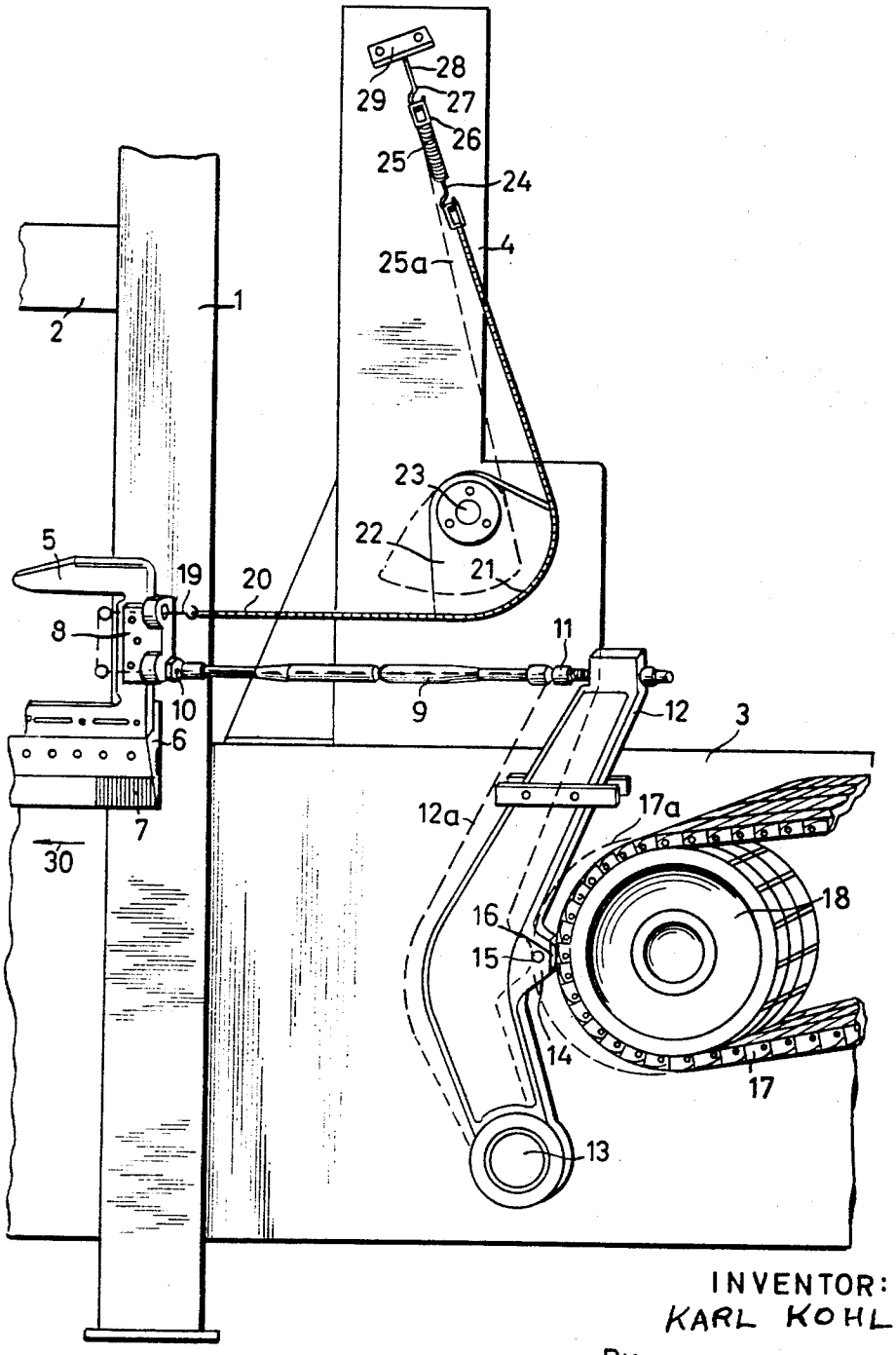
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GUIDE BAR DRIVE FOR A WARP KNITTING MACHINE

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GUIDE BAR DRIVE FOR A WARP KNITTING MACHINE

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ABSTRACT OF THE DISCLOSURE

A chain which connects a guide bar of a warp knitting machine to a helical return spring is trained over a circumferential face of a pivotally mounted guide member. The face spirals about the pivot axis of the guide member in such a manner that the rate of extension of the spring decreases with displacement of the guide bar from its normal position by the pattern mechanism. Excessive pressure exerted by the guide bar on high links of the pattern chain is thereby avoided.

This invention relates to warp knitting machines, and particularly to a drive arrangement for the longitudinal movement of the guide bars which carry the yarn guides.

Warp knitting machines are normally equipped with a pattern chain the links of which cammingly engage rocker arms or like cam followers operatively connected to respective guide bars. There are as many rocker arms as there are guide bars, and the pattern chain is correspondingly provided with several transversely juxtaposed rows of links. Only one guide bar and the associated drive elements need be considered in this specification.

The cam drive provided by the pattern mechanism can move the normally horizontally elongated guide bar in one direction only, and it is customary to provide helical tension springs for returning the guide bar to its normal position. The spring inherently also holds the cam follower in engagement with the pattern chain, and the magnitude of its restoring force determines the contact pressure between the chain and the cam follower, and between elements of the motion transmitting train interposed between the cam follower and the guide bar.

The return spring of the conventional arrangement is lengthened by a distance equal to the distance traveled by the guide bar when the latter is moved away from its normal position by the pattern mechanism. The restoring force of the spring and the contact pressures increase approximately at the rate of spring elongation. It is, therefore, not uncommon in known warp knitting machines for such a return spring to exert a force of 15 kg. in the normal or starting position, and for this force to increase to 45 kg. after full displacement of the guide bar by a pattern chain link of maximum design height.

Great spring forces cause relatively rapid wear of the chain links and of bearings and similar elements which transmit the spring force to a frictionally engaged other machine element. Because of the limited space available, it is not practical to use long springs in which the changes of spring force with the necessary displacement of the guide bar would be reduced to a significant extent.

The object of the invention is the provision of a simple drive arrangement for the return movement of a guide bar in an otherwise conventional warp knitting machine, which reduces the wear of the machine elements associated with the guide bars.

A more specific object is the reduction of wear on the pattern chain.

With these and other object in view, the invention mainly resides in a motion transmitting train interposed between a return spring and a guide bar of a warp knitting machine of the type described above which resiliently deforms the spring at a rate smaller than the rate of movement of the guide bar when the latter is moved away from its normal position by the pattern mechanism. More specifically, the motion transmitting train of the invention may cooperate with an extensible return spring in such a manner that the spacing of the terminal spring portions increases at a rate smaller than the corresponding rate of movement of the guide bar when the latter moves away from its normal position. It is preferred that the spacing of the terminal portions of the return spring increase less during an equal movement of the guide bar as the latter moves away from its normal position.

Other features and many of the attendant advantages of this invention will be readily apparent from the following detailed description of a preferred embodiment when considered with the attached drawing the sole figure of which shows a warp knitting machine equipped with a guide bar drive of the invention in fragmentary front elevation, only as much of the conventional machine elements being shown as is necessary for an understanding of the invention.

The stationary frame of the knitting machine includes a side wall **1**, an upper transverse bar member **2**, and a base which is partly formed by the main drive box **3**.

A guide bar **5** carries leads **6** in which thread guides **7** are embedded, only the right-hand end of the guide bar and of associated elements being shown. Movement of the guide bar **5** in a direction toward the left, as viewed in the drawing, is caused by a push rod **9**. One end of the rod carries an adjustable coupling **10** which engages a fitting **8** attached to the bar **6**. Another adjustable coupling **11** at the other end of the bar **9** is attached to a rocker arm **12** which is pivotally attached to the drive box **3** by a pin **13**. A lug **14** laterally projecting from the arm **12** is provided with a cam follower roller **16** mounted on a shaft **15** and engaging a pattern chain **17** which is trained over a chain wheel **18** of the knitting machine.

The apparatus described so far is largely conventional. It will be understood that the lever is pivoted counterclockwise from the illustrated position when the roller **16** travels over a link in the chain **17** whose thickness is greater than that of the links represented by fully drawn lines in the drawing. The position of the arm **12** when deflected by heavier links **17***a* shown in outline by broken lines is indicated in broken lines at **12***a*.

The roller **16** is held in abutting engagement with the pattern chain **17**, and the guide bar **5** is returned to the illustrated position after displacement by the deflected arm **12***a* by a spring arrangement with which this invention is more specifically concerned.

A hook **19** attached to the fitting **8** engages one end of a thin pull chain **20** or other flexible tension member which is trained over the arcuate face **21** of a segment-shaped guide plate **22**. The plate **22** is mounted on a column **4** extending upwardly from the drive box **3** by means of a pivot pin **23**, and the face **21** extends about the axis of the pin in a spiral whose end nearer the hook **19** is farther from the pivot axis than the remote end of the face **21**.

A hook **24** engages the other end of the pull chain **20**. The hook is integral with one end of a helical tension spring **25** whose other end forms an eye **26** and is suspended from a hook **27** whose threaded stem **28** engages a matingly threaded opening in a bracket **29** on the column **4**.

When the guide bar **6** is shifted toward the left by the push rod **9**, the chain **20** pulls the hook **24** away from the bracket **28**. During the initial phase of guide bar movement from the fully drawn position, the displace-

ment of the hook **24** is approximately equal to the displacement of the guide bar. Because the face **21** of the guide bar is a spiral about the pivot axis of the plate, and because there is no relative movement between the plate face **21** and the engaged portion of the taut chain **20** during leftward movement of the guide bar **6**, the guide plate **22** is pivoted clockwise in such a manner that the length of chain pull **20** engaging the face **21** becomes shorter with progressing displacement of the guide bar. While the angle of warp in which the chain **20** engages the face **21** remains unchanged during initial pivotal movement of the plate **22**, the average radius of the engaged arcuate face decreases. The rate of movement of the hook **24** thus decreases relative to the rate of movement of the guide bar.

Ultimately, there is reached a condition in which the angle of warp also decreases, and in which the run of the chain from the hook **24** to the plate **22** is no longer tangential to the spiral face **21**. The chain then may assume a position as indicated by the broken line **25***a*. When the chain runs along one of the approximately radial faces of the plate **22** to the face **21**, pivoting movement of the plate causes only minimal displacement of the hook **24**.

The rate of increase of the restoring force of the spring **25** thus decreases with the displacement of the guide bar **6** from its normal, illustrated position, and the overall change of length of the spring **25** for any finite displacement of the guide bar **6** is smaller than that displacement.

The actual relationship of the spring force or spring length to the displacement of the guide bar may be selected to suit specific requirements, and a guide plate having a shape different from the segment shape of the plate **22** may be chosen to produce similar or different effects. The use of a circular guide plate eccentrically mounted on the pivot pin **23** is specifically contemplated.

It will also be appreciated that the same or similar effects can be achieved by mounting the pivot pin **23** on a slide movable on the column **4** against the restraining force of another spring in a direction to shorten the path of the chain **20**. The slide may be arranged, for example, in a guide groove of the column **4** extending from the illustrated position of the pin **23** upward and toward the left. With such an arrangement, the guide plate **22** may be replaced by a pulley having a circularly arcuate engaging face for the chain **20**.

The force holding the cam follower roller **16** in contact with the links of the chain **18** varies relatively little with the height of the links in the illustrated apparatus as compared to devices in which an extensible spring acts directly on the guide bar of a warp knitting machine without the interposed transmission mechanism constituted by the tension member **20** and by the guide plate **22**. The wear of the high chain links is significantly reduced thereby.

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

What I claim is:

1. In a warp knitting machine having a support, an elongated guide bar mounted on said support for longitudinal movement toward and away from a normal position and carrying a plurality of yarn guides, pattern means for moving the guide bar longitudinally away from said normal position, a tension spring mounted on the support, a flexible tension member connecting the spring to the guide bar in such a manner that the spring opposes the movement of the guide bar by the pattern means and urges the bar to move to the normal position, and a guide member mounted on said support for pivotal movement about an axis and having a circumferential face, said tension member being trained over said face, the improvement which comprises:

(a) the spacing of said face from said axis decreasing in a circumferential direction,

(b) said guide member being pivoted about said axis during said movements of the guide bar by the tension member trained over said face.

2. In a machine as set forth in claim **1**, said spring having two longitudinally terminal portions respectively secured to said support and to said tension member, the length of said spring being increased when said guide bar is moved by said pattern means away from said normal position thereof, the spacing of said face from said axis decreasing in a circumferential direction in such a manner that the length of said spring increases at a rate smaller than the rate of movement of said guide bar when the guide bar is moved by said pattern means.

3. In a machine as set forth in claim **1**, said face being arcuate.

References Cited

UNITED STATES PATENTS

71,299	11/1867	Hainsworth	139—87
729,102	5/1903	Stimpson	139—87
818,743	4/1906	Cassidy et al.	139—87
1,417,220	5/1922	Wilkinson	139—87
1,836,136	12/1931	Thatcher	139—87
2,106,434	1/1938	Morton et al.	66—86
2,229,928	1/1941	Morrison	66—86
2,451,187	10/1948	Young	66—86
2,625,023	1/1953	Bellini	66—86
2,775,881	1/1957	Held	66—86

FOREIGN PATENTS

950,874	10/1956	Germany.

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