# United States Patent [19]

**Kohl**

[11] **3,828,586**

[45] **Aug. 13, 1974**


[54] **TENSION BAR FOR WARP KNITTING MACHINE**


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[22] Filed: **Mar. 15, 1973**

[21] Appl. No.: **341,629**

[30] **Foreign Application Priority Data**

Mar. 15, 1972 Germany .......................... 2212478

[52] **U.S. Cl.** .................................. **66/146,** 66/86 A

[51] **Int. Cl.. D04b 15/44,** D04b 27/12, D04b 27/14

[58] **Field of Search** ........................... 66/86 A, 146



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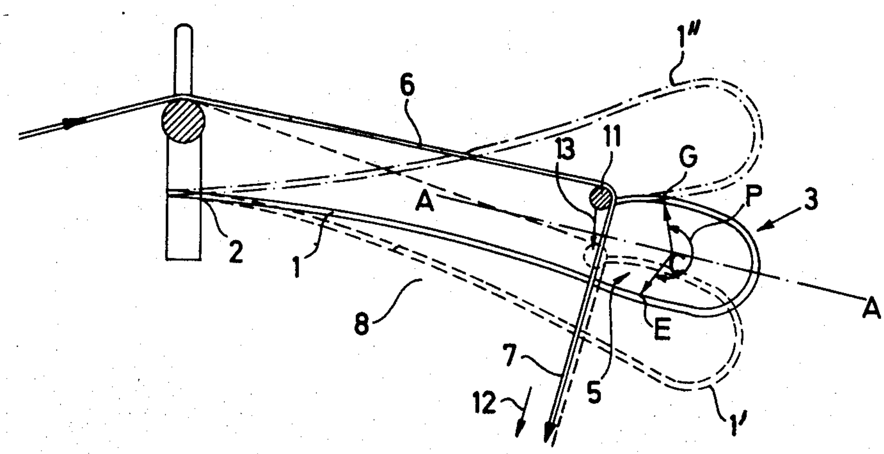
[57] **ABSTRACT**

There is provided a novel form of tension bar for permitting directional change of threads in a warp knitting machine. The novel device comprises substantially of a rigid bar, plurality of substantially J-shaped springs wherein the short end of the "J" spring is attached to the carrier bar and means for anchoring the "J" springs so that the shafts thereof lie in a substantially common plane to which the axis of the carrier bar is parallel.

**3 Claims, 3 Drawing Figures**

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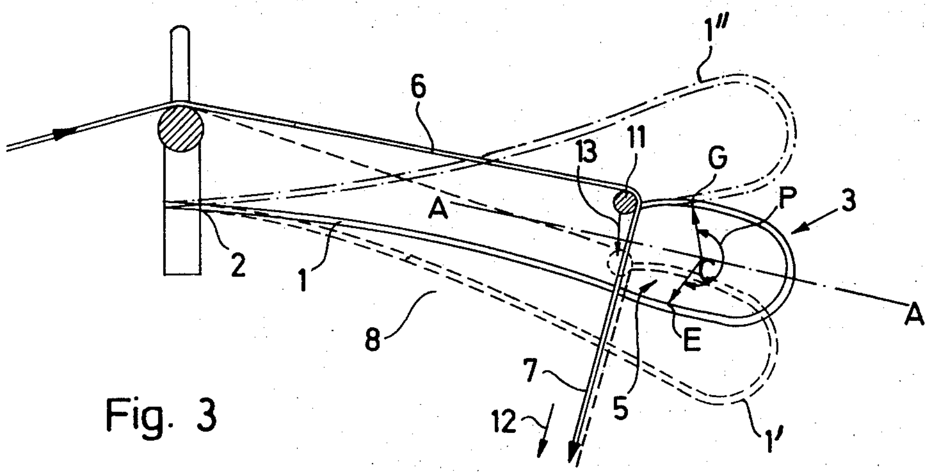

Fig. 3

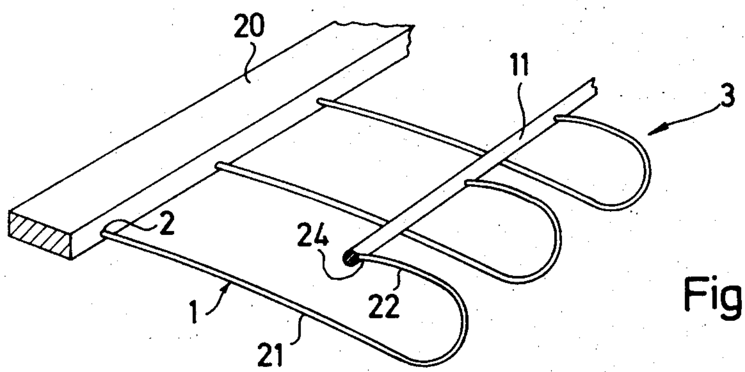

Fig. 1

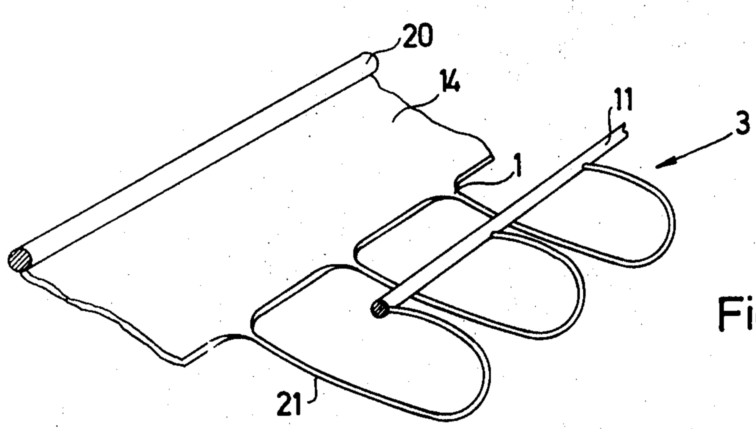

Fig. 2

# TENSION BAR FOR WARP KNITTING MACHINE

## DESCRIPTION OF THE PRIOR ART

Most of the tension bars known to the art comprise a spring-like plate which carries the turning bar at the free end thereof. The path of movement of this tension bar, for example, the track along which the turning bar can move is to all intents and purposes the same as the path of travel of the turned thread. This has an undesirable effect on stitch formation when there is a considerable amount of bending in the plate. It has further been found that it is extremely difficult to obtain moderate degrees of variation of spring resiliance. It is therefore very difficult to vary the properties of these springs to suit the requirements of specific stitch formations.

It has been suggested that the spring plate be provided with a concave bend therein. The disadvantage of this suggestion was that the path of the turning or carrier bar could not be altered and furthermore there was the danger that under high thread tension the plate would open up in an outward direction. It would therefore be desirable to provide a tension bar which has the characteristics of a soft spring which, when placed under increasing thread tension would tend to move in a rearward rather than a forward direction.

## SUMMARY OF THE INVENTION

The novel tension bar device of the present invention comprises a carrier bar, a set of substantially J-shaped spring members and a base. The long portion of the spring members designated as the shafts are attached to the base member in such a manner that the shafts are parallel to each other and lie in a common plane. The hook portions or short ends of the "J" springs are attached at the end thereof to the carrier bar in such a manner that the axis of the carrier bar is parallel to the common plane of the shafts and perpendicular to the direction of the individual shafts. When the device is mounted in the warp knitting machine the open part of the spring faces the source of the thread.

## DESCRIPTION OF THE DRAWINGS

FIG. 1 is a downward perspective view of one embodiment of the device of the present invention.

FIG. 2 is a downward perspective view of another embodiment of the present invention.

FIG. 3 is a side elevational view of the embodiment of FIG. 1 when mounted in different operative and non-operative positions on the machine showing the position of the thread.

The line drawing shows the spring and the thread in the at-rest position.

The dashed lines show the relative positions of the device and the thread when operating under tension.

The dashed and dotted position indicates an alternative positioning of the spring wherein the shaft of the spring lies above the carrier bar rather than beneath it.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

The device of the present invention as illustrated in FIG. 1 comprises a base **20**, a substantially J-shaped spring **1** comprising a longer shaft portion **21** and a shorter hook portion **22**, and a carrier bar **11**. End **2** of shaft **21** is imbedded in the base **20** and end **24** of hook portion **22** is imbedded in the carrier bar **11**. All shafts **21** are imbedded in base **20** so that they lie parallel to each other in a common plane, and springs **1** being substantially of the same length and being attached at ends **24** thereof to carrier bar **11** will cause carrier bar **11** to lie parallel to the common plane of shafts **21** and perpendicular to each individual shaft **21**.

An alternate embodiment of the invention is shown in FIG. **2**. In place of utilizing the individual "J" springs with long shafts there is utilized a flexible spring plate **14** which is attached to base plate **20** and the individual shafts **21** are attached to an edge of plate **14** thus enabling the use of shorter shaft portions on the spring.

In the invention as illustrated certain modifications may be carried out with respect to the design of the "J" spring, either in the single spring embodiment of FIG. **1** or in the composite embodiment of FIG. **2**. These modifications may be best illustrated by consideration of the side elevational view of FIG. **3**. The following discussion will be carried out with reference to a line AA running parallel to the untensioned shaft portion **21** and bisecting the curved portion of the "J" hook. The center of curvature of the bend **3** of **1** along axis AA is point C. The distance CG represents the radius of curvature. The axis CE is the axis of curvature of the end portion of sector **24** and axis CF is the axis of curvature of the end portion of the contiguous end of shaft **21**. The angle P between CE and CF is the bending angle between sector **21** and sector **24**. The angle P is at least 150° and may, as shown in FIG. **3**, be greater than 180°.

When the device of the present invention is attached to and intergrated with an operating warp knitting machine the thread passes over the carrier bar **11** in such a manner that portion **6** is, in the principle modification shown in FIG. **3**, substantially parallel to sector **21** and, in passing over carrier bar **11** is changed by approximately 90° to run in the direction and position indicated by part **7**.

During the operation of the machine tension is placed upon the device whereby the end **3** moves downwardly in relation to end **2** into the dotted position indicated by **1'**. In the course of this movement carrier bar **11** moves in direction **13** causing the thread **7** to move downward and slightly rearward.

The device of the present invention can also be employed in a reverse orientation, that is to say, in place of the carrier bar **11** being above sector **21** of spring **1**, the spacial orientation of the device is reversed so that carrier bar **11** is under shaft **21** as illustrated in the lined and dotted orientation shown by **1''**.

It is an especial advantage of the invention described herein, in particular those embodiments illustrated in the drawings that at least a portion of the spring device stretches outwardly of the location of the turned thread.

It is an especial advantage of the device of the present invention that it permits the evening out of differences in thread tension which arise because of certain aspects of the pattern design and which would otherwise be transmitted to various portions of the beam mechanism. This desirable end was not achievable by tension bars of the prior art.

By means of the solution provided by the present invention in which a resilient bearer element is provided for the carrier or turning bar, it is enabled to undergo two bending stages. These comprise first, the previously known bending of the resilient carrier element and secondly the bending of the free hook element, that is to say, the short end of the "J" spring. This gives rise to a mode of motion for the carrier or turning bar which was not available in the devices of the prior art. As a result of this new carrier element, the turning bar itself is able to describe a longer and more desirable path whereby the rise in thread tension, for example the tension peaks during stitch formation are substantially lowered. This is especially so in the rearward settings of the guide bars and as a result the feeding of the threads to the guide bars proceeds far more quietly.

The forward end of the spring element lies in front of the yarn sheet which is stretched between the spring elements. Whereas heretofore, the springs of the prior art moved in a direction parallel to that of the yarn sheet in the device of the present invention, the spring path is diagonal to the direction of the yarn sheet.

I claim:

**1.** A warp knitting machine comprising:

a. a carrier bar

b. A plurality of substantially J-shaped springs of equal length comprising a shaft portion and a short hook portion and

c. base for the said springs wherein the long ends of said springs are attached to said base in an orientation where the shaft portion of the springs are mutually parallel, the hook portions of the springs lying above the shaft portions and oriented substantially upwardly and towards said base, said carrier bars being attached to the ends of said hook portion and lying upwardly of and parallel to the common plane of the shaft portions of said springs.

**2.** A tension bar according to claim **1** wherein the bending angle of the long shaft portion relative to the end of the short hook portion near the carrier bar is at least 150°.

**3.** A tension bar according to claim **1,** additionally comprising a spring plate, said plate being attached at one edge thereof to the spring bar and the shafts of the "J" spring being attached to the other edge thereof wherein the principle plane of said plate ties in the common plane of said spring shafts.

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