United States Patent [19]

Kohl

[11] **3,797,278**

[45] **Mar. 19, 1974**

[54] **WARP KNITTING MACHINE**

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[22] Filed: **Dec. 4, 1972**

[21] Appl. No.: **311,784**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 161,859, July 9, 1971, abandoned.

[52] **U.S. Cl.** **66/84**
[51] **Int. Cl.** **D04b 23/06**
[58] **Field of Search** 66/84, 86, 85

[56] **References Cited**

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[57] **ABSTRACT**

A warp chain receives yarn from a plurality of spools fixedly arranged laterally adjacent a warp knitting machine. The yarn is transferred from the spools to the chain by a plurality of pivotal yarn guides whose free ends pass through arcuate paths during pivoting of the guides. One point of each yarn guide path is adjacent the warp chain for transfer of the yarn thereto and all the arcuate paths intersect at least in one point in the region of the yarn transfer point.

5 Claims, 5 Drawing Figures

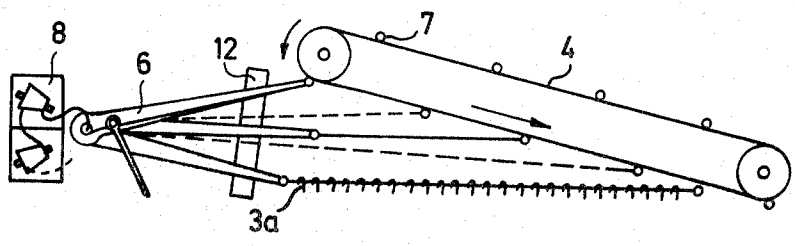
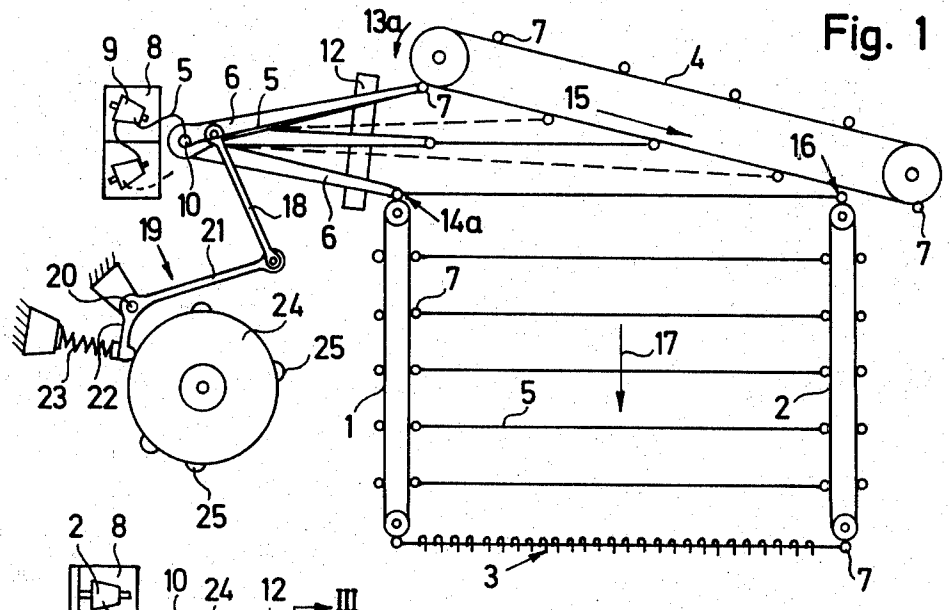


Fig. 1



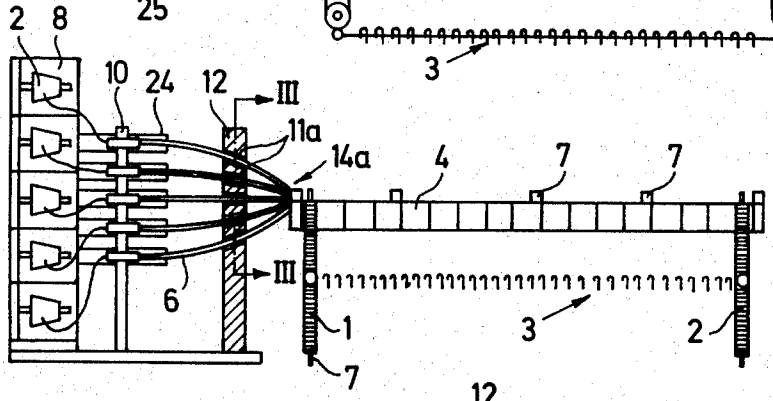


Fig. 2

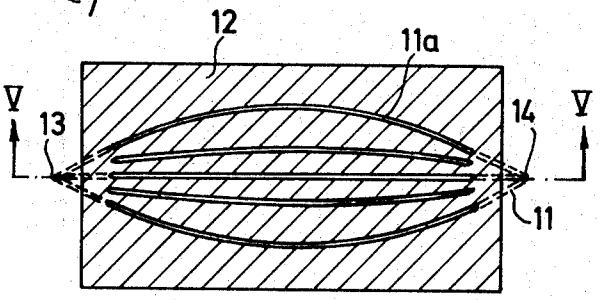


Fig. 3

Fig. 4

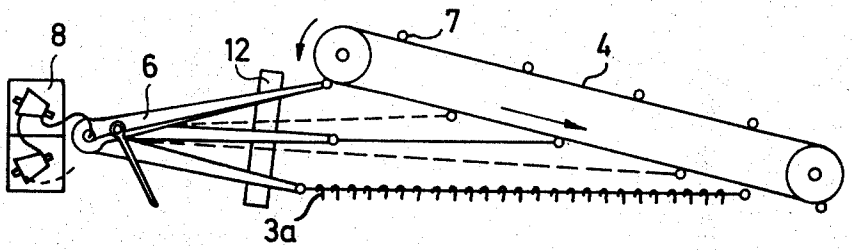
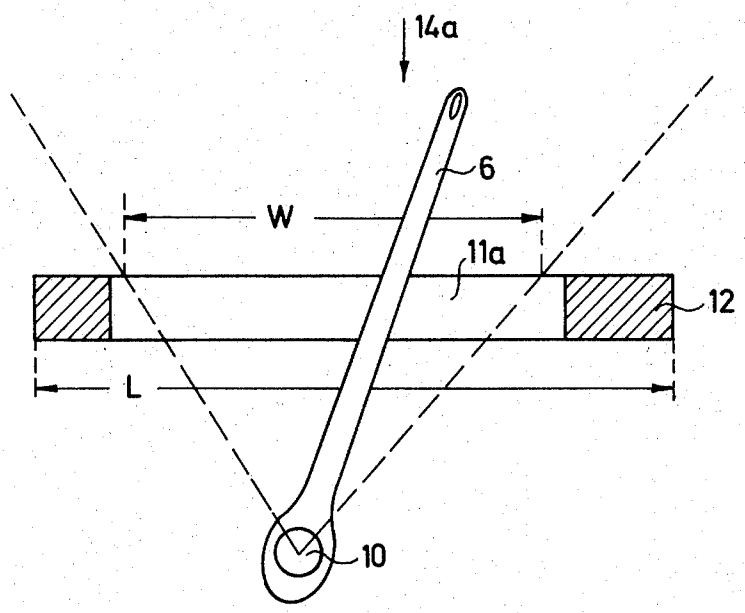


Fig. 5



WARP KNITTING MACHINE

This is a continuation-in-part of may copending application Ser. No. 161,859, filed July 9, 1971 now abandoned.

The present invention relates to improvements in warp knitting machine wherein a warp chain receives yarn from a plurality of yarn storing spools and lays warp threads by rotating in an endless path across the width of the machine, either by transferring individual warp threads directly to a row of knitting needles or a pair of pattern chains, the row of knitting needles or the pattern chains being arranged transversely of the warp.

In such a machine, the chains have yarn clamps receiving the yarn ends and pulling the yarns of the spools as the chains rotate. When the warp thread has been laid parallel to the row of knitting needles, normally mounted on a needle bar, it is cut off from the trailing end of the yarn coming from the spools, and this trailing end is again transferred to a succeeding yarn clamp on the rotating chain.

While various arrangements for the yarn transfer between the spools and the warp chain have been suggested, they have had various disadvantages, including relatively low output due primarily to relatively slow warp thread transfer and interruptions caused by the necessity of reconnecting spools.

It is the primary object of the invention to overcome these and other disadvantages by the improvements herein disclosed.

According to this invention, a plurality of spools storing yarn are fixedly arranged laterally adjacent the warp knitting machine of otherwise conventional structure. For instance, four, six or more spools may be mounted on a fixed frame to serve as the warp thread supply for the machine. Since any desired number of spools may be mounted on the frame and each spool may be stored with a readily insertable substitute spool, the spools may be readily replaced without interruption of the machine operation, with a minimum of servicing. Since the spools are fixedly mounted, rather than on the rotating warp chain, the chain may be rotated at high speed limited only by the operational speed of the machine.

The warp chain of the warp knitting machine of the present invention is arranged for receiving yarn from respective spools and for rotating in an endless path across the width of the machine to lay the warp threads. A plurality of pivotal yarn guides each having a free end receiving yarn from a respective spool is arranged between the spools and the wrap chain. The free ends of the yarn guides pass through arcuate paths during pivoting of the guides and one point of each of the yarn guide paths is adjacent the warp chain for transferring the yarn to the rotating warp chain. Theoretical extensions of all the arcuate paths intersect at least in one point in the region of the point of yarn transfer from a respective yarn guide to the warp chain.

In the preferred embodiment specifically described herein, the machine further comprises a pair of pattern chains of substantially equal length arranged on the machine for rotating transversely of the warp and for receiving the yarns from the warp chain. The warp chain is inclined in respect of the pattern chains, with one end of the warp chain adjacent the yarn guides being farther removed from the pattern chains than the opposite end of the warp chain. Theoretical extensions of all the arcuate paths of the free ends of the yarn guides intersect in an additional point in the region of a yarn transfer point between the yarn guide and the pattern chains.

The above and other objects, advantages and features of the present invention will be more fully understood by reference to the following detailed description of a now preferred embodiment thereof, taken in conjunction with the accompanying drawing wherein

FIG. 1 is a schematic top view showing only those parts of an otherwise conventional warp knitting machine which constitute this invention;

FIG. 2 is a side view of the machine of FIG. 1;

FIG. 3 is a section along line III—III of FIG. 2 through the guide plate for the yarn guides to illustrate the arcuate guide channels for the yarn guides;

FIG. 4 shows a modification of the apparatus of FIG. 1 in a fragmentary corresponding view; and

FIG. 5 is a section along line V—V of FIG. 3.

Referring now to FIGS. 1–3, a pair of pattern chains 1, 2 of equal length are shown to be arranged at the respective ends of a warp knitting machine, with the warp chain 4 being arranged for rotating in an endless path across the width of the machine defined by the two pattern chains to lay the warp threads. The pattern chains extend into the region of the needle bar indicated schematically by a row of knitting needles 3. For a better understanding of the operation of the pattern chains and the needle bar in the arrangement of the invention, they have been illustrated 90° from their actual position.

The warp chain 4 is arranged on the machine for receiving yarn from a plurality of pivotal yarn guides 6 each having free ends receiving yarn from respective ones of spools 9. The warp chain is inclined in respect of the pattern chains, with one end of the warp chain adjacent the yarn guides 6 being farther removed from the pattern chains 1, 2 than a warp chain end opposite thereto. Each of the chains carries a plurality of yarn clamps 7 spaced from each other to hold the yarns fed and transferred to the chains.

A frame 8 is fixedly arranged laterally adjacent the machine for storing a plurality of yarn storing and supply spools 9. The ends of the yarn guides 6 opposite to their free ends are journaled on a common support shaft 10 for being pivoted thereabout, as will presently be described.

At least the portion of the yarn guides adjacent their free ends is resiliently bendable or yielding to be guided in arcuate guide channels 11*a* of a guide plate 12 which is associated with the yarn guides so that the free ends of the yarn guides pass through portions of arcuate paths 11 within guide plate 12 during pivoting of the guides all of which paths intersect in points 13 and 14. These points of intersection are outside the guide plate, i.e. in theoretical extensions of the actual paths travelled by the yarn guides. While the extensions of all the paths of the free yarn guide ends intersect in these two points, the yarn guides do not collide during their pivoting movements because only one yarn guide is at any one time in the region of the point of yarn transfer 13*a* or 14*a* to the warp chain or to the pattern chains, respectively. The point of intersection 13 of the paths is associated with the point of transfer to the warp chain and the point of intersection 14 is associated with the point of yarn transfer to the pattern chains (see FIG.

1). The drive of the yarn guides is so controlled that only one yarn guide has its free end in the yarn transfer region 13*a*, another yarn guide has its free end in the transfer region 14*a*, while all other yarn guides are in intermediate pivotal positions, as schematically indicated by the block marks in the paths 11 in FIG. 3, each of these marks constituting the position of a respective yarn guide during operation of the machine.

As shown in FIG. 5, the width W of the guide plate channels 11*a* is shorter than the length L of plate 12, i.e. the guide channels terminate short of the plate edges, pivoting movement of the yarn guides being bounded at respective ends by the width of the channels.

The warp yarns 5 are received from the spools by the yarn guides 6 and transferred therefrom in the region 13*a* to a yarn clamp 7 of warp chain 4 as the chain rotates in an endless path in the direction of arrow 15 about the two pulleys over which it is trained. The yarn transfer from the yarn guides to the yarn clamps may be effected by suction or simply by making use of the static electricity. As the chain rotates in the direction of arrow 15, it automatically pulls the yarn from the spools, the end of the yarn clamped to the warp chain 4 finally reaching the yarn transfer point 16 where the lower end of the warp chain adjacent the pattern chains transfers the yarn end to pattern chain 2. Meanwhile, the yarn guide has pivoted down to region 14*a* where it transfers a yarn end to pattern chain 1. In both cases, the yarns are taken along by yarn clamps 7 on the respective chains, causing the yarn to be separated between the yarn guide 6 and the clamp 7. The warp thread now extends parallel to the row of knitting needles 3 between the pair of pattern chains in the direction of arrow 17 until it is laid into the knitting needles. Meanwhile, the yarn guide continues its upward pivotal movement until the yarn end is again seized by warp chain 4 and a new warp thread is laid. All of the yarn guides execute the same pivotal movement in synchronized succession so that a continuous supply of warp threads is delivered to the knitting needles 3.

As is shown in FIG. 1 with reference to only one of the yarn guides 6, the yarn guides are each connected by a link 18 to the longer arm 21 of a rocker 19 mounted on a stationary pivot shaft 20. The rocker is biased counterclockwise, as viewed in FIG. 1, by a helical compression spring 23 acting on the shorter rocker arm 22 into engagement with a pattern wheel 24 carrying cams 25. When the knitting machine operates, the wheel 24 is rotated continuously, and the cams 25 operate the yarn guides 6 in the desired sequence.

The afore-described yarn guide drive is coupled with the chain drives for synchronization in a well-known manner, not requiring illustration nor further description.

As is shown in FIG. 4, the pattern chains may be eliminated and the needle bar 3*a* may be mounted adjacent the warp chain 4 so that the warp yarns 5 may be transferred directly to the knitting needles rather than to pattern chains.

I claim:

1. A warp knitting machine comprising

1. a plurality of spools storing yarn and fixedly arranged laterally adjacent the machine;
2. a warp chain arranged on the machine for receiving yarn from respective ones of the spools and for rotating in an endless path across the width of the machine to lay the warp threads;
3. a plurality of pivotal yarn guides having a free end receiving yarn from a respective one of the spools; and;
4. guide means for the free yarn guide ends for guiding the guide ends through portions of arcuate paths during pivoting of the guides, and one point of each of the yarn guide path portions being adjacent the warp chain for transferring the yarn to the rotating warp chain, and

all the arcuate paths intersecting at least in one point in the region of the point of yarn transfer from a respective one of the yarn guides to the warp chain.

2. The warp knitting machine of claim 1, further comprising a pair of pattern chains of substantially equal length arranged on the machine for rotating transversely of the warp and for receiving the yarns from the warp chain, the warp chain being inclined in respect of the pattern chains, with one end of the warp chain adjacent the yarn guides being farther removed from the pattern chains than a warp chain end opposite thereto, all the arcuate paths intersecting in an additional point in the region of a yarn transfer point between the yarn guides and the pattern chains.

3. The warp knitting machine of claim 2, wherein the guide means comprises a guide plate associated with the yarn guides, the free ends of the yarn guides being guided through their arcuate paths in correspondingly arcuate channels in the guide plate constituting said path portions, groups of said channels defining different arcs.

4. The warp knitting machine of claim 3, further comprising a shaft supporting ends of the yarn guides opposite to their free ends for pivoting the yarn guides about the shaft.

5. The warp knitting machine of claim 4, wherein at least a portion of the yarn guides adjacent the yarn transfer points is resiliently bendable for movement in the arcuate channels.

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