 13 and against a cutting device 26.

The afore-described apparatus operates as follows:

The warp threads 7 are fed to the knitting area between the two comb members 9, 10 from a warp beam (not shown) in a known manner. Chain stitches of the auxiliary warp threads 6 are interwoven with the warp threads 7 by means of the latch needles 2 and guide needles 5 in the usual manner, the hooked ends of the latch needles 2 moving in the path 28 in the direction of the arrows in FIGS. 1 and 2.

Before the needle tip approaches the position I, that is the position illustrated in FIG. 1, a length of weft determined by the measuring device 20 is unwound from the spool 19 but temporarily held by the clamping device 22. When the needle tip reaches position I, the jaws of the clamping device 22 are released, and the measured length of weft thread 8 is projected from the nozzle 21 into the longitudinal slot 13 under the pressure of air supplied through the conduit 23. The thread assumes the position seen in FIG. 1.

The air supply to the nozzle 21 is now shut off. The cover 16 is lifted from the slot 13 by the pusher pins 18, and air under pressure is simultaneously admitted through the conduit 24 to the bore 14. Blasts of air are released from the channels 15 or 15' and entrain the weft thread 8. The thread is carried by the stream of air from the position IV illustrated in FIGS. 1 and 3 to the position V in the knitting area as shown in FIGS. 2 and 4. The latch needle 2 simultaneously moves from position I downward to position II, and then forward to position III. In moving from position II to position III, the needle top passes under the raised weft thread 8 and takes another lap from the auxiliary warp thread 6. When this lap is retracted during subsequent movement of the needle 2 from position III to position I, the weft thread 8 is woven into the loop so formed.

The jaws of the clamping device 22 are closed, and the lifting arm 25 follows the upward movement of the weft thread 8. It moves from the position shown in FIG. 3 to that seen in FIG. 4, thereby moving a portion of the thread 8 against the cutting device 26 which severs the thread as seen in FIG. 5. A length of the weft thread 8 is now secured by the loops of auxiliary warp thread 6, and the next length of weft thread may be projected into the slot 13 as is seen in FIG. 6. A new cycle begins.

The pusher pins 18 may be actuated in a known manner by a cam or crank mechanism linked to the needle motion. They are retracted and permit the cover 16 to close the slot 13 as soon as a length of weft thread 8 has been blown from position IV to position V so as to make the slot 13 ready to receive the next length of weft thread.

FIGS. 7 to 10 show fabrics that may be produced on the apparatus of the invention. The fabric illustrated in FIG. 7 consists of chain stitches 1 and of the inserted weft threads 8 only. It is shown in a front view and in a warpwise section in a conventional manner.

FIG. 8 shows a fabric in which the warp stitches 1 and the weft threads 8 form a pattern analogous to that of FIG. 7, but the warp stitches 1 pass through a non-woven fabric 27.

FIG. 9 illustrates a fabric produced on the apparatus of the invention from weft threads 8 and straight warp threads 7 interwoven with warp stitches 1.

FIG. 10 conventionally shows a fabric in which the threads constituting the fabric of FIG. 9 are employed to reinforce a non-woven fabric 27 through which the stitches 1 pass back and forth.

It should be understood, of course, that the foregoing disclosure relates to only a preferred embodiment of the invention, and that it is intended to cover all changes and modifications of the example of the invention herein chosen for the purpose of the disclosure which do not constitute departure from the spirit and scope of the invention set forth in the appended claims.

We claim:

1. In a warp knitting machine, in combination:
(*a*) a plurality of warp threads;
(*b*) a plurality of knitting needle means juxtaposed in a predetermined direction, said needle means being simultaneously movable into a position of engagement with respective portions of said warp threads for knitting the same into stitches of a warp chain;
(*c*) a supply of elongated weft thread;
(*d*) first pneumatic means for longitudinally propelling a length of said weft thread into a first position wherein said weft thread longitudinally extends in said direction and is remote from said warp thread portions; and
(*e*) second pneumatic means for propelling said length of weft thread from said first position transversely of said direction into a second position adjacent said warp thread portions for engagement of respective portions of said weft thread length by said warp thread portions while the same are being knitted into warp chain stitches.

2. In a warp knitting machine as set forth in claim 1, said needle means and the engaged portions of said warp threads defining a knitting area, said first and second pneumatic means including a member formed with a slot elongated in said direction, said slot having a longitudinally elongated orifice constituting nozzle means aimed at said knitting area, said first pneumatic means including means for passing a stream of air longitudinally through said slot, said length of weft thread being arranged to be entrained by said stream into said slot, said length of weft thread when in said first position thereof extending in said slot, cover means for closing said orifice when said stream is passed through said slot, said second pneumatic means including a plurality of channels having respective axes transverse of the direction of elongation of said slot and aimed at said knitting area, said channels communicating with said slot, and means for supplying air under pressure to said channels.

3. In a warp knitting machine as set forth in claim 2, said axes being substantially perpendicular to the direction of elongation of said slot.

4. In a warp knitting machine as set forth in claim 2, said axes being obliquely inclined to the direction of elongation of said slot.

5. In a warp knitting machine as set forth in claim 2, said cover means being of resiliently yieldable material, and biased to normally close said orifice under the resilient force thereof; and means for displacing said cover means from the normal position thereof in which it closes said orifice.

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