

Warp knitting machine, especially crochet galloon machine

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Technical field

The invention relates to a warp knitting machine, especially a crochet galloon machine, according to the
10 pre-characterizing clause of Claim 1.

Prior art

Many warp knitting machines of the type mentioned in
15 the introduction are known, as, for example, from WO 92/13127, in which guide bars can be driven individually by means of a summation gear, individual displacement elements having different degrees of displacement and being connected by means of coupling
20 members to a regulating device which can be controlled according to the particular pattern. This drive is relatively complicated, and it is necessary to move relatively large masses which make the drive very sluggish and greatly limit the performance of warp
25 knitting machines. Moreover, due to the number of displacement elements, intermediate elements and members for coupling to a pattern-related regulating device, the drive requires a considerable overall volume, this being a serious disadvantage because the
30 guide bars have to be arranged near the knitting point and the space available for drive elements is greatly restricted correspondingly.

DE-A-21 19 053 discloses a device for shedding on
35 weaving looms, in which the warp yarns are driven by means of a linear motor, drive members, which each move at least one warp yarn, being arranged in a common stator. It cannot be understood how such a linear motor

could also be suitable for driving a guide bar of a warp knitting machine.

Presentation of the invention

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The object of the invention is to improve further a warp knitting machine, especially a crochet galloon machine, of the type mentioned in the introduction.

10 The set object is achieved, according to the invention, by means of the characterizing features of Claim 1.

Since an electronically controllable linear motor has at least two drive members which are connected in each
15 case to a guide bar and which are guided to and fro in a common stator by means of a closed magnetic circuit, there being present, moreover, for each drive member at least one drive coil which is connected to the control device and the plane of turn of which is oriented
20 transversely to the magnetic flux direction, this results, for the guide bars, in an extremely small and nevertheless effective drive which, moreover, can be controlled in a simple way by means of an electronic control device, so that it is possible for the drive to
25 have a hitherto unknown small design. Accordingly, the masses and frictional forces are extremely low and the electronic control is direct and effective, so that high drive speeds are possible, along with very low wear, the least possible generation of noise and the
30 most minimal energy consumption. Moreover, a high degree of control flexibility for pattern purposes is achieved.

Advantageous embodiments of the invention are described
35 in Claims 2 to 11.

In principle, it is possible to arrange the drive coil for driving the drive members on parts of the stator

and to provide merely permanent magnets on the drive members. However, the embodiment according to Claim 2 is more advantageous, since it allows a simpler, more effective and more individual control of the drive members.

The drive force can be increased if there is not only one drive coil present on the drive member, but two or more drive coils arranged one behind the other in the direction of movement.

An especially advantageous embodiment of the stator is described in Claim 4, the development according to Claim 5 being especially preferred.

The magnets of the stator may be electrical exciting magnets, but they are preferably designed, according to Claim 6, as permanent magnets.

An embodiment according to Claim 7 is especially advantageous, since it can then be seen which position the drive member assumes in each case, so that it is not necessary to operate with a constant stroke up against limit stops, but, instead, the control device can also instigate the position into which the drive member is to be moved. Particularly by means of the development of the warp knitting machine according to Claim 8, it is possible for the drive member to be controlled exactly as regards the magnitude of the displacement travel and the stopping position, with the result that optimum patterning of the warp knit fabric to be produced is possible.

In principle, it is conceivable for the drive member according to Claim 10 to execute a curved to-and-fro movement, but the embodiment according to Claim 9 is especially advantageous.

A development according to Claim 11 is advantageous. The cooling device may, for example, be a suction blower which sucks away hot air and therefore also serves, at the same time, for cleaning the linear motor. However, more intensive cooling is achieved if the cooling device is designed for the supply of cooling air.

Brief description of the drawings

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Exemplary embodiments of the invention are described in more detail below with reference to diagrammatic drawings in which:

15 Figure 1 shows the guide bar of a warp knitting machine with a linear motor in a view of the longitudinal side of the guide bar;

20 Figure 2 shows the linear motor of Figure 1 in the section II-II of Figure 3;

Figure 3 shows the linear motor in the section III-III of Figure 2; and

25 Figure 4 shows the arrangement of two linear motors.

Ways of implementing the invention

30 Figure 1 shows a guide bar 2 of a warp knitting machine in a diagrammatic illustration and to the extent necessary for the present invention, since large numbers of warp knitting machines and especially crochet galloon machines are known.

35 The guide bar 2 is mounted displaceably in the longitudinal direction in bearings 4, the bearings themselves being capable of executing, depending on the mode of execution, an optional up-and-down movement

according to the arrow 6, so that a yarn 10 is inserted into knitting needles 12 by means of yarn guides 8. A linear motor 14 is connected via a coupling member 16 to the guide bar 2 and imparts a to-and-fro movement 18 to the latter.

The linear motor, illustrated in more detail in Figures 2 and 3, contains a stator 20, on which are arranged a front bearing block 22 and a rear bearing block 24 which guide a drive member 28 displaceably to and fro in bearings 26, said drive member being connected to the guide bar 2 by means of the coupling member 16. The drive member 28 is provided with a widened portion 30 which runs downwards and in which is arranged a drive coil 32 connected to a control device 36 via leads 34. This widened portion 30 engages to and fro into a slot 38 of the stator 20 which contains a core 40 made of magnetically conductive material. This core is formed by a base part 42, on which project end parts 44, 46, between which are arranged one or more intermediate parts 48 which form the slots 38. Fastened to the end parts 44, 46 and to the intermediate part 48 are magnets 50 which are preferably permanent magnets and which, together with the core, produce a peripherally closed magnetic circuit 52, in which the field lines running from north to south run, on the one hand, between the magnets and therefore also between the drive coils 32 arranged in the slots and are closed via the end parts and the base part. So as not to disturb this magnetic circuit, the intermediate parts 48 carrying the magnet 50 consist of magnetically non-conductive material. In the present example, the linear motor has an intermediate part 48 which subdivides the region between the end parts 44 and 46 into two slots 38, in each of which a drive member 28 is arranged. The arrangement may also readily be such that a larger number of slots and drive members 28 may be provided.

The linear motor is designed, further, in such a way that it co-operates with a sensor 54 for recognizing the position of the drive member 28, the said sensor being connected to the control device 36 via a lead 56.

5 For recognizing the position, position markers 58 are arranged on the drive member 28 or on another member, such as, for example, the guide bar, connected to the drive member, so that it is possible, via the control device 36, to detect the position in which the drive
10 member 28 is located. The linear motor is equipped, further, with a cooling device 60 in the form of a blower which blows cooling air over and through the linear motor. Cooling with oil is also possible.

15 The linear motor is driven to and fro in alternating directions and braked by means of a pulsed current, the frequency of the pulsed current determining the drive speed. The control device is, then, designed in such a way that, by means of corresponding analog or digital
20 software, it can move the drive member up to a predeterminable position and also hold it in this position. It is consequently possible, for example in conformity with the pattern to be produced, to control the drive member 28 on the guide bars in different
25 sequences of movement and amounts of movement according to the particular pattern. The drive may be controlled in various ways known per se.

In control according to the difference or absolute
30 method, the travel is compared with an absolute reference quantity. The control always knows the position in which the drive member is located. Even after the warp knitting machine has been switched off and restarted, it is possible to run on from the
35 respective position of the drive member.

In the incremental method, the increase in travel is used as measurement quantity, and, whenever the warp

knitting machine is restarted, the drive member has to be started up from a zero or basic position determined by a stop.

- 5 Figure 4 shows that a plurality of linear motors may be arranged in a warp knitting machine, which each drive a plurality of, for example, 10 guide bars. In the example of Figure 4, a front linear motor 14a is followed by a rearwardly offset second linear motor
- 10 14b, the linear motors in each case executing the variable stroke H.

LIST OF REFERENCE SYMBOLS

H	stroke
2	guide bar
4	bearing
6	movement
8	yarn guide
10	yarn
12	knitting needle
14	linear motor
14a	front linear motor
14b	rear linear motor
16	coupling member
18	movement
20	stator
22	front bearing block
24	rear bearing block
26	bearing
28	drive member
30	widened portion
32	drive coil
34	lead
36	control device
38	slot
40	core
42	base part
44	end part
46	end part
48	intermediate parts
50	magnets
52	magnetic circuit
54	sensor
56	lead
58	position marker
60	cooling device

PATENT CLAIMS

1. Warp knitting machine, especially crochet galloon machine, with guide bars (2) which can be driven
5 individually and can be controlled by means of a control device (36), characterized in that the said machine has an electronically controllable linear motor (14, 14a, 14b) with at least two drive members (28) which are connected in each
10 case to a guide bar (2) and which are guided to and fro in a common stator (20) by means of a closed magnetic circuit (52), there being present for each drive member (28) at least one drive coil (32) which is connected to the control device
15 (36) and the plane of turn of which is oriented transversely to the magnetic flux direction.
2. Warp knitting machine according to Claim 1, characterized in that the drive coil (32) is
20 arranged on the drive member (28).
3. Warp knitting machine according to one of Claims 1 or 2, characterized in that, for each drive member (28), there are two drive coils (32) arranged one
25 behind the other in the direction of movement.
4. Warp knitting machine according to one of Claims 1 to 3, characterized in that the drive members (28) are arranged in each case in a slot (38) of the
30 stator (20) which has, on both sides of the drive members (28), magnets (50) which form a peripherally closed magnetic circuit (32) via a core (40) consisting of magnetically conductive material.
- 35 5. Warp knitting machine according to Claim 4, characterized in that the core (40) is a base part



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- 5 (42) and two end parts (44, 46) which project from the latter and which, together with at least one intermediate part (48) projecting from the base part (42) and consisting preferably of magnetically non-conductive material, forms the slots (38) for the drive members (28).
- 10 6. Warp knitting machine according to Claim 4 or 5, characterized in that the magnets (50) are permanent magnets.
- 15 7. Warp knitting machine according to Claims 1 to 6, characterized in that each drive member (28) is assigned a sensor (54) for position recognition, the said sensor being connected to the control device (36).
- 20 8. Warp knitting machine according to one of Claims 1 to 7, characterized in that the control device (36) is designed in such a way that each drive member (28) can be controlled individually into any desired position.
- 25 9. Warp knitting machine according to one of Claims 1 to 8, characterized in that each drive member (28) is guided to and fro in a straight line.
- 30 10. Warp knitting machine according to one of Claims 1 to 8, characterized in that each drive member (28) is guided to and fro in an arc-shape.
- 35 11. Warp knitting machine according to one of Claims 1 to 10, characterized in that the linear motor (14, 14a, 14b) is assigned a cooling device (60), preferably for the supply of cooling medium such as, for example, cooling air.