April 26, 1966 R. F. LANTHIER 3,247,686

GUIDE BARS FOR WARP KNITTING MACHINE

Filed May 28, 1963 4 Sheets-Sheet 1

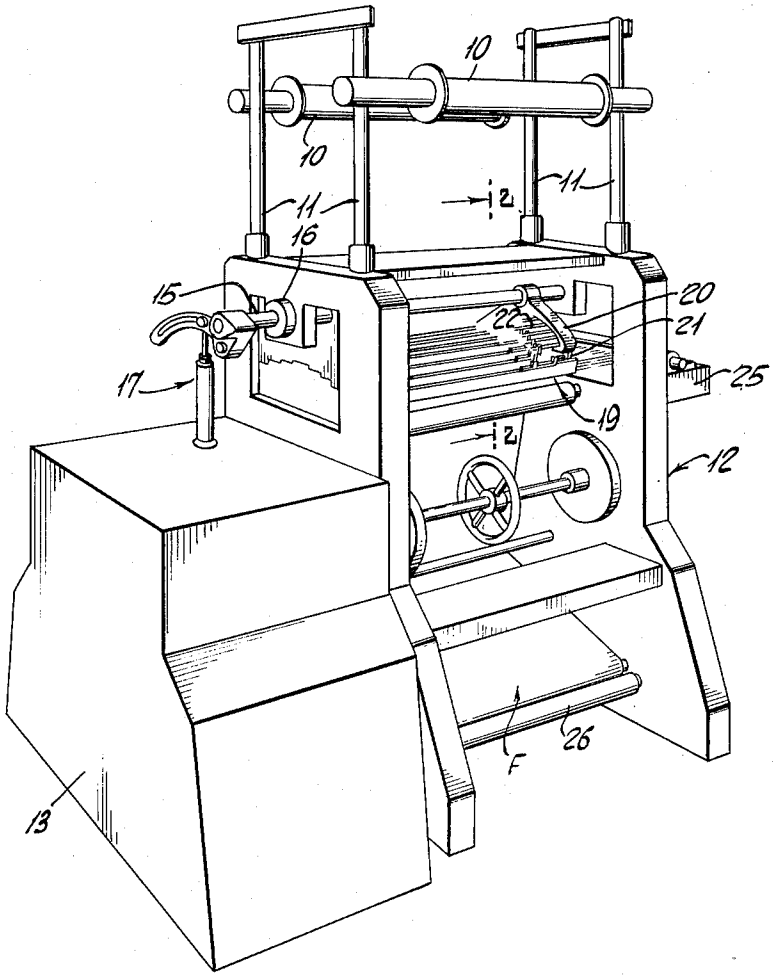

Fig. 1.

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GUIDE BARS FOR WARP KNITTING MACHINE

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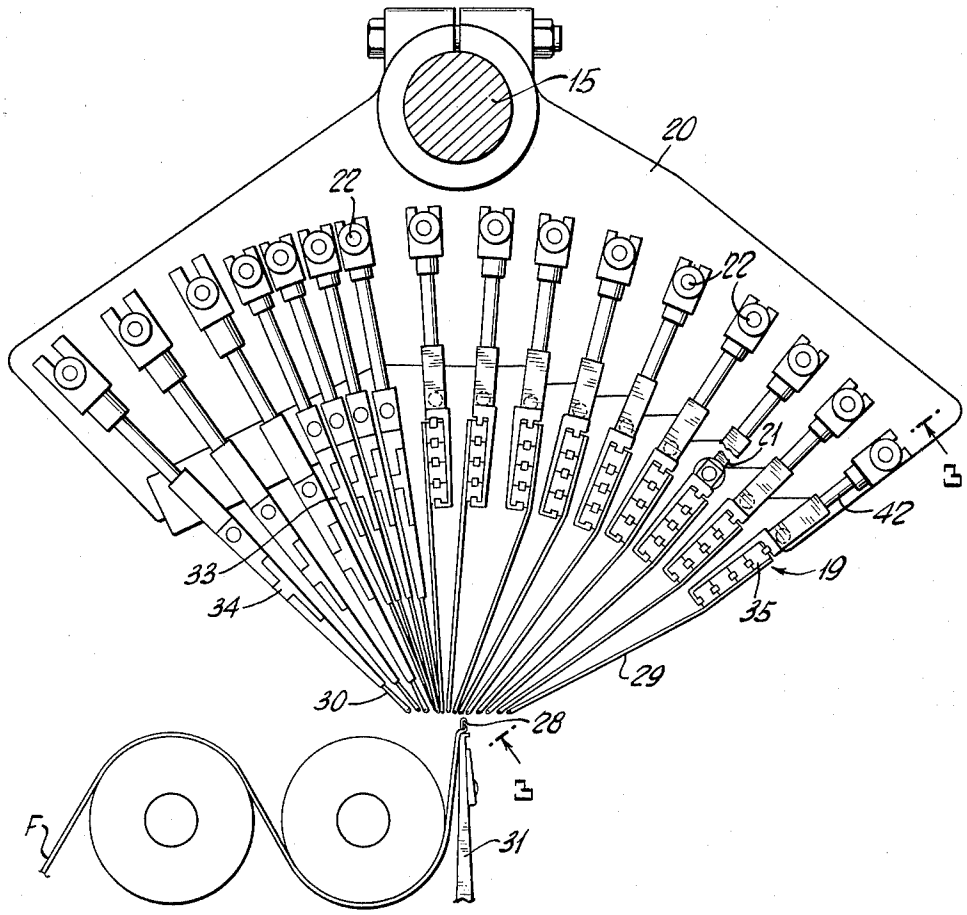

Fig. 2.

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GUIDE BARS FOR WARP KNITTING MACHINE

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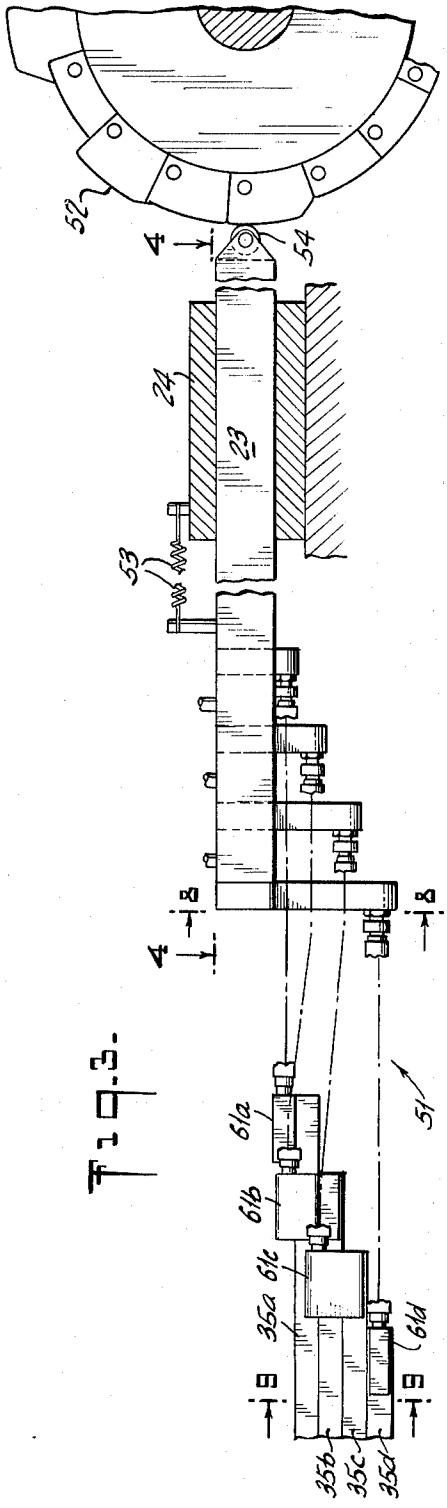

FIG. 3.

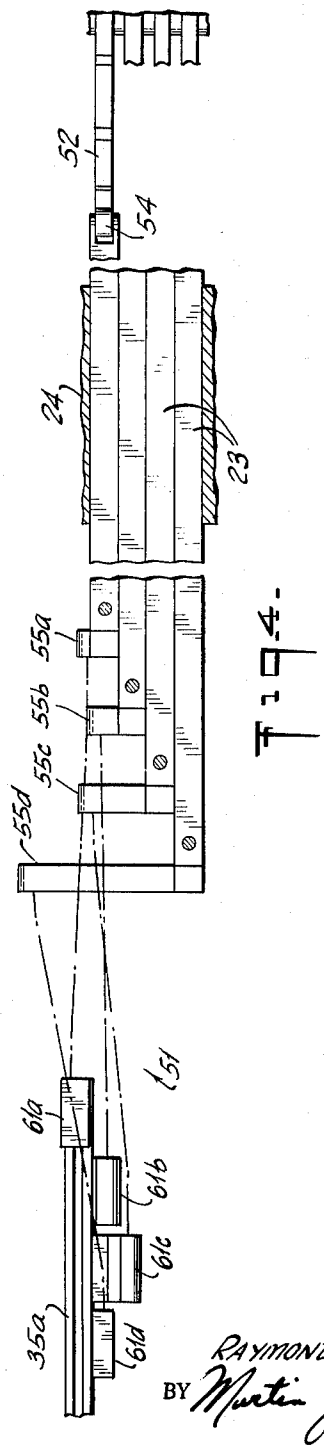

FIG. 4.

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GUIDE BARS FOR WARP KNITTING MACHINE

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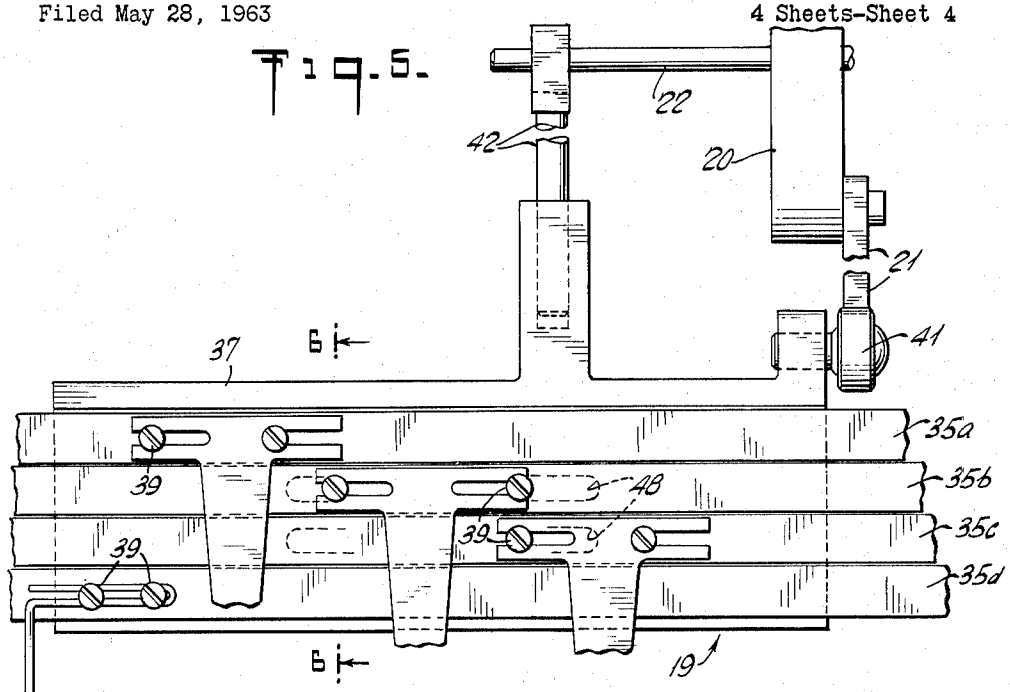
Fig. 5.



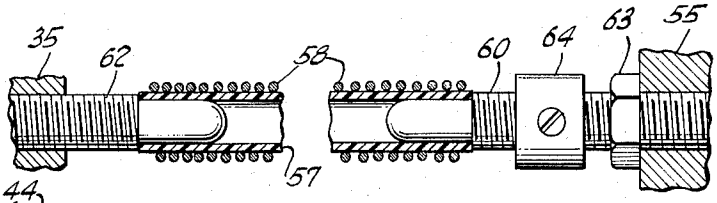


Fig. 7.

Fig. 6.

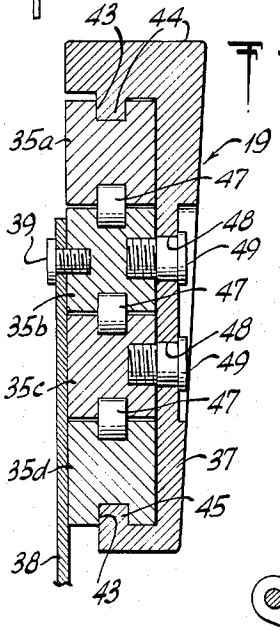


Fig. 8.

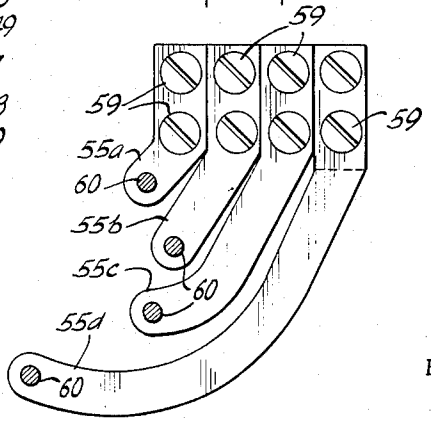
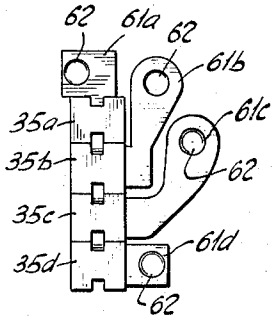


Fig. 9.



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GUIDE BARS FOR WARP KNITTING MACHINE

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Filed May 28, 1963, Ser. No. 283,830
7 Claims. (Cl. 66—86)

The present invention relates to an attachment for warp knitting machinery and more particularly to means for easily increasing the number of guide bars avaliable for use in a warp knitting machine such as a knitting machine of the Raschel type.

The intricacy and variety of pattern that can be created by a Raschel type warp knitting machine are primarily dependent upon the number of guides available for independent movement as the knitted fabric is produced. The guides are carried by the guide bars and it is the shogging movement imparted to the guide bars that creates the pattern in the fabric as the machine goes through its knitting cycle.

Because the modern trend has been and continues to be a demand for more and more intricate and various designs many attempts have been made to provide a warp knitting machine with a substantial increase in the number of independently movable guide bars. The solution for the problem is not only important to increase the flexibility of machines already in the field but to provide new compact machines which can produce more intricate and varied patterns without substantially increasing the cost, size and weight of the machine.

Attempts have been made to increase the number of guide bars available to the knitter by increasing the number of individual guide bars suspended from the hangers. This procedure is self-limiting as all of the guides in each knitting cycle must be swung from one side of the needles to the other sided uring the gaiting motion. As can be readily appreciated by those familiar with the operation of a Raschel knitting machine, the magnitude of the angular displacement of the guide bar hangers and the distance through which the guides must be moved during gaiting are directly related to the speed at which the machine can produce fabric. The longer the gaiting motion that is necessary, the slower the rate of production of the machine.

It is the primary object of the present invention to provide a guide bar assembly in which the number of individual movable guide bars is increased without increasing the length of the arc of movement required during gaiting.

It can further be appreciated that increasing the number of guide bars simply by increasing the number of single guide bars supported by the hangers, with its concomitant increase in the arc of the gaiting motion, causes an excessive amount of yarn to be pulled from the yarn supply source during the gaiting motion. This creates an over-abundance of slack in the yarn when the guides, after shogging, move back through the needles to the latch side and makes it extremely difficult to control and maintain proper tension in the knitting yarn.

It is a further object of the present invention to provide a means for increasing the number of the guide bars without increasing the size of the machine or the space it occupies and further without substantially increasing the weight of the machine.

It is still another object of the present invention to provide a device in which there is an increase in number of available independently movable guide bars without increasing the vibrational forces created during the knitting cycle, which forces have a harmful effect on the machine, its mounting and the surroundings.

An important feature of the present invention is that it may be incorporated in presently existing Raschel knitting

machines without substantial alteration of the machine and therefore its advantages can be obtained by adapting machines already in use in the field. Moreover, even after adaptation to incorporate the present invention the machine will continue to use the presently exiting chains and links and a further investment for changes therein is not necessary.

These and other objects and advantages of the present invention will be more readily apparent from the following description and drawings, in which drawings:

FIG. 1 is a diagrammatic perspective view of a Raschel knitting machine in accordance with the invention illustrating the general structure for placement purposes;

FIG. 2 is a sectional view taken along line **2—2** on FIG. 1;

FIG. 3 is a sectional view taken along line **3—3** on FIG. 2;

FIG. 4 is a sectional view taken along line **4—4** on FIG. 3;

FIG. 5 is an enlarged front elevation of a fragment of the guide bars together with their associated mounting bracket and hanger arm;

FIG. 6 is a sectional view taken along line **6—6** on FIG. 5;

FIG. 7 is a partially broken-away enlarged elevation view of the pusher bar and its associated mountings;

FIG. 8 is a sectional view taken along line **8—8** on FIG. 3; and

FIG. 9 is a sectional view taken along line **9—9** on FIG. 3.

The invention as shown herein will be illustrated and described as adapted for use in a Raschel knitting machine of the type illustrated in FIG. 1. Of course it is adaptable for use in warp knitting machines of all types.

No useful purpose will be served by describing in detail a high speed warp knitting machine of the Raschel type, the structure and mechanism of which are well known in the art. There is contained herein, therefore, a detailed description of the guide bars and their associated parts which embody the present invention with only a limited description of the machine in which the present invention will be employed merely to indicate how the invention is associated with and adapted for use in a conventional warp knitting machine of the Raschel type.

The knitting yarn is fed into the knitting machine from beams **10** carried on beam rack **11** and through other guide and tension maintaining means (not shown) well known in the art.

The knitting elements are carried by heavy frame **12** and the driving mechanism for the machine is contained within housing **13**.

The guide bar rocker shaft **15** is journalled in bearing **16** carried by frame **12** and has imparted to it a timed reciprocal motion from the driving mechanism contained in housing **13** through suitable connecting rod and lever **17**.

Secured to the rocker shaft **15** are the guide bar hangers **20** from which the guide bar assemblies **19** are suspended by hanger arms **21** and stub rods **22**. In the machine illustrated there are two guide bar hangers **20**, one located at each side of the machine.

The shogging motion is transmitted to the guide bar assembly **19** through the push bars **23** which are carried within slider boxes **24** mounted on shelf **25** rigidly secured to frame **12**. A conventional pattern chain carried on and driven by pattern chain drum mounted adjacent to shelf **25** imparts the desired shogging sequence to the push bars **23**. The pattern chain and its associated parts are not illustrated in FIG. 1.

The fabric F produced by the machine is fed down

through the bottom of the machine and is taken off between tension rollers **26**.

As can best be seen in FIG. 2 the fabric F is produced by the knitting action accomplished by needles **28** and the guides carried on hangers **20**. This knitting action is accomplished and the pattern obtained through a series of movements well known in the art.

The pattern guides **29** and the ground guides **30** which carry the yarns to be knitted threaded through eyes located near their lower ends are moved in shogging motion in and out of the plane of FIG. 2. The guides **29** and **30** are also moved in the gaiting motion by shaft **15** rocking the hangers **20**. The needles **28** mounted for substantially vertical reciprocal movement on trick plate **31** are provided with suitable and customary latches. By timed relative movement of the guides and needles in the customary well-known manner the fabric is produced.

As seen in FIG. 2 the nine hanger arms **21** and associated stub rods **22** carried by the guide bar hanger **20** to the furthest right in the drawing all have supported therefrom multiple guide bar units **19** embodying the present invention. Moving in a counter-clockwise direction the next four hanger arms **21** and stub rods **22** carry the conventional single guide bars **33** and the last three elements carried by the hanger **20** and located on the extreme left-hand side of FIG. 2 are the heavier ground guides **30** and ground guide bars **34**.

In producing the fabric the yarn carried by the guides **29** produces the design while the yarn carried by the ground guides **30** produces the ground fabric. Since the ground guide bars which knit the ground fabric are under heavier tension and carry a greater burden than the pattern guides **29** it is necessary that they be constructed in a more sturdy manner than pattern guides **29**. Moreover, since the shogging motion of the ground guides is usually limited to movement around one single needle their increased weight is not of substantial importance. This factor of weight is important, however, in connection with the pattern guides **29** and their associated pattern guide bars **35**. To create the desired pattern the shogging motion of the pattern guides **29** transmitted to them by their associated guide bars **35** may be substantial and require their movement past several of the needles **28**.

As can be appreciated from FIG. 2, by employment of the present invention four separate independently movable guide bars **35** are now located in the same space where previously only two guide bars **33** of the old type could be accommodated.

To accomplish this two of the hanger arms **21** and stub rods **22** carried by hangers **20** are removed and a single hanger arm **21** and stub rod **22** installed to replace them. From the single hanger arm **21** and stub rod **22** depends one multiple guide bar assembly **19**.

As can best be appreciated from FIGS. 5 and 6 the pattern guide bars **35***a*, **35***b*, **35***c* and **35***d* are all mounted for slideable movement in guide bar bracket **37**. Each of the guide bars **35** carries one or more yarn guides **38** as may be called for by the pattern to be knitted. The guide bars **35** are provided with threaded apertures into which screws **39** are threaded to secure the yarn guides **38** to the guide bars **35**. The T-shaped heads of the yarn guides **38** are provided with slots to permit lateral adjustment. Also shown is a wire yarn guide **40** having a single loop at its upper end to receive the screws **39**.

The guide bar bracket **37** is held securely in position by the hanger arms **21** and stub rods **22**. A ball joint **41** is provided in the linkage between hanger arm **21** and guide bar bracket **37** so that the proper angular position of the guide bar bracket **37** with respect to the vertical can be obtained. Positioning rod **42** is secured to the guide bar bracket **37** at its lower end and at its upper end is provided with a collar that can be tightened around stub rods

22 to securely hold the guide bar bracket **37** in its proper position.

As can be noted from FIG. 2, by a proper combination of angular position of the guide bar brackets **37** at ball joint **41** and angular bend in the yarn guides **29** the yarn carrying lower ends of yarn guides **29** can all be located closely adjacent to one another in proximity to the needles **28**.

The guide bar bracket **37** is channel-shaped and is adapted to receive four guide bars **35***a*, **35***b*, **35***c* and **35***d*. The guide bars **35** are H-shaped and have slots **43** extending throughout their entire length. A lip **44** is formed in the upper portion of the bracket **37** to engage in slot **43** of guide bar **35***a*, and a lip **45** is formed by the lower portion of bracket **37** to engage in the lower slot **43** of guide bar **35***d*. Interposed between guide bars **35***a* and **35***b*, and between guide bars **35***b* and **35***c*, and between guide bars **35***c* and **35***d*, are anti-friction nylon rollers **47**. These rollers **47** roll in slots **43** between the guide bars **35** and have a diameter slightly greater than the total depth of the two adjacent slots **43** so that the guide bars **35** are slightly separated from one another along their entire length. Other spacer elements can be located between the guide bars **35** to insure that they will be separated from one another and freely movable, independent of one another.

Threaded through slots **48** in the vertical portion of guide bar bracket **37** into guide bars **35***b* and **35***c* are screws **49**. These screws slide in slots **48** and serve to further hold the guide bars **35***b* and **35***c* in their proper position.

As can be appreciated from FIG. 6 the guide bars **35** will be held by lips **43** and screws **49** to insure that they will hold their proper position as they are moved in a shogging motion during the knitting cycle. This is important to make sure that there will be no interference between the guides **38** and the needles **28** in gating.

The shogging motion is imparted to the pattern guide bars **35** through push rods **23** and shogging linkage **51** from the pattern chain **52**. The push rods **23** are mounted for slideable movement in slider boxes **24** secured to shelf **25**. As viewed in FIG. 3 the right-hand end of push rods **23** are held firmly against the pattern chain **52** by springs **53** and are provided at this end with an anti-friction roller **54**.

The shogging linkage **51** which links the push rods **23** to the guide bars **35** is flexible in nature to accommodate the gaiting motion of the guide bars **35**. Each of the push rods **23** has secured to it at its innermost end an anvil **55**. The anvils **55***a*, **55***b*, **55***c* and **55***d* are linked to their respective guide bars **35***a*, **35***b*, **35***c* and **35***d* by a link of flexible nylon tubing **57**. To provide additional rigidity a spring **58** is tightly coiled around the nylon tubing **57**.

The anvils **55***a*, **55***b*, **55***c* and **55***d* are all of different lengths and are so shaped that the nylon tubing **57** and springs **58** associated with each of the guide bars **35** will not interfere with one another as the knitting cycle proceeds through its shogging and gaiting motions.

As can best be seen in FIGS. 7, 8 and 9, each of the anvils **55** is secured to its associated push rod **23** by threaded screws **59** and has located at its outer end a stud **60**. The stud **60** is threaded into anvil **55** and the nylon tubing **57** is force-fit around the smooth outer end of the stud **60**. In like manner, each of the guide bars **35** is provided with an attaching member **61***a*, **61***b*, **61***c* and **61***d* which carries a stud **62** threaded into it, and the other end of the nylon tubing **57** is force-fit around the smooth end of stud **62**. The attaching members **61***a*, **61***b*, **61***c* and **61***d* are so shaped that they cooperate with the shape of the anvils **55** to prevent interference between the nylon tubings **57** as the machine proceeds through its shogging and gaiting motions.

Stud **60** is provided with a lock nut **63** and adjusting

screw collar **64** so that minor adjustments can be made to take up slack in the nylon tubing **57**.

While the device as shown here employs the use of the flexible nylon tubing **57** to positively connect the push rods **23** with the guide bars **35**, this structure is not an essential feature of the invention. As would be apparent to anyone skilled in the art, the well-known guide stud carried by the guide bars, which in turn simply bear on anvils carried by the push rods, could be employed, as could any other suitable linkage known in the art.

In operation during the knitting cycle each of the guide bars **35** can be independently moved in a shogging motion by its associated series of chain links and each of the guide bars **35** and the guides **38** carried thereon will function in the knitting cycle in the conventional manner well known in the art.

Since all of the guide bars **35***a*, **35***b*, **35***c* and **35***d* are separated from one another by anti-friction means, movement is completely free and unrestricted and is no more limited in the structure shown than in the conventional mounting thereof. Except that the shogging motion of the guide bars **35** is limited by the fact that the guides **38** carried thereon all lie in the same plane and cannot pass each other or cross over.

What I claim is:

1. In a warp knitting machine having a guide bar hanger and means for urging said guide bar hanger in a gaiting motion, a guide bar carrying member supported by said guide bar hanger, a plurality of guide bars supported by said guide bar carrying member and mounted for slideable movement relative to one another, and means for independently urging each of said guide bars in a shogging motion, said last mentioned means comprising a shogging linkage, push rods mounted for slideable movement relative to said guide bar hanger, means for resiliently urging said push rods into engagement with said shogging linkage, flexible members linking each of said push rods to one of said guide bars, each of said push rods having located at its end away from said shogging linkages an anvil, and each of said guide bars having located at its end nearest the push rods an attaching member and each of said flexible members being secured at one end to one of said anvils and at its other end to one of said attaching members, said anvils and attaching members being formed so as to prevent said flexible members from interfering with one another as the knitting machine goes through its gaiting and shogging motions.

2. In a warp knitting machine a guide bar bracket, a plurality of independently movable guide bars carried by said guide bar bracket, said guide bars being arranged one substantially vertically above the other in said guide bar bracket, said warp knitting machine having a guide bar hanger, means for urging said guide bar hanger in a gaiting motion, and means for securing said guide bar bracket to said guide bar hanger.

3. A device as claimed in claim **2**, wherein said guide bars are mounted in anti-friction contact with one another.

4. In a warp knitting machine including a hanger having a gaiting motion, a guide bar bracket, means for securing said guide bar bracket to the hanger, and a group of guide bars carried by said guide bar bracket and being independently movable therein, said guide bars of said group being arranged one substantially vertically above the other.

5. In a warp knitting machine, a guide bar hanger, means for imparting a gaiting motion to said hanger, a plurality of guide bar brackets secured to said hanger, a group of independently movable guide bars carried by each of said guide bar brackets, said guide bars of each group being arranged one substantially vertically above the other in said guide bar brackets, knitting elements, yarn guides on said guide bars for placing yarn on said knitting elements, and means for independently shogging said guide bars.

6. In a warp knitting machine a plurality of independently movable guide bars carried by a single guide bar bracket, said guide bars being mounted one directly above the other in said guide bar bracket, said warp knitting machine having a guide bar hanger, means for urging said guide bar hanger in a gaiting motion, and means for securing said guide bar bracket to said guide bar hanger, each of said guide bars having a front face and the front faces of all of said guide bars carried by a single guide bar bracket lying in a single plane.

7. In a warp knitting machine a plurality of independently movable guide bars carried by a single guide bar bracket, said guide bars being mounted one directly above the other in said guide bar bracket, said warp knitting machine having a guide bar hanger, means for urging said guide bar hanger in a gaiting motion, and means for securing said guide bar bracket to said guide bar hanger, each of said guide bars having a yarn guide secured thereto, said yarn guides being secured to said guide bars at one end of said yarn guides and said ends all lying in a single plane.

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