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(71) Applicant: **SHIMA SEIKI MANUFACTURING, LTD.**
Wakayama (JP)

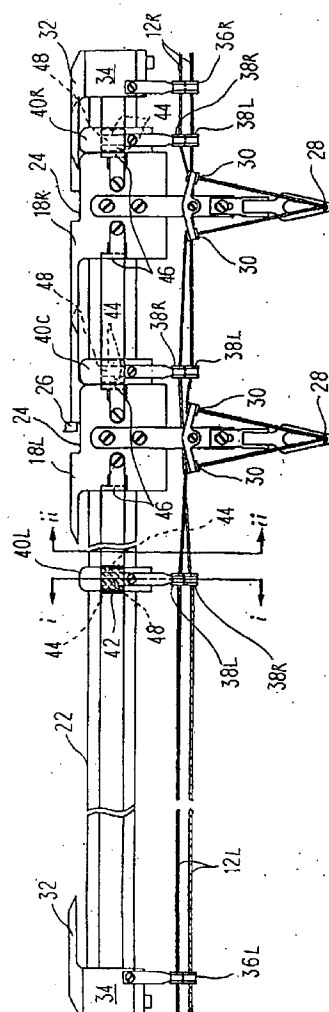
(72) Inventor: **Mori, Kouji**
Kainan-City, Wakayama (JP)

(74) Representative: **Leale, Robin George**
FRANK B. DEHN & CO.
Imperial House
15-19 Kingsway
London WC2B 6UZ (GB)

(54) **A flat knitting machine**

(57) Carriers (18) and movable eyelet holders (40) are shiftably held on a carrier rail (22). Catching means (44) for carriers (18) to catch the movable eyelet holders and releasing means (42) for releasing the catching are provided. The catching means (44) may be comprised of, for example, a combination of a magnet and a magnetic material, and the releasing means (42) a combination of a magnet and a magnet. The attracting force of the releasing means (42) is made greater than the attracting force of the catching means (44).

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Description

The present invention relates to flat knitting machines, and in particular, relates to a system therein for guiding yarns to be fed for knitting.

The present applicant proposed a yarn guiding system for a flat knitting machine as disclosed in Japanese Patent SHO 62-50589. In Japanese Patent SHO 62-50589, as shown in Fig. 11, a carrier 102 is slidably held on a carrier rail 101. A connection bar 104 extending parallel to the carrier rail 101 is loosely engaged with a holder 103 of the carrier 102, and movable eyelet holders 105, 105 are fixed on both the ends of the connection bar 104. When the carrier 102 comes in contact with one side of either one of the movable eyelet holders 105, 105, the movable eyelet holder 105 will be pushed by the carrier 102 and thus it and the other movable eyelet holder 105 will move together.

In the above-mentioned system, the movable eyelet holders 105, 105 move according to the movement of the carrier 102 to limit the spans of a yarn 106 between the respective pairs of supporting points. Hence the yarn stretched between an eyelet provided on one end of the knitting machine base and the carrier 102 will not become slack or vibrate. Thus entanglement with nearby yarns and irregular knitting can be prevented.

In the above-mentioned system, for example, even when a single yarn is fed from one end of the knitting machine to a single carrier, two movable eyelets are needed. In the above-mentioned system, suppose, for example, a plurality of carriers are held on one carrier rail, on the same track on the front or on the back, and these carriers are used to simultaneously knit sleeves and the body to produce an integral garment. In this case, near the ends of the needle beds, the carriers are prevented by the connection bars from coming close to each other. As a result, the desired knitting procedure can not be accomplished. This problem is not limited to integral garments. The problem is generally experienced when a plurality of carriers are located on the same track.

The objective of the present invention is to provide an improved yarn guiding system for a flat knitting machine which preferably requires no connection bar.

According to the invention there is provided a flat knitting machine comprising a front needle bed and a back needle bed, with the fronts of the needle beds facing each other, carrier rails arranged in parallel with said needle beds, and carriers and movable eyelet holders displaceably arranged on said carrier rails,

characterized in that the flat knitting machine further comprises catching means for allowing said carriers to catch said movable eyelet holders and releasing means for releasing said movable eyelet holders from said catching means.

Preferably, the catching and/or the releasing means comprises a magnet. Thus, for example both said catching means and said releasing means may consist of a

combination of a magnetic material and a magnet or a combination of a magnet and a magnet. In this case, both catching and releasing are effected by the attracting forces resulting from the above-mentioned combinations. It is particularly preferable for the attracting force of said releasing means to be greater than the attracting force of the catching means. Preferably, one member of the combination in said catching means is provided in said carrier and the other member is provided in said movable eyelet holder in such a way that both the members will contact with each other when the carrier and the movable eyelet holder come close to each other. Preferably, one member of said releasing means is provided at the back of the movable eyelet holder and the other element is provided on the carrier rail.

In this way, the catching means and the release means can be produced easily through a combination of a magnet and a magnet or a combination of a magnet and a magnetic material. Preferably, a combination of a magnetic material and a magnet is used for the catching means, and a combination of a magnet and a magnet is used for the releasing means. With this arrangement, the attracting force of the releasing means can be easily made greater than the attracting force of the catching means. Moreover, with this arrangement, the carrier and the movable eyelet holder always attract each other. In contrast to the above-mentioned arrangement, if a combination of a magnet and a magnet is used for the catching means, the carrier and the movable eyelet holder may repel each other. To avoid such an effect, it is necessary to select the polarities of the carrier and the movable eyelet holder. In contrast to this, when the catching means is composed of a combination of a magnet and a magnetic material, any carrier and any movable eyelet holder will attract with each other, posing no such problem of polarities.

In the preferred embodiments, the movable eyelet holder is provided with a magnet comprising the catching means and a magnet comprising releasing means, respectively. These functions, however, may be served by one single magnet. For example, one magnet may be placed along the back (on the carrier rail side) and sides of the movable eyelet holder. In the preferred embodiments, a magnetic material is provided on the carrier side and a magnet is provided on the movable eyelet holder side. This arrangement, however, may be reversed.

As an alternative, the catching means and the releasing means may be configured mechanically. For example, said catching means may comprise a combination of a catcher arm protruding laterally and having a recess, a catcher piece for engaging with said recess, and an activating means for activating said catcher piece towards said recess. In this arrangement, as the catcher piece is pressed against the recess by the activating means, the catcher piece can stabilize the movable eyelet holder against shocks and vibrations during the catching.

The catcher arm may be provided on the movable eyelet holder, and the catcher piece and the activating means may be provided on the carrier. Preferably, however, the catcher arm is provided on the carrier, and the catcher piece and the activating means are provided on the movable eyelet holder.

Now let us examine a case wherein a plurality of carriers are used and both the carriers are set to one end of the needle beds. In this case, preferably, the movable eyelet holder between both the carriers is to be caught by the inner carrier. To this end, it is necessary to prevent the carriers from coming too close to each other so that the movable eyelet holder being caught by the inner carrier will not be caught by the outer carrier. It is hard to provide such a mechanism on the movable eyelet holder. It, however, is easy to provide the mechanism on the carrier. For example, such a mechanism may be the contact member shown in Fig. 10. It is, therefore, rational to provide both the contact member and the catcher arm on the carrier. In turn, it is preferable to provide the catcher piece and the activating means on the movable eyelet holder.

The above-mentioned releasing means may be comprised, for example, of a protrusion provided on said carrier rail for releasing said catcher piece from said recess, resisting said activating means.

Preferably, at least the same number of movable eyelet holders as that of the carriers are provided on said carrier rail. For example, when all yarns are fed from one end of the needle beds, if the releasing means (being a magnet, etc.) is provided at the center of the carrier rail, and the carriers and the same number of movable eyelet holders with that of the carriers are provided on the carrier rail, the span of the yarn between two supporting points will be not more than one half of the length of the needle bed. When yarns are fed from both the ends of the needle beds, the number of movable eyelet holders to be provided is at least the same number with that of the carriers plus one. A releasing means (being a magnet, etc.) is provided at the center of the carrier rail. In this case, the span of the yarn between two supporting points is not more than one half of the length of the needle beds. When yarns are to be fed from both ends of the needle beds, preferably, a plurality of said carriers are provided on said carrier rail, and said movable eyelet holders are provided in such a way that each carrier is placed between a pair of said movable eyelet holders. When the number of the releasing means is increased, for instance, when the releasing means are provided to divide the length of the needle beds into three equal portions, the number of the movable eyelet holders will be increased accordingly.

Thus, by means the present invention, carriers can be brought closer to each other than is possible when connection bars are used. Thus, integral knitting, intarsia knitting, etc. can be produced more easily. As the yarns are supported by movable eyelet holders, the span of the yarn between supporting points is short and

the yarns experience less sagging and vibration. Hence entanglement of adjacent yarns and irregular knitting due to varying tensions in the yarns can be prevented.

Certain embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings, in which:-

Fig. 1 is a front view of a flat knitting machine of one embodiment of the present invention.

Fig. 2 is a partially magnified front view of the embodiment of Fig.

Fig. 3 is a sectional view along the line ii of Fig. 2.

Fig. 4 is a sectional view along the line ii-ii of Fig. 2.

Fig. 5 is a front view of another embodiment of the present invention.

Fig. 6 is a sectional view along the line iii-iii of Fig. 5.

Fig. 7 is a sectional view along the line iv-iv of Fig. 5.

Fig. 8 is a front view of one other embodiment of the present invention.

Fig. 9 is a sectional view along the line v-v of Fig. 8.

Fig. 10 is a diagram showing another layout of carriers of the embodiment.

Fig. 11 is a front view of a conventional flat knitting machine.

In the following, the first embodiment of the present invention will be described with reference to the attached drawings. Fig. 1 is a schematic front view of a flat knitting machine of one embodiment of the present invention, and the mark 1 in the drawing denotes the flat knitting machine in its entirety.

In this flat knitting machine, a pair of needle beds 2 and 2, one in the front and one in the back, are arranged with their tops opposing to each other on a frame 4, and knitting needles are stored protractibly and retractably in the respective needle beds 2. On the top of the needle bed, a carriage 6 for protracting or retracting the needles is slidably mounted. Each yarn 12 is drawn out of one of a plurality of yarn packages 10 provided on the cone stand plate 8 of the flat knitting machine 1. Each yarn is passed through one of the top tension assemblies 14 provided above the flat knitting machine 1. The yarn 12 is then put through one of the side tension assemblies 16 provided on both the ends of the flat knitting machine, and fed to a needle by a carrier 18 which will be described later. On the frame 4, a plurality of carrier rails 22 are held by support members 20 above the needle beds, in parallel with the longitudinal directions of the needle beds 2. On the tracks of the front and back planes of each carrier rail 22, carriers 18 are slidably mounted. A recess 24 is provided on the top of each carrier 18, and the carriage 6 catches a carrier 18 by fitting a carrier catching pin 26 in the recess 24 of the carrier 18. The carrier 18 is provided with a yarn feeder hole 28 at the bottom thereof, and a feeder 30 is provided in the left and in the right, respectively, of a portion above the yarn feeder hole 28. The yarn 12 is fed via the side tension assembly 16 to the needles of the needle bed 2 by the carrier 18 which follows the carriage 6.

Each carrier rail 22 is provided with a pair of carrier

stoppers 34 having a slider 32 on the top thereof to limit the movable range of the carrier 18, and each carrier stopper 34 is provided with a fixed eyelet 36. Moreover, on the carrier rail 22, at least one movable eyelet holder 40 having one movable 38 is slidably held.

Next, the carriers 18, the movable eyelet holders 40 and the stoppers 42 in the present embodiment will be explained. Fig. 2 shows a case wherein two carriers 18 held on the same carrier rail 22 are used and the carriers 18 are fed with yarns from both the ends of the knitting machine. Fig. 3 shows the section along the direction i-i of Fig. 2. Fig. 9 shows the section along the direction ii-ii of Fig. 2.

On the same carrier rail 22, two carriers 18L, 18R are held, and movable eyelet holders 40L and 40R are held in such a way that two carriers 18L, 18R are put between them. Moreover, a movable eyelet holder 40C is held on the carrier rail 22 between the two carriers 18L, 18R. Each movable eyelet holder 40 has two movable eyelets 38L, 38R as yarn guiding members. The movable eyelets 38L, 38R of each movable eyelet holder 40 are dedicated to the respective yarn carriers; hence when yarns 12 are fed to the respective carriers 18, the yarns 12 will not touch with each other and can be fed satisfactorily.

For a carrier 18 to catch a movable eyelet holder 40, a catching means is provided. The catching means consists of magnets 44 on both sides of each movable eyelet holder 40 and attraction plates 46 made of a magnetic material on both sides of the carrier 18. When an attraction plate 46 comes to contact with a magnet 44 provided on one side of a movable eyelet holder 40, the attraction plate 46 will be attracted by and caught on the magnet.

To release the movable eyelet holder 40 from the carrier 18, a releasing means is provided. The releasing means consists of a stopper 42 being a magnet provided at the center of the carrier rail 22 along its longitudinal direction, and magnets 48 provided on the backs of the movable eyelet holders 40. A threaded hole is provided at the fixed position of the stopper 42 on the carrier rail 22, and the stopper 42 is fixed to the carrier rail 22 with a screw. The stopper 42 has such a size that when the carrier 18 and the movable eyelet holder 40 pass over the stopper 42 the stopper 42 will not contact them. When the movable eyelet holder 40 passes over the stopper 42, the magnet 48 will be attracted and caught by the stopper 42. The attractive force between the stopper 42 and the magnet 48 is set greater than the attractive force between the attraction plate 46 and the magnet.

As explained above, in the present embodiment, the catching means for catching the movable eyelet holder 40 by the carrier 18 consists of the magnets 44 provided on the sides of the movable eyelet holder 40 and attraction plates 46 which are made of a magnetic material and provided on sides of the carrier 18; one magnet is made to contact one attraction plate. If the

carrier 18 itself is made of a magnetic material, there is no need of providing attraction plates 46. The catching means may consist of only magnets 44 provided on sides of the movable eyelet holder 40.

Next, the routes of the respective yarns 12 fed from both ends of the knitting machine will be described. The yarn 12L being fed from the fixed eyelet 36L in the left of the knitting machine is passed through the movable eyelet 38L of the movable eyelet holder 40L, and the movable eyelet 30 and the yarn feeder hole 28 of the carrier 18L, then fed to needles.

The yarn 12R fed from the fixed eyelet 36R at the right of the knitting machine is passed through the movable eyelet 38R of the movable eyelet holder 40R, and the movable eyelet 30 and the yarn feeder hole 28 of the carrier 18R, then fed to needles. Another yarn is also fed to the carrier 18L; the yarn is passed through the movable eyelet 38L of the movable eyelet holder 40R, the movable eyelet 38L of the movable eyelet holder 40C, and the movable eyelet 30 and the yarn feeder hole 28 of the carrier 18L, then fed to needles.

Now, the action of the present embodiment will be described by taking knitting a multiple-color jacquard as an example. In this case, two carriers 18L, 18R held on the track of a carrier rail 22 and two other carriers 18, 18 held on a different track are used. Yarns 12 are fed from both the ends of the knitting machine to the respective carriers 18. The actions of the carriers 18, movable eyelet holders 40 and stoppers 42 on one track are similar to those of their counterparts on the other track. Hence their actions on one track will be described. The routes of the yarns 12 are just as described above.

Assume the carriage 6 moves towards the right. For example, before starting knitting, the carriers 18L, 18R are set at the left end of the carrier rail 22. The movable eyelet holder 40L is made to contact the carrier 18L on the left side thereof, and the movable eyelet holder 40C is made to contact the carrier 18R on the left side thereof. The carrier 18L and the movable eyelet holder 40C are kept apart from each other, with a clearance between them. With this arrangement, when the carriage 6 moves towards the right, the carrier 18R will catch the movable eyelet holder 40C. If the movable eyelet holder 40C is in contact with both the carriers 18L and 18R, the movable eyelet holder 40C will not necessarily be caught by the carrier 18R. The movable eyelet holder 40R is set at the position of the stopper 42 which is provided at the midpoint of the side of the carrier rail 22 in its longitudinal direction. A yarn carrier 18 held on a track on the back may be set, for example, at the right end thereof.

To start knitting, the carriage 6 makes the carrier catching pin 26 fit in the recess 24 in the top of the carrier 18R. The carrier 18R is shifted towards the right together with the carriage 6. At the time, due to the attracting force between the attraction plate 46 of the carrier 18A and the magnet 44 of the movable eyelet holder 40C, the movement of the carrier 18A towards the right will

make the movable eyelet holder 40C move towards the right. When carrier 18A comes to the position of the stopper 42, the carrier 18A will contact the movable eyelet holder 40A, and the movable eyelet holder 40A will be pushed by the carrier 18A to start to move towards the right. When the movable eyelet holder 40C being caught by the carrier 18A comes to the position of the stopper 42, the magnet 48 provided on the back of the movable eyelet holder 40C and the stopper 42 will attract each other due to their respective magnetic forces. The attractive magnetic force between the magnet provided on the back of the movable eyelet holder 40C and the stopper 42 is greater than the attractive force between the attraction plate 46 provided on the carrier 18A and the magnet 44 provided on the side of the movable eyelet holder 40C. Hence the movable eyelet holder 40C will stop at the position of the stopper 42. As a result, the movable eyelet holder 40C has been released from the carrier 18A, and the carrier 18A will continue to move towards the right, pushing the movable eyelet holder 40A. At the right end of the carrier rail 22, the engagement between the carrier catching pin 26 of the carriage 6 and the carrier 18A will be released by the slider 32 of the carrier stopper 34, and the carrier 18A will come to a halt.

Next, the carriage will reverse its movement. To move towards the left, the carriage 6 will make the carrier catching pin 26 fit with the carrier 18 held on the carrier rail 22B. The carrier 18 will shift towards the left together with the carriage 6. The carrier 18 being caught by the carriage 6 will catch the movable eyelet holder in a similar manner, and the engagement with the carriage will be released by the slider of the stopper 34 provided at the left end of the carrier rail 22B. The carrier 18 will come to a halt.

With the reversal of the carriage 6 again, to move towards the right, the carriage 6 will make the carrier catching pin 26 fit into the recess 24 in the top of the carrier 18L. The carriage 6 will move the carrier 18L towards the right together with it. At the time, due to the attracting force between the attraction plate 46 of the carrier 18L and the magnet 44 of the movable eyelet holder 40L, the movable eyelet holder 40L will start to move towards the right when the carrier 18L moves to the right. When the carrier 18L comes to the position of the stopper 42, the carrier 18L will contact the movable eyelet holder 40C which has been standing there. Then the movable eyelet holder 40C will be pushed by the carrier 18L to move towards the right. The movable eyelet holder 40L which has been caught by the carrier 18L will be released from the carrier 18L at the position of the stopper 42 by the attractive force between the magnet 48 and the stopper 42, and the movable eyelet holder 40L will come to a halt at the position of the stopper 42. The carrier 18L will move towards the right, pushing the movable eyelet holder 40C. Before the movable eyelet holder 40C comes to contact with the carrier 18A on the side thereof, which has been shifted, the carrier

catching pin 26 will be controlled to release the engagement between the carriage 6 and the carrier 18L so that the carrier 18L and the movable eyelet holder 40C will come to a halt. This operation is similar to that before the start of knitting; it makes the carrier 18L halt before the movable eyelet holder 40C contacts the carrier 18A so that when the carrier 18L moves towards the left next time the carrier 18L can surely catch the movable eyelet holder 40C.

As explained above, in the present embodiment, each yarn fed from the fixed eyelet 36 to the carrier 18 is supported by the movable eyelet holder 40, and the span of the yarn 12 between two supporting points never exceeds one half of the length of the needle bed 2. Accordingly, entanglement of adjacent yarns and irregular knitting due to changing tensions in the threads can be prevented. Such entanglement and tension could otherwise be caused by sagging and/or vibration of the yarns between the fixed eyelets 36 and the carriers 18.

In the present embodiment, the case wherein two carriers 18 are held on the carrier rail 22 has been explained. However, more than two carriers 18 may be held on the carrier rail 22.

Fig. 5 shows the second embodiment of the present invention. Parts corresponding to those of the embodiment shown in Fig. 1 through Fig. 4 are denoted by the same reference marks. In the first embodiment, the configuration is such that two carriers 18L, 18R on the same carrier rail 22 are used and the movable eyelet holder 40 can pass over the stopper 42. In the present embodiment, the configuration is such that only one carrier 18 on a carrier rail 22 is used, and a movable eyelet holder 50 being caught by a carrier 18 is made to contact a stopper 52 so as to release the movable eyelet holder 50 from the catching by the carrier 18. In the present embodiment, a knitting process is employed wherein yarns are fed from both the ends of the knitting machine to the carrier 18.

First, the carrier 18, the movable eyelet holders 50 and stopper 52 of the present embodiment will be described. Fig. 5 is a front view of the movable eyelet holders 50, the carrier 18 and the stopper 52. Fig. 6 is a sectional view of Fig. 5 along the line iii-iii, and Fig. 7 is a sectional view along the line iv-iv. Just like the first embodiment, a magnet 44 is provided on one side of the movable eyelet holder 50, and an attraction plate 46, which is made of a magnetic material and attracts the magnet, is provided as a catching means for the carrier 18 to catch the movable eyelet holder 50, on one side of the carrier 18, at the position of contact with the magnet 44. As a releasing means for releasing the movable eyelet holder 50 from the carrier 18, the stopper 52 is fixed with a screw at the midpoint of one side of the carrier rail 22 in its longitudinal direction. The stopper 52 has such a size that it can contact the side of the movable eyelet holder 50 and does not hinder the travel of the carrier 18.

In the present embodiment, yarns are fed from both

the ends of the knitting machine. Hence movable eyelet holders 50L, 50R are held to the left and to the right of the stopper 52 which is held at the midpoint of one side of the carrier rail 22 in its longitudinal direction, and the carrier 18 is held between the two movable eyelet holders 50. A yarn 12L being fed from a fixed 36L on the left end of the knitting machine is passed through a movable 38 of the movable eyelet holder 50L and a feeder 30 of the carrier 18, and fed from the yarn feeder hole 28 to the needles. A yarn 12A being fed from a fixed 36A on the right end of the knitting machine is passed through a movable 38 of the movable eyelet holder 50A and a feeder 30 of the carrier 18, and fed from the yarn feeder hole 28 to the needles.

Now the action of the present embodiment will be described. Assume the carriage 6 moves towards the right. Before starting knitting, the carrier 18 being in contact with the movable eyelet holder 50L is set at the left end of the carrier rail 22, and the movable eyelet holder 50A is set to the right of the stopper 52 on the carrier rail 22. To start knitting, the carriage 6 makes the carrier catching pin 26 engage with the carrier 18. The carrier 18 is shifted towards the right together with the carriage 6. With regard to the carrier 18 and the movable eyelet holder 50L, due to the attracting force between the attraction plate 46 of the carrier 18 and the magnet 44 of the movable eyelet holder 50L, both being in the contact with each other, the movement of the carrier 18 towards the right will make the movable eyelet holder 50L move towards the right. When the carrier 18 comes to the center of the carrier rail 22, one side of the carrier 18 will contact one side of the movable eyelet holder 50R, and the carrier 18 will move towards the right while pushing the movable eyelet holder 50R. One side of the stopper 52 will contact one side of the movable eyelet holder 50L being caught by the carrier 18. The catching of the movable eyelet holder 50L by the carrier 18 will be released by this, and the movable eyelet holder 50L will come to a halt in the position. The carrier 18 will continue to move towards the right, pushing the movable eyelet holder 50R.

Next, the reversal of the carriage 6 and its movement towards the left will be described. Due to the engagement between the carrier catching pin 26 of the carriage 6 and the carrier 18, the carrier 18 will shift towards the left together with the carriage 6. At the same time, due to the attractive force between the attraction plate 46 provided on the carrier 18 and the magnet 44 of the movable eyelet holder 50R, the movement of the carrier 18 towards the left will make the movable eyelet holder 50R move towards the left. When the carrier 18 comes to the center of the carrier rail 18, the carrier 18 will contact one side of the movable eyelet holder 50L which has been made to halt by the stopper 52 since the previous move of the carriage 6 towards the right, and the movable eyelet holder 50L will be pushed by the carrier 18 to move towards the left. The movable eyelet holder 50R being caught by the carrier 18 will contact one side

of the stopper 52, and the catching of the movable eyelet holder 50R by the carrier 18 will be released, and the movable eyelet holder 50R will come to a halt in the position. The carrier 18 will continue to move towards the right, pushing the movable eyelet holder 50L.

Hence the yarns 12 are held by movable eyelet holders 50 between the fixed eyelets 36 of the knitting machine and the carrier 18. Thus the span of the yarn 12 between two supporting points does not exceed one half of the length of the needle bed.

Fig. 8 shows the third embodiment of the present invention. Fig. 9 is a sectional view along the line v-v of Fig. 8. Parts corresponding to those of the embodiments shown in Fig. 1 through Fig. 7 are denoted by the same reference marks. Here attention should be given to the mechanical operations of the catching process by the carriers and the release of catching by the stoppers.

Now, the movable eyelet holders 60, carriers 62 and stoppers 64 will be described. A groove 66 is vertically formed in the center of the body proper of the movable eyelet holder 60. A slider 69 is installed in the groove 66 in such a way that the sliding member 69 can slide vertically. A pin 68, being an association member for catching, is connected to the sliding member 69. A spring 72, being an activating means, is set between the pin 68 and a fixed pin provided in the upper portion of the body proper of the movable eyelet holder 60. The slider 69 is pulled upwards by means of the spring 72. The carrier 62 is provided with a catcher arm 78 to associate with the pin 68 of the movable eyelet holder 60 and catch the movable eyelet holder 60, and said catcher arm 78 is provided at its top end with a slider for lowering the pin 68 of the movable eyelet holder 60 and with a downward recess 76. When the carrier 62 and the movable eyelet holder 60 contact each other, the pin 68 of the movable eyelet holder 60 will be lowered by the slider 74 at the top end of the catcher arm 78, and the pin 68 will fit in the recess 76. Then the carrier 62 will catch the movable eyelet holder 60. When the carrier 62 moves while pushing the movable eyelet holder 60, one side of the carrier 62 contacts one side of the movable eyelet holder 60. At this time, the pin 68 of the movable eyelet holder 60 is lowered along the carrier's inner slope beyond the recess 76.

The stopper 64 being the release means is fixed with a screw at the center, in the longitudinal direction, on one side of the carrier rail 22. The stopper 64 has a protrusion provided at a point where it contacts the upper part of the slider 69. When the carrier 62 pulls the movable eyelet holder 60, the stopper 64 will contact the upper part of the slider 69. As a result, the slider 69 will be lowered against the shrinking force of the spring 72; the stopper 64 will lower the slider 69 over a distance longer than the distance between the slider 74 and the recess 76. The pin 68 will be released from the recess 76 of the catcher arm 78, and the movable eyelet holder 60 will be released from the carrier 62 and will come to a halt at the position of the stopper 64. The movable

eyelet holder 60 being pushed by the carrier 62 can pass over the stopper 64 without being released from the catching. With the above-mentioned configuration, the knitting described in the first embodiment can be made in the present embodiment as well.

In the first embodiment, when two carriers 18, 18 come close to each other at one end of the carrier rail 22, the carrier catching pin 26 was controlled so that the movable eyelet holder 40C would not contact one side of the carrier 18. In the present embodiment, when the movable eyelet holder 60C contacts the carrier 62 at the end, the pin 68 of the movable eyelet holder 60 will be lowered. Hence the inner carrier 62 can not catch the movable eyelet holder 60. To avoid this, just like the first embodiment, the required control may be given by the carrier catching pin 26, however, in the third embodiment, a contact member 80 is provided for each carrier 62 as shown in Fig. 10. The contact member 80 has such a length that when two carriers 62, 62 contact each other by the contact members 80, 80, the movable eyelet holder 60C will not contact the carrier 62 which has been stationary. Moreover, an extended slider 82 is provided on the top of the carrier 62 to release the engagement between the carrier catching pin 26 and another carrier 62. With this, the contact member 80 of the carrier 62 which is moving will contact the contact member 80 of the carrier 62, which is stationary at the end of the carrier rail 22, and come to a halt. The extended slider 82 on the top of the carrier, which has been stationary, will release the engagement between the carrier catching pin 26 and the carrier 62 which has been moving. Such a technique is also possible in the first embodiment.

In each embodiment, the stopper is fixed with a screw at the center, in the longitudinal direction, of the carrier rail. However, a dovetail groove may be made in the carrier rail, and a stopper, which can move in the groove, may be fixed with a screw. With this arrangement, when yarns are fed from one end of the knitting machine, the stopper can be set at any desired position according to the width of knitting.

In each embodiment, yarns are fed to the carriers from both the ends of the knitting machine, however, yarns may be fed from one end of the knitting machine. In such a case, it is suggested that each carrier has a dedicated movable eyelet holder, and the movable eyelet holder is provided on the feeding side of the carrier.

Claims

1. A flat knitting machine comprising a front needle bed and a back needle bed, with the fronts of the needle beds facing each other, carrier rails arranged in parallel with said needle beds, and carriers and movable eyelet holders displaceably arranged on said carrier rails,
characterized in that the flat knitting machine

further comprises catching means for allowing said carriers to catch said movable eyelet holders and releasing means for releasing said movable eyelet holders from said catching means.

2. A flat knitting machine as claimed in claim 1, characterized in that both said catching means and said releasing means comprise a combination of a magnetic material and a magnet or a combination of a magnet and a magnet, wherein both catching and releasing are effected by the attracting forces resulting from the above-mentioned combinations.
3. A flat knitting machine as claimed in claim 2, characterized in that the attracting force of said releasing means is greater than the attracting force of said catching means.
4. A flat knitting machine as claimed in any preceding claim, characterized in that said catching means comprises a combination of a magnetic material and a magnet and said releasing means comprises a combination of two magnets.
5. A flat knitting machine as claimed in any of claims 2 to 4, characterized in that one member of the combination in said catching means is provided in said carrier and the other member is provided in said movable eyelet holder in such a way that both the members will contact each other when the carrier and the movable eyelet holder come close to each other.
6. A flat knitting machine as claimed in any of claims 2 to 5, characterized in that one member of the combination of said releasing means is provided at the back of the movable eyelet holder and the other element is provided on the carrier rail.
7. A flat knitting machine as claimed in claim 1, characterized in that said catching means comprises a combination of a catcher arm protruding laterally and having a recess, a catcher piece for engaging with said recess, and an activating means for activating said catcher piece towards said recess.
8. A flat knitting machine as claimed in claim 7, characterized in that said catcher arm is provided on said carrier, and said catcher piece and said activating means are provided on said movable eyelet holder.
9. A flat knitting machine as claimed in claim 7 or 8, characterized in that said releasing means comprises a protrusion provided on said carrier rail for releasing said catcher piece from said recess, resisting against said activating means.

10. A flat knitting machine of as claimed in any preceding claim, characterized in the number of movable eyelet holders at least equals that of the carriers provided on said carrier rail.

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11. A flat knitting machine as claimed in claim 10, characterized in that the number of movable eyelet holders provided on the carrier rail at least equals the number of the carriers plus one.

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12. A flat knitting machine as claimed in any preceding claim, characterized in that a plurality of said carriers are provided on said carrier rail, and in that said movable eyelet holders are provided in such a way that each carrier is placed between a pair of said movable eyelet holders.

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FIG. 1

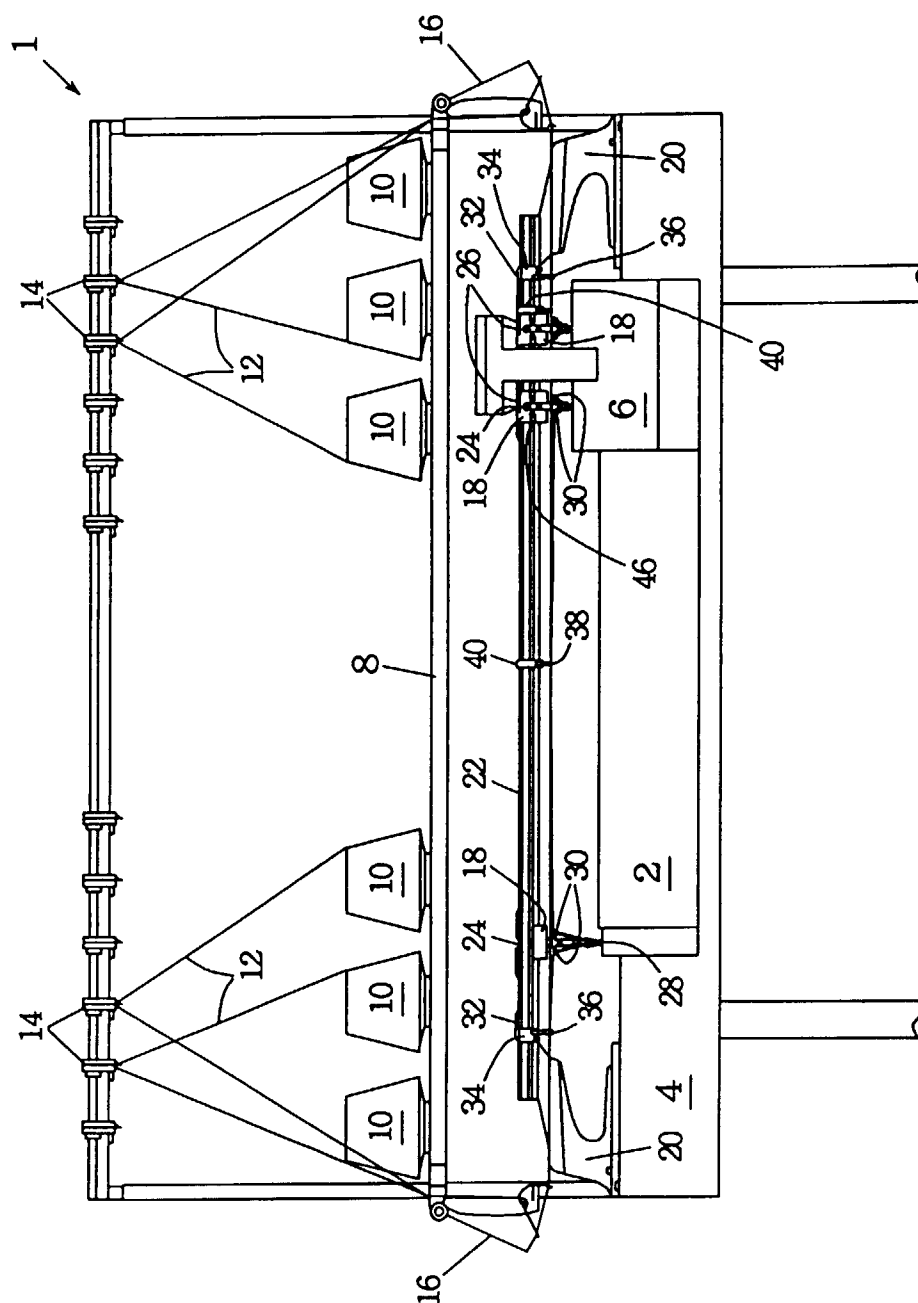
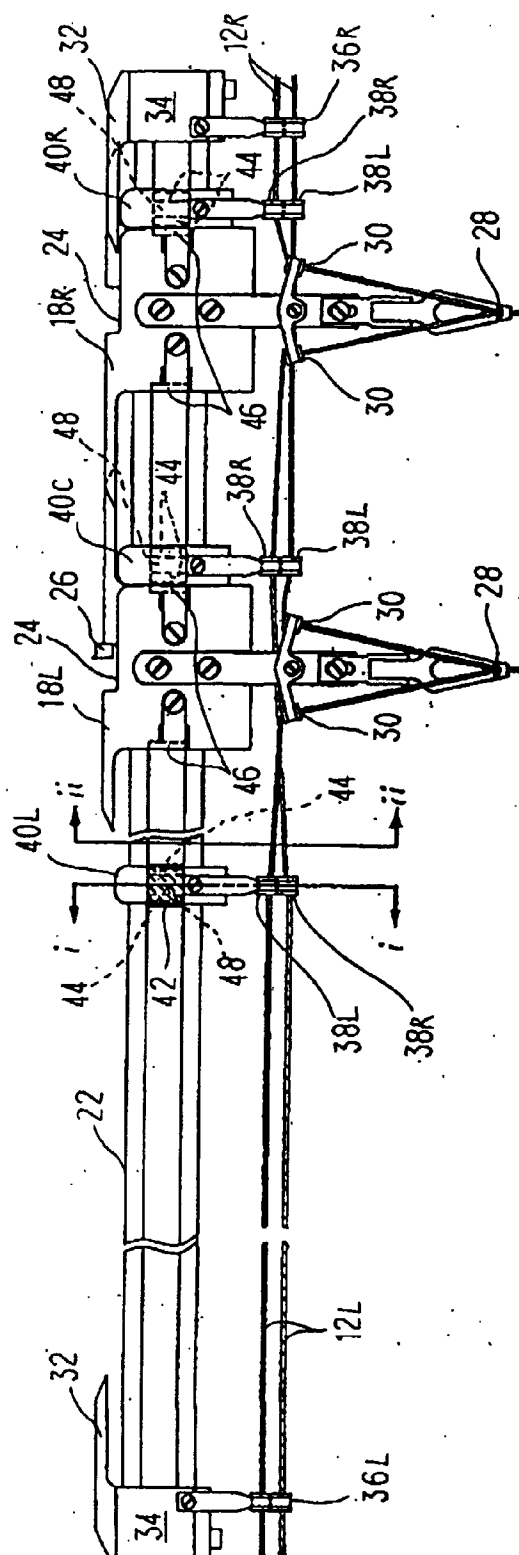
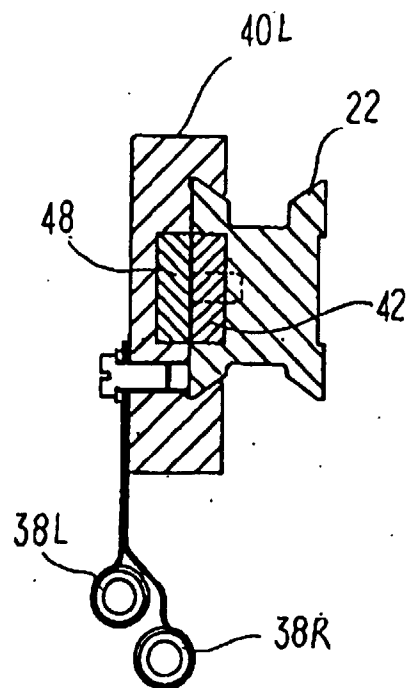


FIG. 2



F I G. 3



F I G. 4

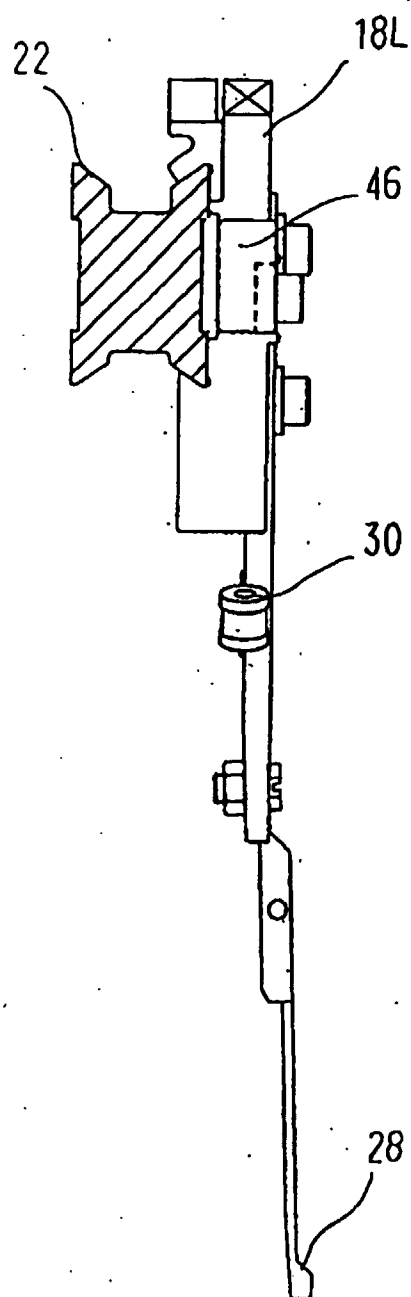
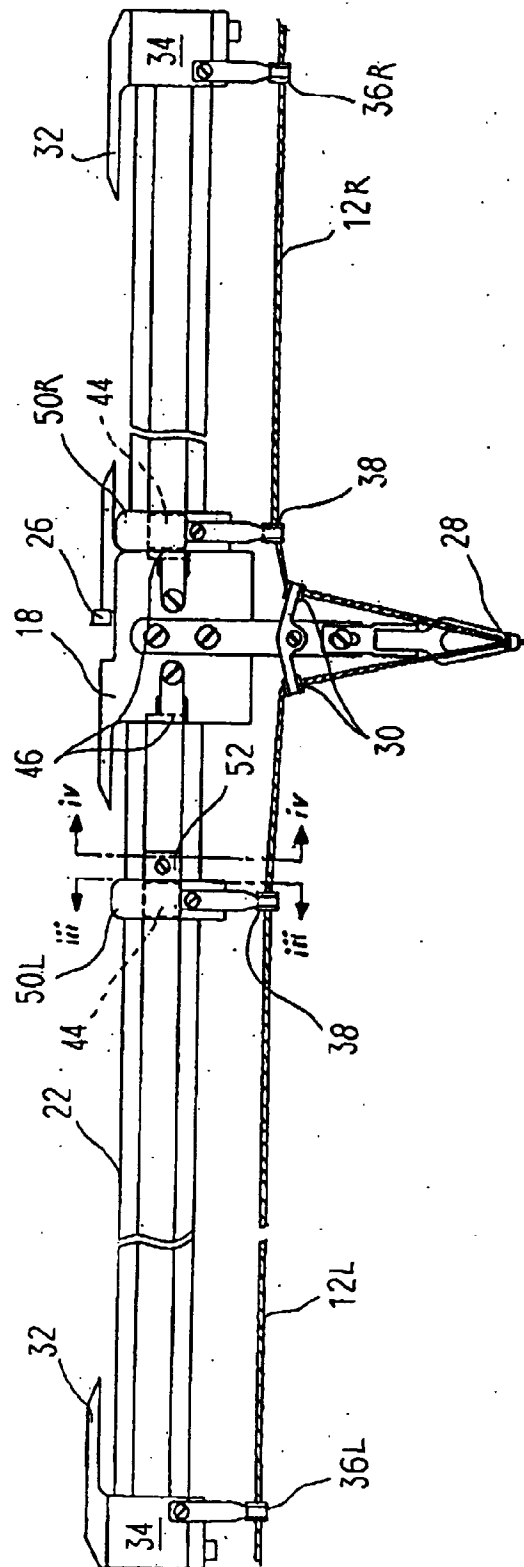
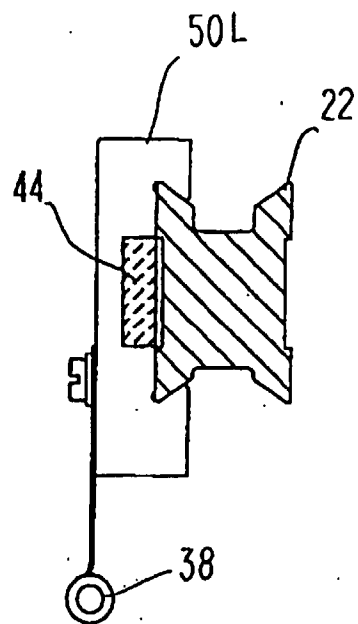


FIG. 5



F I G. 6



F I G. 7

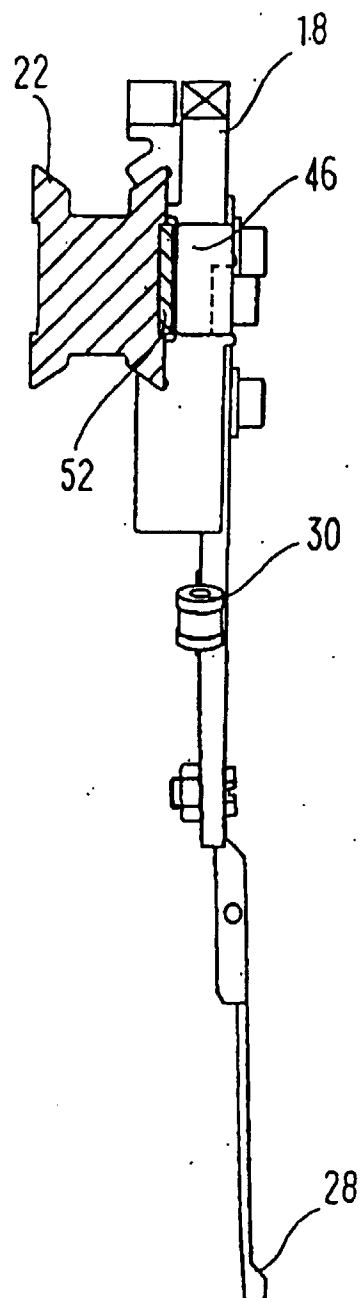
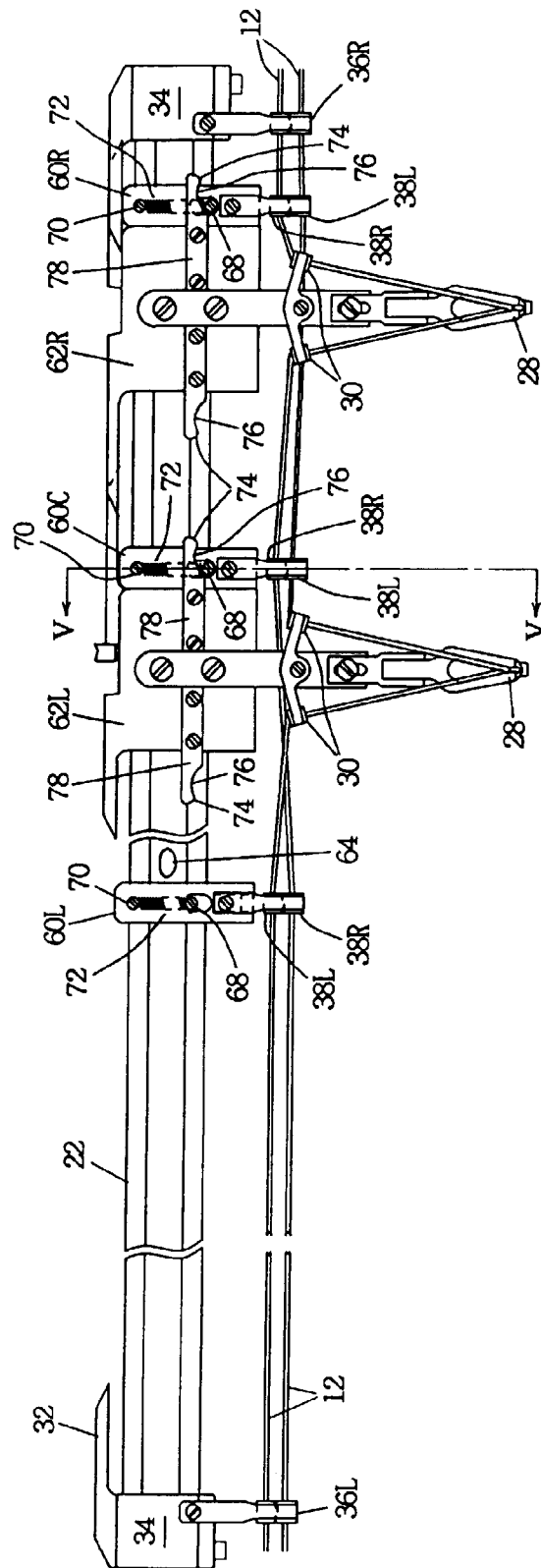


FIG. 8



F I G. 9

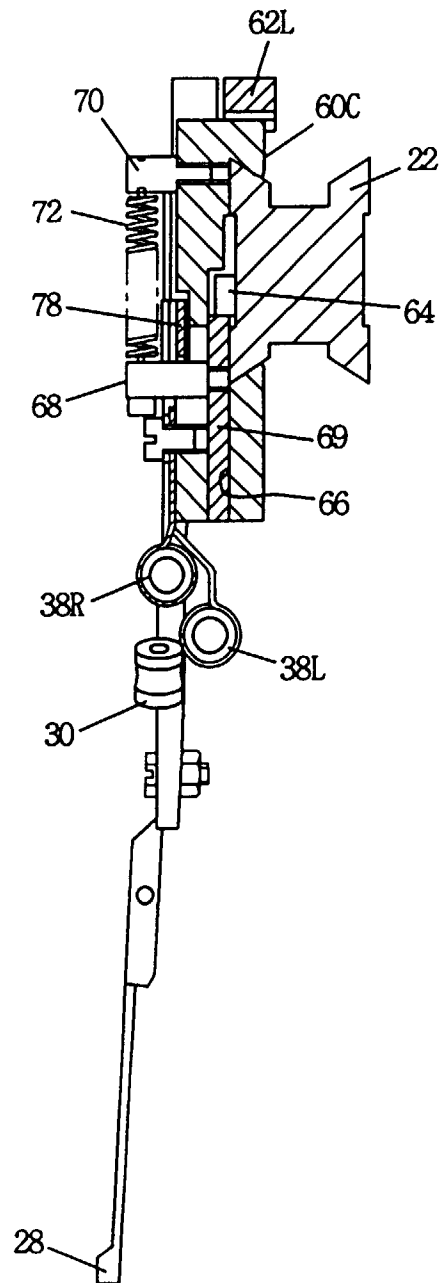


FIG. 10

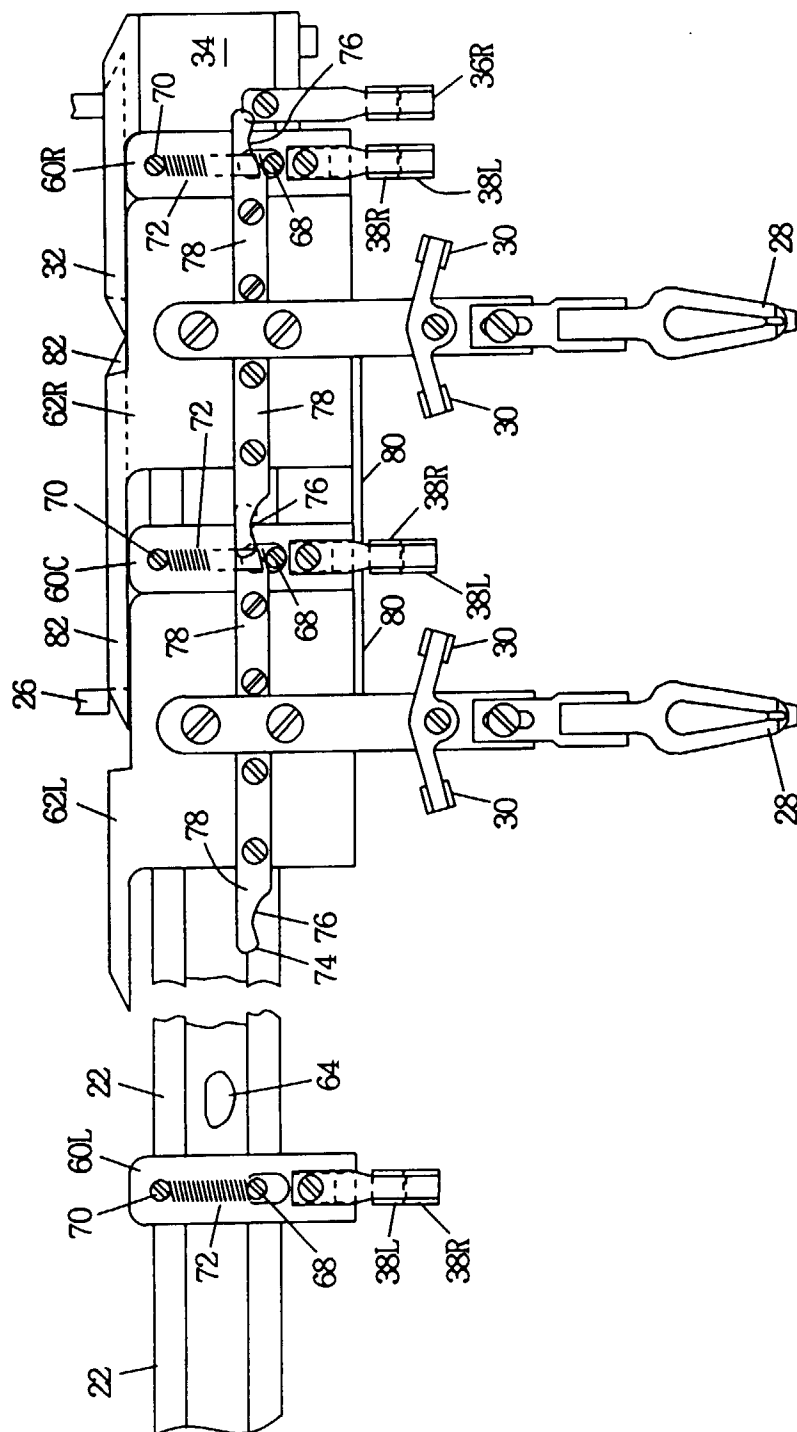
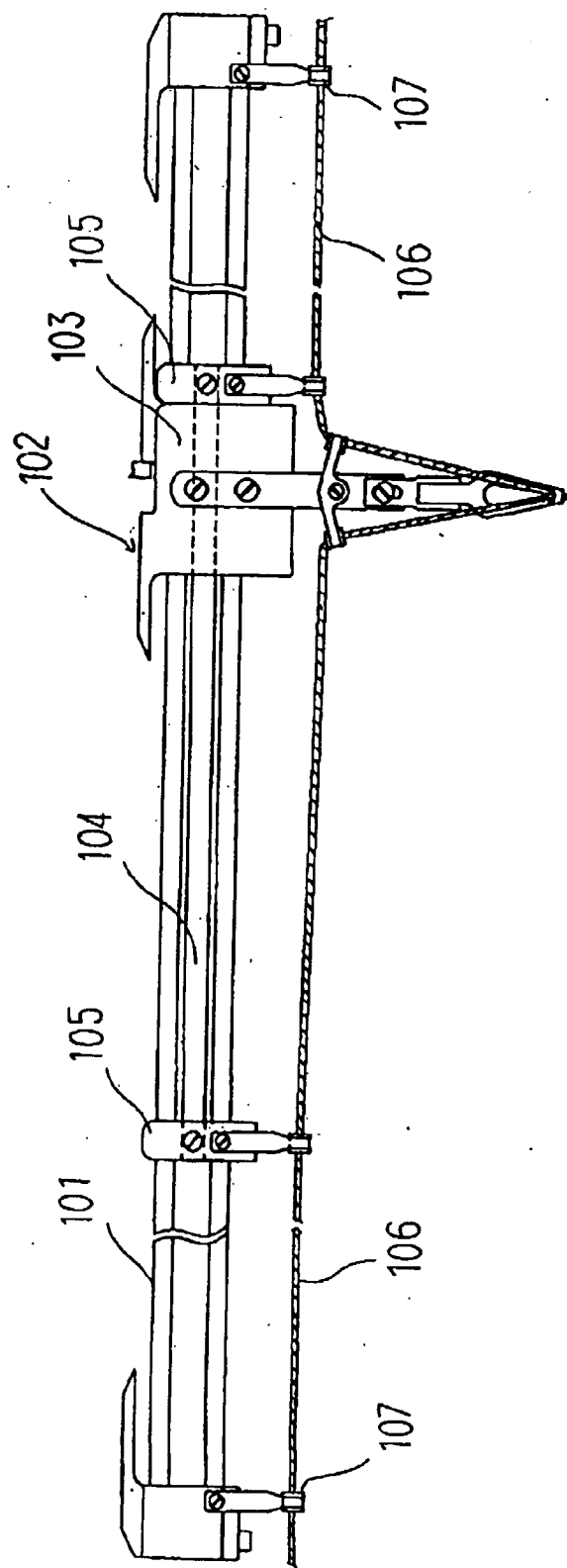


FIG. 11





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 95 30 9398

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
D,A	JP-B-62 050 589 (---)		D04B15/56
A	EP-A-0 277 287 (H. STOLL GMBH & CO.)		
A	US-A-3 688 525 (JEFFCOAT)		
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			D04B
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
THE HAGUE		15 April 1996	Van Gelder, P
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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