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(54) METHOD OF AND APPARATUS FOR FEEDING YARN TO A FLAT BED KNITTING MACHINE HAVING CIRCULATING KNITTING CARRIAGES

(71) We, VEB WIRKMASCHINENBAU KARL-MARX-STADT, of 73 Annaberger Strasse, Karl-Marx-Stadt, German Democratic Republic, a Corporation organised under the laws of the German Democratic Republic, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a method of feeding yarns to a flat bed knitting machine having circulating knitting carriages and to an apparatus for carrying out the method.

It is known in machines with circulating knitting carriages to arrange on each carriage one or more bobbins which are carried along by the carriage. When the knitting capacity is increased larger bobbins are required, and in the case of multiple yarn change the bobbin mass which must be carried along is still considerably greater. The movement of this large mass requires considerable space and energy, and the braking of the carriages when stopping the machine is rendered difficult.

In order to overcome these disadvantages, an apparatus has already become known wherein the bobbins are arranged stationary. Between stationary yarn guides fixed above the machine which follow a stationary bobbin creel, and the yarn guides on the carriages a yarn guide device having a plurality of yarn guides is provided which moves the yarn guides along a closed loop figure of eight path synchronously to the circular movement of the carriages.

Such device has the disadvantage that the yarn guides cannot be selected independently of their sequence on the loop path. Consequently no further possibility of variations exists in the case of multiple yarn change. Moreover, during the movement of the carriage in a loop, additional yarn is drawn off which is not required for the knitting and has to be refed.

It is an object of the invention to reduce the standstill times of the machine, the circulating masses and also the energy consumption.

The underlying aim of the invention is to provide a method of and an apparatus for feeding yarns to a knitting machine which make it possible to draw off the yarns from a stationary bobbin creel without the yarns becoming tangled among themselves, and to realise the multiple yarn change without standstill times for the machine.

Accordingly, the present invention consists in a method of feeding yarns to a flat bed knitting machine having circulating knitting carriages, wherein the yarns are drawn off from a stationary bobbin creel and are fed through the intermediary of a plurality of fixed and a plurality of circulating yarn guides to the individual knitting carriages, characterised in that the circulating yarn guides are disconnectable and in the disconnected state describe particular paths deviating from the carriage path and are selected and connected to the carriage mutually independently, describe an identical path with the carriage during knitting and after completion of the knitting process, clamping and cutting of the yarn become disconnected and are fed back along their particular paths to a selection station, the yarns being guided in different planes between the fixed and the circulating yarn guides so that each yarn is guided in a particular plane.

Conveniently, the speed of the movement of the circulating yarn guides in the disconnected state is independent of the speed of movement of the carriages.

In order that the invention may be more readily understood, reference is made to the accompanying drawings which illustrate diagrammatically and by way of example embodiments thereof, and in which:—

Fig. 1 shows an arrangement of oval yarn guide paths,

Fig. 2 shows an arrangement of trapezoidal yarn guide paths,

Fig. 3 shows an arrangement of rectangular yarn guide paths,

Fig. 4 shows an embodiment of apparatus for use with the arrangement of Fig. 1,

Fig. 5 shows schematic view of the yarn guide movement for Fig. 4, and

Fig. 6 shows an embodiment of apparatus for use with the arrangement of Fig. 2.

The embodiments illustrated relate to apparatuses which are applicable to flat bed knitting machines having circulating knitting carriages 14. A first embodiment is illustrated in Figs. 1 to 4. The knitting carriages 14 move along a path 1, whilst yarn guides 10 move along paths 2 and both follow an identical path only along the section AE (Fig. 1) during which the yarn guides 10 and carriages 14 are connected together. The paths of the individual yarn guides lie juxtaposed in separate, for example parallel planes, the position of which is variable with reference to the plane of the path of the knitting carriages.

The apparatus according to Fig. 4 operates with transport systems which are respectively arranged above the straight regions of the path of the knitting carriages 14. These transport systems comprise essentially devices for the movement of the yarn guides 10 in tracks which are parallel to the carriage travel direction, and devices for the return of the yarn guides to a collecting point. For the movement in the carriage travel direction, guideways 13, for example rails, are provided upon which horizontal carriages 11 are mounted slidably. The yarn guides 10 are arranged movably in these horizontal carriages 11 and guided by rollers 12.

After the connection of the selected yarn guide to the knitting carriage 14 and the release of a clamp 15 provided at the end of the yarn guide 10 (Fig. 5), the normal knitting operation commences, which is completed with the clamping and cutting off of a yarn 33. A latching means 17 of the yarn guide in the knitting carriage is released by a cam 16 at the end of a pair of needle beds. A spring 18 secured to the horizontal carriage 11 draws the yarn guide with clamp upwards. A gearwheel 19 fitted to a lever joint thereby comes into mesh with a rack 20 which is secured to the horizontal carriage 11, and the yarn guide hinges out of its angled position into the straight position and is arrested in that position by a stop 21. When the yarn guide has reached its top position it is engaged by bars 22 which extend across the width of all the yarn guides. The bars 22 are secured for circulation on chains 23, belts or the like, and this entire arrangement for the return is located above the guide rails 13. The return speed of the yarn guides 10 may deviate from the knitting speed.

At the selection point 9 (Fig. 1), that is at the commencement of the one needle bed pair, the yarn guides 10 are firmly held by an arresting means 34. Pivotable levers 24 move continually across the horizontal carriage 11. In the case of programmed selection a stop 27 on the horizontal carriage 11 is pivoted counter to a spring 28 by a magnet 25 through a linkage 26 and the respective carriage is moved back a further distance until a rack 30 fixed pivotably at the end of this path comes into mesh with a gear wheel 29 fitted to the horizontal carriage 11. This causes the gearwheel 29 to mesh with a rack 31 which is arranged on the lever arm of the yarn guide 10 which is guided in the horizontal carriage 11. The yarn guide is moved downwards counter to the spring 18 and becomes angled when the gear wheel 19 meshes with the rack 20. A knitting carriage 14 is locked and entrained by the latter. The rack 30 is brought out of mesh for this purpose. The return pivoting movement of the pivotable lever 24 serves simultaneously to impart a starting acceleration to the horizontal carriage 11. It will be seen from Fig. 5 that the yarn guides 10 with clamp 15 can slide unobstructedly past each other in their extended position.

The apparatus illustrated in Fig. 6 is, like that above described, arranged respectively each over the straight portions of the path of the knitting carriages. In contrast to the first embodiment, the levers which constitute the yarn guides 3 are one-armed levers and are guided upright in paths. Two paths 5 and 6 are arranged at right-angles to the needle beds, and the paths 4 to 4*y* for the yarn guides 3 cannect these two. The yarn guides 3 have different heights so that the yarns cannot become entangled. In detail, the apparatuses operate as follows:

When the carriage 35 completes the knitting process the yarn becomes clamped in the yarn guide 3 and is cut off. When, upon the arrival of the carriage, the stop 36 arranged at the entrance to the path 5 is reached by the lever 37 which is located at the end of the needle bed pair, then an arresting means 38 in the carriage 35 is released counter to a spring 39. The yarn guide 3 is then removed out from the carriage by the spring 40 and reaches the path 5. Associated with the path 5 is a transport device 42, the drivers 41 of which transport the yarn guide past a sensing device 43. The latter is connected by traction lines by way of a lever 45 to a stop 46. When this stop 46 is hinged upwards by a signal from the sensing device 43, the yarn guide 3 is aligned into the appropriate path 4 . . . 4*y*. This is effected by the spring 48 when it is released by the lever 47 which is in turn connected to the stop 46. The spring 48 is restressed by a wind-up mechanism 49. Further transport devices are provided in the paths 4 . . . 4*y*. They each consist of two chains 50, the drive 51 and transverse rods 52 having drivers 53. At the end of each path 4 . . . 4*y* there is

arranged a magnet 54 which operates counter to a spring 55. This magnet selects the required yarn guide 3 and brings it in the path 6 with a further transport device 57 to a collection point 58. The transport device 57 is provided with drivers 56 similar to the drivers 41 of the transport device 42.

A tripping device 59 secured to the carriage 35 causes release of a spring 61 by the abutment means 60. By this means the yarn guide 3 is transported into the carriage 35 and fixed therein counter to the spring 40 by the arresting means 38. Then, by way of an abutment 62 which is fastened to the carriage 35, a slide 63 is moved against a spring 64, both at the end of the path 6, and a fresh yarn guide 3 is brought into readiness.

As a variant of this embodiment it is possible, instead of the tripping device 59 and spring 61, to employ a positive connecting device, for example cams, magnet or the like.

For the third embodiment it is possible to employ an apparatus of the kind previously described, but which must be arranged above the machine at right-angles to the needle bed pairs. This means that paths similar to the paths 4 . . . 4y of the yarn guides 3 are arranged mutually parallel and at right-angles to both needle bed pairs and hence to the direction of movement of the carriages 35. The yarns must be fed to the carriages in staggered heights so that they cannot become entangled.

This apparatus, similar to that previously described, can be operated in two manners with different auxiliary devices.

The yarn guide 3 (Fig. 3) which is connected to the carriage at the selection point A; A′ is entrained by it as far as the section FF′. There it is disconnected and returned on its respective path to the selection point. In the centre of the sections AF; A′F′ there is provided for each path at least one stationary yarn guide, for example in the form of a yarn eye 7 (Fig. 2). By means of this yarn eye 7 the yarns 8 are fed from a bobbin creel (not shown) to the yarn guides 3.

With this mode of operation, after completing the knitting process at the point E additional yarn must be drawn off in order that the carriage 35 may continue to the point B. This additional yarn must be fed again on the section BC or else stored until yarn is again required on the counter bed from point C.

It is therefore also possible to arrange an additional disconnecting device at point E. Then the yarn guide 3 becomes uncoupled at the point E and is fed back on the path EDC to the carriage 35 and is there reconnected. The carriage itself moves on the path EBC.

As a further improvement of the last mentioned embodiments, the circulating yarn guides 3 are optionally manufactured from two parts. The lower parts all have a uniform height and are respectively entrained by the knitting carriage as described. The upper parts have the necessary staggering and move on short paths round the stationary yarn guide 7. For this the yarns are fed from the bobbin creel through the stationary yarn guides 7 to the upper parts of the movable yarn guides 3. The passage of the yarn occurs in different heights, that is to say the yarn guides 7 and the top parts of the yarn guides 3 have equal heights by pairs. From the upper part of the yarn guides 3 the yarn is drawn to the lower part of the yarn guides 3 and passes through the latter to the knitting station when the lower part is connected.

This embodiment has the great advantage that the yarns move across the greater part of the machine in one plane and this plane is easy for the operative to supervise. The yarn guiding in staggered heights can therefore be arranged in a smaller space relative to the floor area of the machine, and can optionally be protected from extraneous influences.

WHAT WE CLAIM IS:—

1. A method of feeding yarns to a flat bed knitting machine having circulating knitting carriages, wherein the yarns are drawn off from a stationary bobbin creel and are fed through the intermediary of a plurality of fixed and a plurality of circulating yarn guides to the individual knitting carriages, characterised in that the circulating yarn guides are disconnectable and in the disconnected state describe particular paths deviating from the carriage path and are selected and connected to the carriage mutually independently, describe an identical path with the carriage during knitting and after completion of the knitting process, clamping and cutting of the yarn become disconnected and are fed back along their particular paths to a selection station, the yarns being guided in different planes between the fixed and the circulating yarn guides so that each yarn is guided in a particular plane.

2. A method according to claim 1, wherein the speed of movement of the circulating yarn guides in the disconnected state is independent of the speed of movement of the carriages.

3. A method according to claim 1 or 2, wherein the circulating yarn guides move along two groups of oval paths, the planes of which are parallel each to a needle bed pair.

4. A method according to claim 1 or 2, wherein the circulating yarn guides move along two groups of trapezoidal paths, the planes of which are parallel each to a needle bed pair.

5. A method according to claim 1 or 2, wherein the circulating yarn guides move along a group of rectangular paths, while they are connected at the selection station to the

respective knitting carriage, are disconnected at the end of the needle bed pair, are guided perpendicularly thereto as far as the opposite needle bed pair and are there reconnected to the respective knitting carriage, entrained by the latter and at the end of the needle bed pair are moved in their respective track as far as the selection station.

6. An apparatus for carrying out the method claimed in any of claims 1 to 4, wherein above each straight portion of the path of the knitting carriages there is arranged a transport system for a group of circulating yarn guides which is constituted in each case by devices for the guidance of the yarn guides in paths parallel to the carriage travel direction and devices for the return of the yarn guides to a collecting point.

7. An apparatus according to claim 6, wherein the circulating yarn guides are constructed as two-armed levers, the guided lever arms having a uniform length and being mutually parallel, whilst the yarn guiding lever arms have staggered lengths.

8. An apparatus according to claim 6, wherein the circulating yarn guides are single-armed and are guided in mutually parallel paths in a device inclined to the path of the knitting carriages.

9. An apparatus for carrying out the method claimed in any of claims 1, 2 and 5, wherein above the knitting machine there is arranged a transport system for a group of circulating yarn guides, which comprises devices for the guidance of the yarn guides in mutually parallel paths extending perpendicularly to the straight portions of the path of the knitting carriages.

10. An apparatus according to claim 6 or 9, wherein the circulating yarn guides are single-armed and have staggered heights.

11. An apparatus according to claim 6 or 9, wherein the circulating yarn guides comprise two superimposed parts, of which the lower parts have an equal height whereas the upper parts have staggered heights and only the lower parts are connected to the knitting carriage.

12. An apparatus according to claims 6 or 9 to 11, wherein two circulating yarn guides are guided in a path.

13. A method of feeding yarns to a flat bed knitting machine having circulating knitting carriages, substantially as herein described.

14. An apparatus for feeding yarns to a flat bed knitting machine having circulating knitting carriages substantially as herein described with reference to and as shown in the accompanying drawings.

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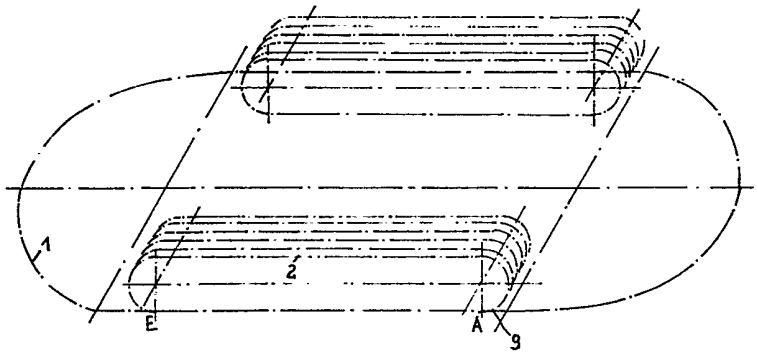

Fig. 1

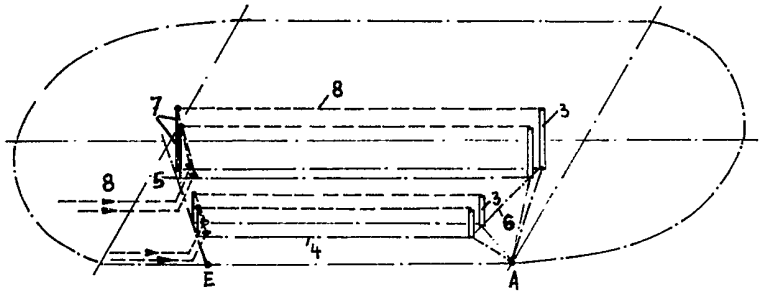

Fig. 2

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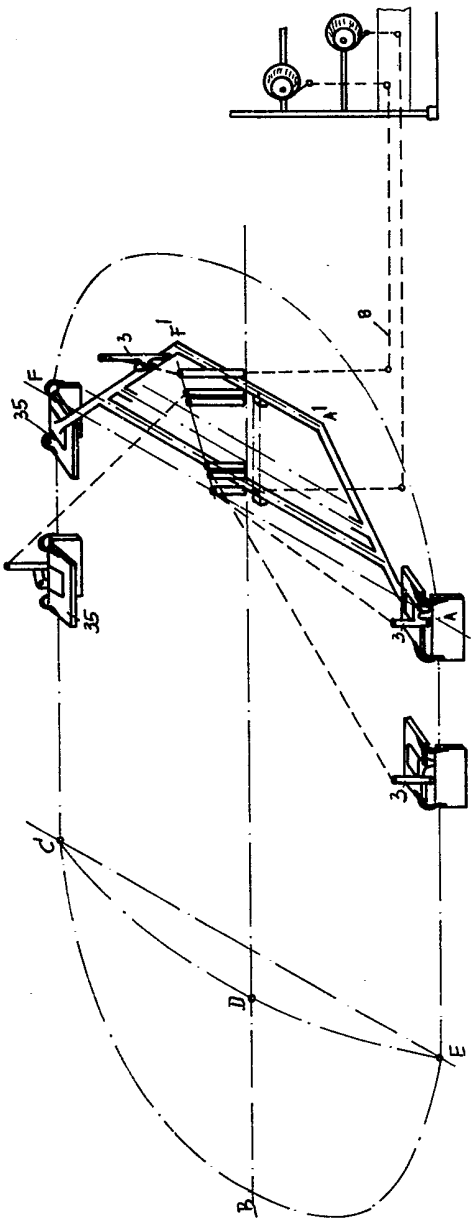

Fig. 3

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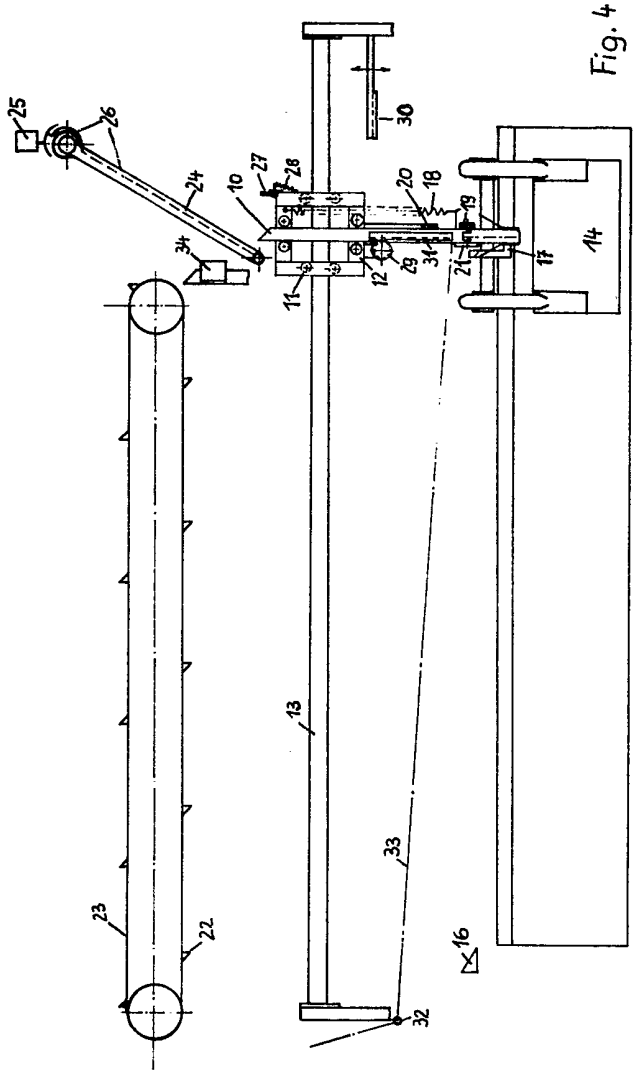

Fig. 4

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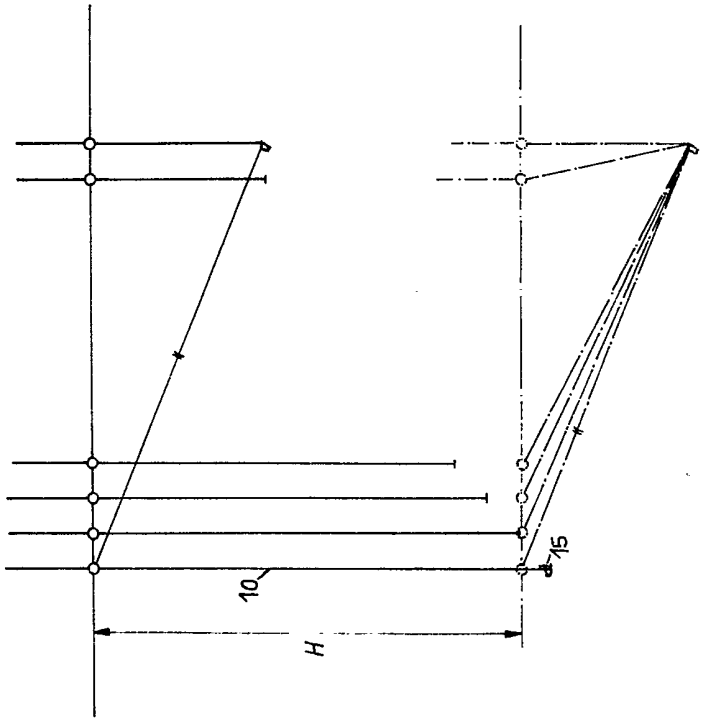
Fig.5



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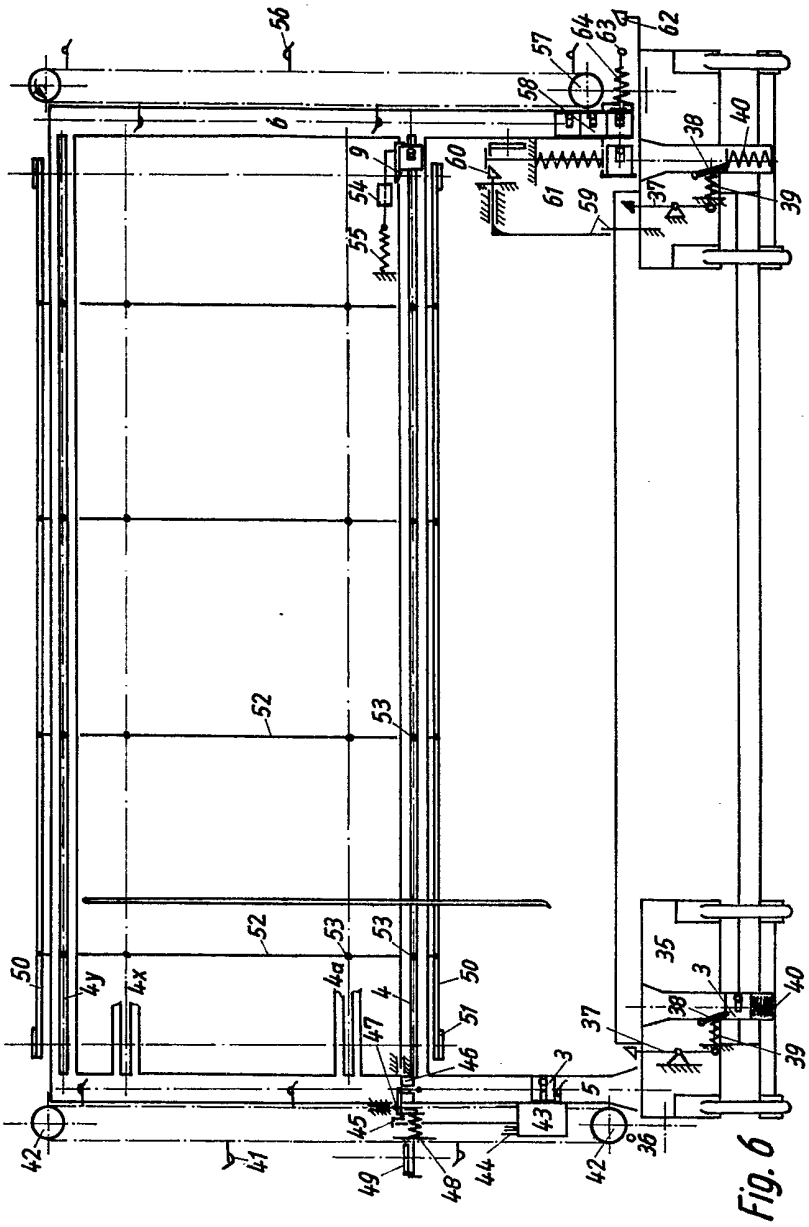

Fig. 6