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(54) **Improved double-hooked needle and slider combination for double cylinder circular knitting machines.**

(57) An improved double-hooked needle and slider combination for double-cylinder circular knitting machines, in particular for hosiery production, in which the hooks (5) at the two ends of the needle (3) are provided with a latch which is maintained in its semi-open position by a spring when opposing forces are absent, the slider tip (30) being shaped with a double inclination to ensure that both the needle and the relative latch arc in their correct position during the transfer of the needle from one bed to the other.

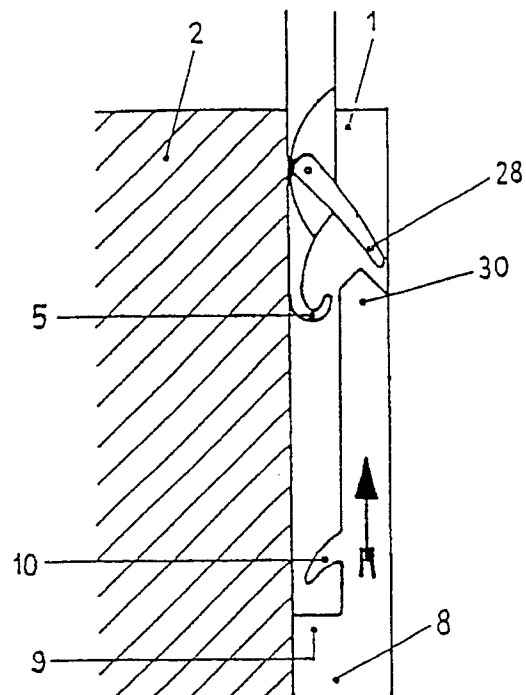


Fig.5

EP 0 428 205 A1

IMPROVED DOUBLE-HOOKED NEEDLE AND SLIDER COMBINATION FOR DOUBLE CYLINDER CIRCULAR KNITTING MACHINES

This invention relates to double cylinder circular knitting machines provided with double-hooked needles which can operate independently in one of the cylinders to produce plain stitches and in the other cylinder to produce purl stitches, said double-hooked needles being transferred between one bed and the other. In this type of machine there is therefore a device for transferring said needles from one cylinder to the other, such machines being able to produce all types of rib knitting and all combinations of plain and purl stitches, to produce patterns such as in the production of socks.

As stated, such machines are fitted with a special type of needle known currently as a double-hooked needle and shown schematically in Figure 1.

For each pair of corresponding tricks 1 of the two machine cylinders 2, one of which is upper and the other lower, there is provided a needle 3 which is made to work alternately in the trick of the upper cylinder and in the trick of the lower cylinder. The needle 3 is substantially symmetrical and is provided at both its upper and lower end with a hook 4, these hooks being identical and each being formed from a curved end 5 and a latch 6 pivoted at 7. The needle 3 is driven by a slider 8 by which it is engaged alternately via one of its hooks, the opposite hook then working to produce knitting.

With each needle there therefore correspond two sliders 8 and 8', one being disposed in the trick of the lower cylinder and the other in the corresponding trick of the upper cylinder, they working in turn to engage the same double-hooked needle at one end and at its other end respectively.

As shown in Figure 1, the curved end 5 of the needle 3 engages in the slider 8 by the effect of the lower horizontal projection 9 and the upper inclined spur 10, which cause the needle 3 to slide in the tricks 1 and undergo the vertical movements imposed on it by the slider 8.

With the configuration shown in Figure 1 the upper hook 4 remains available for working by seizing the yarn from the feeds to form a stitch in cooperation with the sinkers 11.

The needle-slider combination works substantially as a normal circular knitting machine needle in that the sliders are provided with butts for their control by cams and counter-cams as in the case of normal knitting needles. In the configuration shown in

Figure 1 the slider 8' remains substantially inactive in its trick 1' while awaiting delivery of the needle 3, to then take over from the lower slider 8

which then remains inactive in its turn while the upper slider 8' is working.

This take-over is effected by causing the two sliders 8 and 8' to approach each other until they are at a distance apart such that their two spurs 10 and 10' are spaced apart by a distance substantially equal to that between the apertures of the two opposing hooks 5 of the needle 3, after which the end of the transferring slider is moved outwards so that it disengages its own hook 4 and can then retract, having consigned the needle 3 to the other slider.

Devices and methods for effecting this transfer are known in the art, for example in currently used handbooks such as the "Manuale di tecnologia per l'industria della maglia" by Tremelloni and Ceriani of 1982, or the "Manuale di tecnologia tessile" by Bona, Isnardi and Straneo of 1981.

A known-art device and transfer method for the needle 3 are shown in Figure 2. The slider 8 is provided lowerly with butts 12 for their reciprocating vertical drive by cams and counter-cams, not shown in the figure, and by a circular spring 13 which holds the sliders within their tricks.

Transfer takes place from the lower slider 8 to the upper slider 8', which has already been moved into the lowered receiving position by its overlying control cams. The underlying cams which operate on one of the butts 12 then raise the slider 8 so that the needle 3 is moved into the position shown by dashed lines, its upper curved end then engaging the spur 10'.

In its movement in the direction of the arrow F the slider 8 by means of its projection 9 urges the needle 3 upwards. The upper curved end 5 encounters the spur 10' and moves the slider 8' outwards so that it can pass. As soon as the upper curved end 5 has passed beyond the spur 10' the spring 13 returns the slider 8' into position so that the upper curved end 5 engages the spur 10' and the horizontal projection 9'.

As shown in Figure 2 the tip 14 of the sliders 8 and 8' is shaped flared and receding outwards. When the slider 8 is raised to consign the needle 3 to the opposing slider 8', the tip 14 encounters along its upward path a cam 15 known as a spectacle cam, provided with an outwardly flared hole 16 which intercepts the rising tip 14 and displaces it outwards so that the spur 10 disengages from the hook 4 and no longer retains the needle 3, which is raised to work in the upper bed.

After transferring the needle 3 to the upper bed the slider 8 is moved downwards and returns into its trick 1 by the effect of the spring 13.

The reverse transfer from the upper bed to the lower bed takes place in the same manner, with inversion of the illustrated reference indices.

The spectacle cam also comprises other holes 16, not shown in the figure, which are in all cases flared outwards but with opposite inclination, to displace those sliders of the opposite bed outwards when they are lowered to consign the needle.

The method described here with reference to Figure 2 has certain drawbacks, of which the following are of importance.

The spectacle cam 15 is very delicate because it has to be thin and hard, and is therefore fragile, and is exposed to rapid deterioration and frequent breakage.

The slider 8 must engage the hook of the needle 3 with its latch 6 correctly open otherwise the latch breaks. With this method, correct positioning of the latch 6 is ensured only if the stitch formed along the shaft of the needle 3 is cleared, and this does not happen if the feed yarn breaks or is lacking for other reasons. Even if fortunately the lack of yarn has not resulted in breakage of the latches during needle transfer, they still have to be correctly positioned to be able to resume working, this having to be done manually with considerable wastage of time.

More recently, a different method enabling the aforesaid drawbacks to be overcome has been proposed, this being described with reference to Figure 3.

Compared with the method just described, the outward displacement of the slider 8 to transfer the needle 3 to the opposing slider after the needle has been raised, is effected by a radial displacement cam located further from the slider tip to replace the spectacle cam 15, and both the slider tip and the shape of the needle hook 4 are modified.

As shown in the enlarged detail of Figure 3, the needle hooks are modified by prolonging the latch 6 well beyond the curved end 5, and the tip 16 of the sliders 8 and 8' is inclined in the opposite direction to that of the tip 14 of the preceding method. These modifications mean that as soon as the tip 16 of the slider makes contact with the hook 4 of the needle 3 it opens its latch into the correct position, so preventing breakage.

With reference to the sequence of Figure 3, in position A the slider 8 is at its maximum level by the effect of the lifting cam 17, while the slider 8' is being lowered by the lowering cam 18. As 8' is lowered, it is displaced outwards because the spur 10' is urged outwards by the curved end 5.

In position B the cam 18 has moved its slider 8' to its lowest position, the radial cam 19 causing it to re-enter the trick and engage the curved end 5 of the needle. The needle 3 is now engaged with

both its sliders 8 and 8'.

In position C, the radial cam 20 has urged the foot of the slider 8 inwards by causing it to rotate about a bearing centre C, with consequent displacement of its tip 16 outwards, so disengaging the spur 10' from the curved end 5.

In position D the needle 3 has now engaged the slider 8' and is moved upwards by the cam 21, while the slider 8, now free, contacts the cam 22 which moves it downwards.

This modification frees the needle-slider combination from the typical problems of the preceding method, but presents it with a further very preoccupying one.

If the needle 3 has not been totally lowered in its trick, for example because dust or fibre residues or even a piece of yarn have become inserted in the trick, when the tip 16 of the slider 8 moves towards the needle 3 it does not encounter the latch 6 to be opened but instead encounters the curved end 5 of the needle, and becomes wedged between the needle 3 and the trick 1, so expelling the needle from of the trick. This expelling of the needles results in inevitable breakage and the halting of the machine, so requiring a very laborious repair operation for restarting. This eventuality is not improbable, because the radial dimension of the needle hook is 1-2 mm, and therefore a small radial displacement of the needle hook 4 is sufficient for the slider 8 to encounter this difficulty when moved to engage the needle. It is sought to overcome this danger by positioning a series of sensors at the needles to indicate when they begin to undergo any radial displacement from their correct position, for which the sensors have to be set for very small distances with the result that they inevitably initiate alarms and machine shut-downs which are often not necessary.

The present invention provides an improved double-hooked needle and slider combination which obviates the drawbacks of the combination provided by the known art, by enabling the double-hooked needle to be transferred from one slider to the other with absolute reliability.

This improvement consists of a modification both to the double-hooked needle and to the slider, which are described hereinafter with reference to Figures 4, 5 and 6, which illustrate a typical embodiment thereof by way of non-limiting example.

As shown in Figure 4, the double-hooked needle is modified by providing it at both its hooks with an elastic device which retains the latch in its open position when not subjected to other forces, such as when the hook is free of yarn. This type of hook has been long known in the state of the art, for example for manually operated knitting machines. It is also described in USA patent 4,827,739, which relates to flat knitting machines.

The latch 6 of the hook 4 has a bar spring 23 inserted in the cavity 24, which extends beyond the end positions which the latch 6 can assume. Said spring is supported at its ends and is kept in position by a slot inside the cavity 24, which is provided in the needle shaft 25 and also contains the pivoted part of the latch 6. That end of the latch 6 adjacent to its pivot 7 is in contact with the bar spring 23, and comprises two regions 26 and 27 which are flat or at most of slight curvature, these being separated by an end region of greater curvature.

The rear of the pivoted part of the latch 6 therefore consists of a mixed line, of which at least one point is constantly in contact with the spring 23.

The two flat regions 26 and 27 enable the latch 6, in rotating between the end positions indicated by the thinner dashed and dotted lines, to assume two stable positions 28 and 28' indicated by heavier lines, and from which the latch 6 can be moved only with greater elastic deformation of the spring 23.

In Figure 4 the latch 6 is shown by full lines in one of the two stable positions, ie that in which the region 26 engages the spring 23. In this stable position there is a fairly wide space 29 between the tip of the latch 6 and the curved end 5.

The two end positions of the latch 6 shown by thin dashed and dotted lines, ie when completely closed and completely open, are reached only by loading the spring 23, and occur respectively when the stitch loop is cleared from the shaft of the needle 3 and when the formed stitch loop passes from the 5 to the needle shaft, and when the slider engages the curved end 5 with its spur. In the absence of forces which maintain the latch 6 in other positions and which load the spring 23, the latch 6 assumes the positions 28 or 28'.

According to the present invention, the tip of the slider 8, which engages with the double-hooked needle of Figure 4, is also modified as shown in Figure 5.

In this respect, the slider 8 shown in Figure 3 is modified at its tip, which is shaped as a sharp point 30 with two sloping sides to perform a double function. During its travel to engage the double-hooked needle, the slider 8 firstly presents the needle curved end with its inner side, the inclination of which is such that it urges the needle inwards should any fibre residues or other material have prevented it from being properly bedded in the trick 1, and thus correctly positions the needle. Its outer side is of opposite inclination, and as it moves upwards the upper point encounters the latch in the position 28 to completely open it, into the final engagement position shown in Figure 6. The working procedure is substantially that de-

scribed with reference to Figure 3.

The advantages of the improved needle and slider combination of the present invention are considerable.

Besides dispensing with the delicate spectacle cam, the present invention ensures that both the needle 3 and the latch 6 are in their correct position when the slider 8 is brought into contact with the double-hooked needle to take over its control from the opposing slider 8' and vice versa.

The control and verification systems for the radial position of the needles are also simplified and made more efficient, resulting in far fewer shut-downs and maintenance operations, which now take place only when really necessary.

Claims

1. The combination of a double-hooked needle and relative sliders for transferring the needle to enable it to work alternately in one and the other bed of double-cylinder circular knitting machines, characterised in that the needle hooks are provided with an elastic device which maintains in at least a stable open position 28 the latches 6 of those needles which are not subjected to other forces, the tip 30 of the sliders being shaped as a sharp point with two sloping sides.
2. The combination of a double-hooked needle and relative sliders for double-cylinder circular knitting machines as claimed in claim 1, characterised in that that end of the latch 6 adjacent to its pivot 7 has its rear constantly in contact with a bar spring 23 and is shaped with two parts 26 and 27 which are flat or of slight curvature, these being separated by said end, which is of greater curvature.
3. The combination of a double-hooked needle and relative sliders for double-cylinder circular knitting machines as claimed in one or more of the preceding claims, characterised in that the slider, in its travel to take over the control of the double-hooked needle from the opposing slider, encounters with its double-inclination tip 30 firstly the curved end 5 of the needle to be taken over to thus ensure that this is correctly positioned in its cylinder trick, and then the latch 6 to thus ensure that this is completely opened.
4. The combination of a double-hooked needle and relative sliders for double-cylinder circular knitting machines as claimed in one or more of the preceding claims, characterised in that the radial withdrawal and approach movement of the sliders in transferring the double-hooked needle from one machine bed to the other is controlled by cams which act on the slider shank or on its butts.

Fig.1

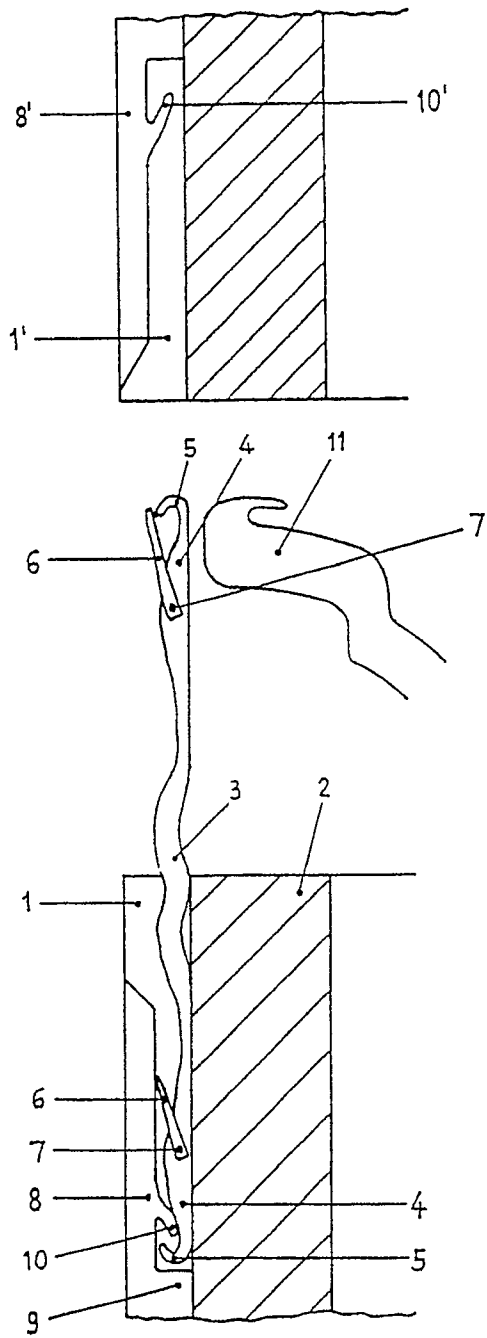
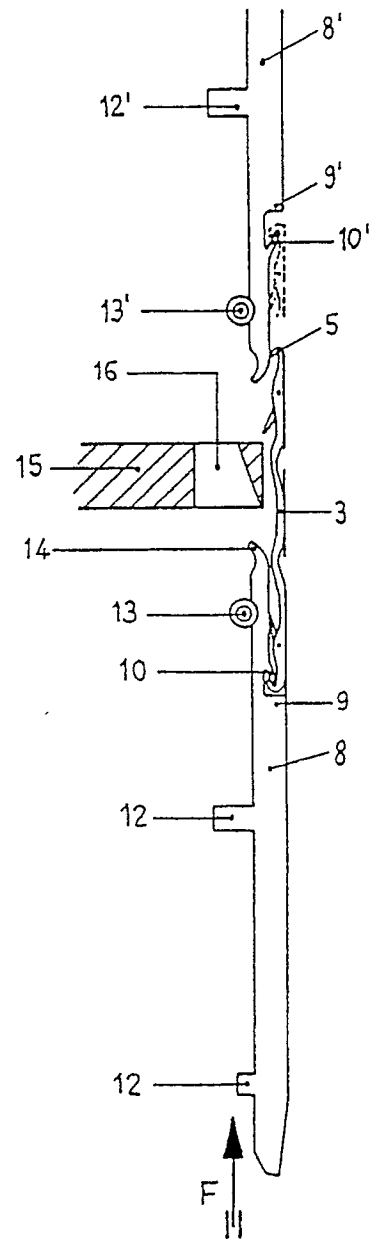


Fig.2



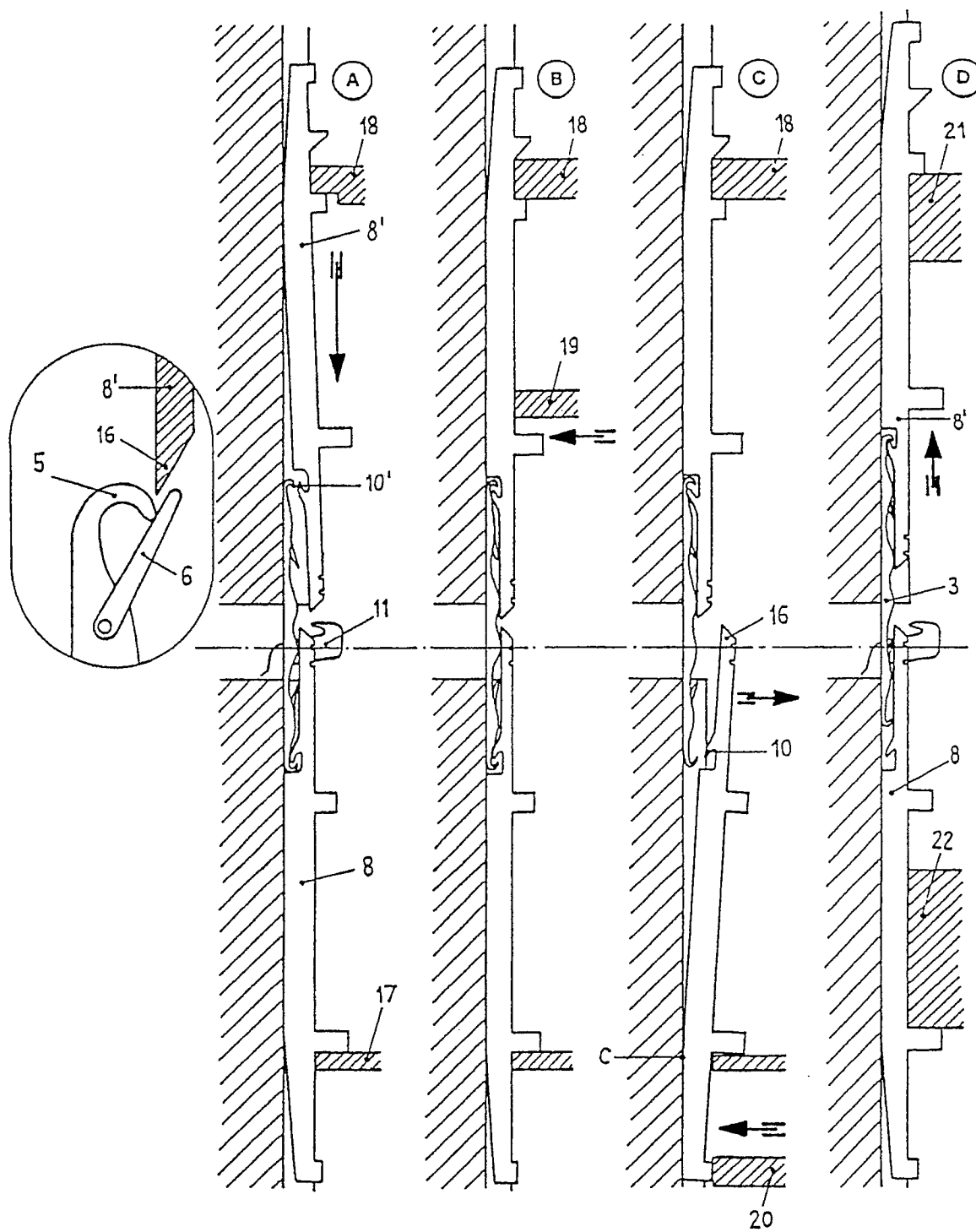


Fig.3

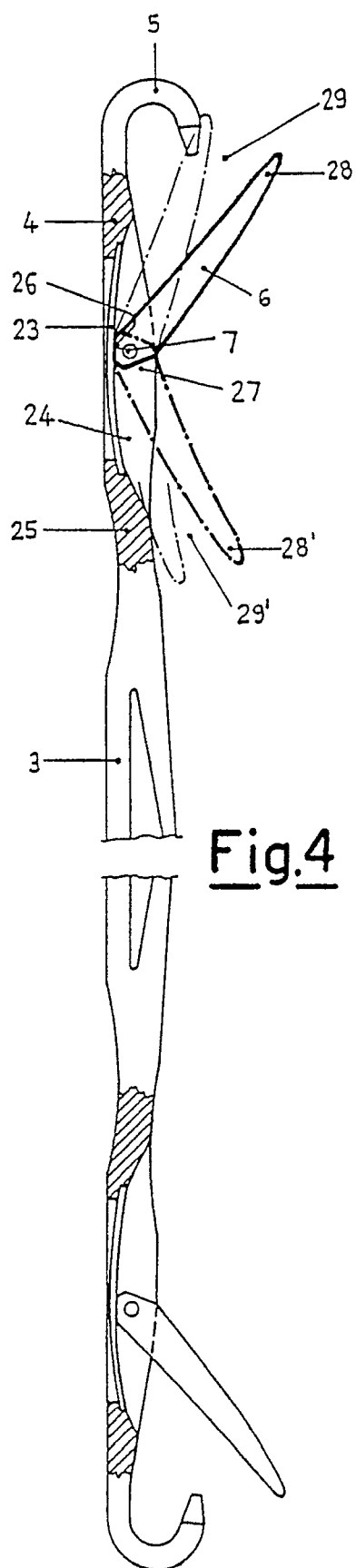


Fig.4

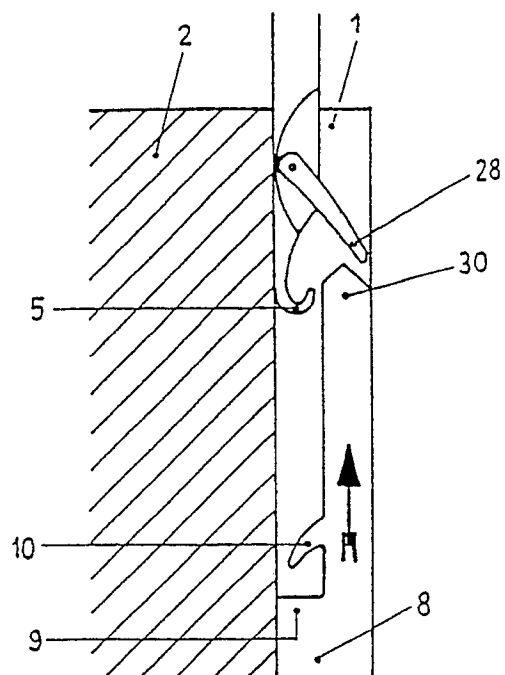


Fig.5

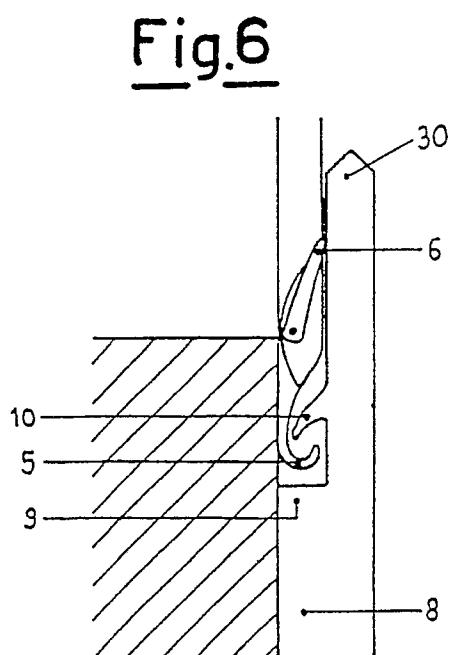


Fig.6



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EUROPEAN SEARCH REPORT

Application Number

EP 90 20 2918

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.5)
A,D	EP-A-0 259 563 (H. STOLL GMBH & CO.) - - -		D 04 B 9/10
A	GB-A-7 680 51 (KARL STEINHOF) - - -		
A	DE-A-1 560 954 (THE BENTLEY ENGINEERING CO. LTD.) - - - - -		
The present search report has been drawn up for all claims			
Place of search		Date of completion of search	Examiner
The Hague		18 December 90	VAN GELDER P.A.
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