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(54) Device to control the slotted leno heald weave mechanism in looms

(57) The invention concerns a control device for a slotted leno heald weave mechanism to form fabric selvages in looms, of the type wherein a continuously rotating driving shaft (14) controls, through a drive mechanism (1) at least two sliders (C1, C2) causing the straightaway reciprocating motion of weave healds (L). According to the invention, said drive mechanism (1) consists of at least one exact straight-line guide mechanism, interposed between said driving shaft (14) and said sliders (C1, C2), the two sliders being fixed onto an endless belt (21) winding around at least two idle pulleys (P1, P2), and being blocked on the two opposite lengths of said belt (21).

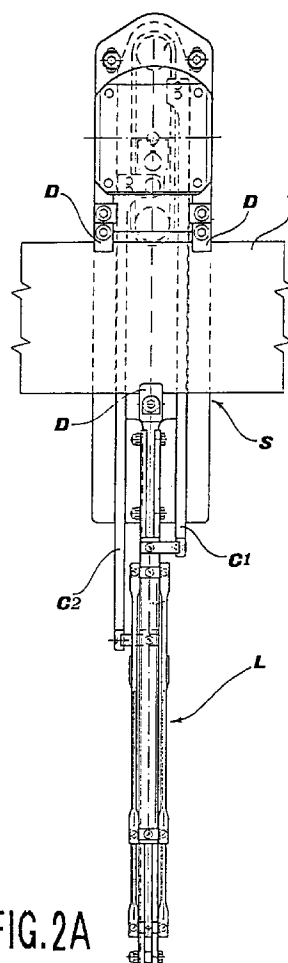


FIG. 2A

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Description

The present invention concerns a control device for a slotted leno heald weave mechanism, to form selvages and split selvages of fabrics in looms.

The slotted leno heald weave is commonly carried out in correspondence of the selvages and/or split selvages, at the sides of the fabric being formed. There are known to be slotted leno heald weave mechanisms substantially consisting of three sliders - a fixed one and two movable ones - carrying as many slotted healds to let the warp yarns through. The movable sliders have to perform a straightaway reciprocating motion, so as to draw along the respective healds with the warp yarns therein, and form, together with the weft yarn, the typical slotted leno heald weave.

The actual operation of the slotted leno heald weave shall not be described herein, as it is well known in this technical field, but a study shall be made on the requirements which the slotted leno heald weave mechanism has to satisfy and, in particular, on the device to control said mechanism.

First of all, the two sliders to which the slotted healds are connected have to perform a straightaway motion, in opposite directions, along axes substantially orthogonal to the weaving plane.

Secondly, the movement of the slotted leno heald weave mechanism has to be synchronized with the working motion of the loom.

Finally, it should be possible to distinctly control more than one slotted leno heald weave mechanism, and thus various pairs of sliders, on the same loom. There can in fact be even more than two of such mechanisms in a loom: as shown by way of example in fig. 1 of the accompanying drawings - which is a side elevation of a gripper loom - the slotted leno heald weave can be carried out either at the weft yarn outlet end, both for the selvage and for the split selvage, or at the weft yarn inlet end, or even half way along the shed if the fabric is subsequently split in two parts.

The possibility to shift the working phase of all such mechanisms helps to improve the efficiency of the slotted leno heald weave. In fact, the opening and closing of the shed in correspondence of said mechanisms will have to be synchronized with the passage of the weft yarn, so that said yarn may be tied and locked as promptly as possible, and may thus be prevented from moving or accidentally sliding out. For example in gripper looms, the closing of the shed takes place close to the drawing gripper while this latter is still not fully out of the shed, so as to promptly block the weft yarn, while on the yarn inlet side, and eventually in the middle, the warp shed may be closed only after full insertion of the weft yarn. It can thus be understood why it is necessary to shift the working phases of the different leno heald weave mechanisms.

Slotted leno heald weave mechanisms, apt to at least partially satisfy said requirements, have already

been proposed in the art.

For example, the Italian Patent No. 1.185.389, in the name of the Applicant, or the EP-B1-393.467, in the name of SOMET S.p.A., illustrate different solutions adopted on devices to control the leno heald weave mechanism. In said prior art documents, a cam synchronized with the working motion of the loom controls the movement of a cord sliding horizontally above the loom and connected, by means of secondary cords, to pairs of sliders forming part of corresponding mechanisms distributed along the loom width. Through a system of pulleys, the secondary cords cause the reciprocating motion of said pairs of sliders in opposition to return springs.

However, the device described in said documents is rather difficult to set up and is highly subject to wear. It moreover requires the presence of return springs - seen that the cords are apt to impart a motion only in the pulling sense - which cause troublesome unsteadiness.

Finally, in said device, a fixed mechanical coupling is provided between the different leno heald weave mechanisms distributed along the loom width; the alternative could be to multiply the number of cords and control cams by the number of mechanisms, so as to make them independent one from the other, but this last solution would be far too complex and bulky. This no doubt represents a limit, since the possibility to shift the working phase of the single mechanisms - as mentioned heretofore - can be highly advantageous.

To overcome the above drawbacks, leno heald weave mechanisms have been proposed, which are individually controlled by electric motors. For example, the International Patent publication WO96/38608, in the name of PIKANOL N.V., discloses a device to control a leno heald weave mechanism, wherein an electric motor operates a double link rod-crank system which allows to obtain the required reciprocating motion of the two sliders. In this way, each device can be individually controlled by restoring, with an "electrical axis", the synchronism between the motion of the electric motors and the motion of the loom.

This solution involves however different drawbacks. In its simplest embodiment, namely that in which the double link rod is flat and pivoted at its centre onto the driving axle, said link rod is not apt to perform complete rotations, in that the oscillation axes of the cranks would be interfering. The motor is thus forced to perform a reciprocating motion, describing rotations of less than $\pm 180^\circ$, which proves to be quite complicated to adjust and to control.

Moreover, the link rod-crank mechanism is itself labile, as it must forcedly be guided in order to perform the required straightaway motion. In fact, in WO96/38608, the sliders to which the ends of the cranks are connected, are guided in their straightaway reciprocating motion by guide elements which make the mechanism more complex and produce undesired sliding frictions. Such frictions, besides causing more wear

to the sliders, involve the requirement to use a more powerful motor.

In the embodiment wherein the link rod is in the form of a short crankshaft, the motor rotation can be continuous; it is however necessary to support, with suitable supports, the crankshaft which would otherwise be overhanging on the motor shaft.

The most serious drawback is anyhow represented by the fact that both the above embodiments, besides being rather complex, determine a superposition - at least through a certain working phase - of the two sliders, which thus involves a misalignment between said sliders in the direction of the rotation axis of the motor shaft. This leads - due to the manner in which the device is mounted on the loom - to a considerable bulk of the leno heald weave mechanism extending towards the loom depth.

This last drawback is far from negligible. In fact, when planning a loom, a constant effort is made to reduce as far as possible the distance between the heald frames unit and the reed beating up zone, so as to reduce the maximum opening of the shed and thereby lessen the stresses of all the mechanical members and of the warp yarns, to the full advantage of an increased reliability of the loom. In view of this, it is necessary for the slotted leno heald weave mechanism - which is mounted on a cross member overlooking the weaving zone and positioned just upstream of the beating up zone - to be of limited size towards the loom depth, at least in the weaving zone, so as not to represent too much of an obstacle to the approach of the heald frames in the beating up zone.

The object of the present invention is to fully overcome the above drawbacks, by supplying a device to control the slotted leno heald weave mechanism - to form selvages and split selvages of fabrics in looms - which can be easily and independently adjusted and operated, which involves low working frictions, which covers a reduced space towards the loom depth, and which is of simple and reliable structure.

According to the invention, said objects are reached with a control device for a slotted leno heald weave mechanism - of the type wherein a continuously rotating driving shaft controls, through a drive mechanism, at least two sliders causing the straightaway reciprocating motion of weave healds - characterized in that, said drive mechanism consists of at least one exact straight-line guide mechanism, interposed between said driving shaft and said sliders.

According to another aspect, the invention supplies a control device for a slotted leno heald weave mechanism - of the type wherein a continuously rotating driving shaft drives at least two sliders causing the motion of weave healds, by means of a motion changing mechanism apt to change the rotary motion into a straightaway reciprocating motion - characterized in that, said motion changing mechanism controls only a first slider, fixed onto an endless belt winding around at least two

idle pulleys with fixed axis, to said belt there being fixed also the second slider, said sliders being blocked on the two opposite lengths of said belt.

Further characteristics and advantages of the device according to the present invention will anyhow be more evident from the following detailed description of a preferred embodiment thereof, given by way of example and illustrated on the accompanying drawings, in which:

Fig. 1 - as already mentioned heretofore - is a diagrammatic side elevation, showing an example of gripper loom;

Figs. 2A and 2B are, respectively, a rear elevation and a side elevation, showing the device according to the invention mounted on a cross member;

Figs. 3A and 3B are, respectively, a part cross section view and a front elevation with removed parts, showing a preferred embodiment of an exact straight-line guide mechanism;

Figs. 4A and 4B are views similar to those of figs. 3A and 3B, showing the operation of the guide mechanism; and

Fig. 5 is a front elevation, showing the device according to the invention in various working phases.

The control device according to the present invention is clearly illustrated in figs. 2A and 2B, wherein it is shown combined with the respective slotted leno heald weave mechanism. Onto a cross member T there is fixed a support plate S carrying:

- on its top rear part, an electric motor M equipped with a drive mechanism 1 comprising an exact straight-line guide;
- on its top central part, a reciprocating motion system 2; and
- on its bottom part, the group of healds L forming the leno heald weave.

The motor M preferably consists of an electric step-by-step motor which controls the drive mechanism 1. Said mechanism reproduces an exact straight-line guide of the conventional type.

The mechanism 1 is preferably that shown in detail in figs. 3A and 3B. A casing 11, on which the motor M is mounted, houses the elements forming the exact straight-line guide. A rotor 12, mounted rotating on a bearing 13, is connected to the driving shaft 14 of the electric motor M. A planetary gear 15 is mounted rotating on the rotor 12 by way of a supporting spindle 15a positioned parallel to, but eccentric in respect of the rotation axis of the shaft 14. As seen in fig. 3B, the gear 15 comprises an outer toothing 16 meshing with an internal gear 17, fixed to or formed in one piece with the casing 11. Onto an end of the spindle 15a there is fixed a supporting block 18 from which axially projects the outlet member of the mechanism 1 in the form of a pin

18a.

Said drive mechanism 1, suitably sized, allows to change the rotary motion of the driving shaft 14 into a straightaway reciprocating motion of the pin 18a - as shown in figs. 4A and 4B - which follows a perfectly sinusoidal law in time, if the rotation of the electric motor M is continuous and constant, but which may follow different motion laws by suitably operating the electric motor M.

The great advantage of this mechanism 1 is to be able to obtain a straightaway reciprocating motion without the help of guide elements which inevitably produce sliding frictions, but simply making use of gearings which keep an overall high driving efficiency, thereby achieving a first object of the present invention.

The reciprocating motion system 2 is meant to transmit the reciprocating straightaway motion of the pin 18a onto two sliders C1 and C2. As clearly shown in fig. 5, the system 2 comprises a pair of idle pulleys P1 and P2 (with their axis fixed onto the casing 11), around which winds an endless belt 21. The upper ends of the two sliders C1 and C2 are respectively blocked on the two opposite lengths of the belt 21. The end of one of the two sliders - for instance, the end of the slider C1 - extends into a lateral projection, so as to form a seat 22 into which is inserted the head of the pin 18a.

Thus, in its straightaway reciprocating motion - illustrated in fig. 5, in the successive steps (a), (b), (c), (d) - the pin 18a draws along the slider C1 which, being fixed to the belt 21, moves in turn also the other slider C2, but in an opposite direction. Hence, as required, when the slider C1 moves upward - according to the arrow F in fig. 5(b) - the slider C2 moves downward, and viceversa. Accordingly, the healds of the group L, linked to the lower ends of the sliders C1 and C2, are caused to perform reciprocating straightaway movements, thereby carrying out the slotted leno heald weave.

As shown in fig. 2B, thanks to the use of an exact straight-line guide mechanism, combined with the belt system, the device of the present invention allows a coplanar arrangement of the two sliders C1 and C2, which leads to a drastic reduction in size towards the loom depth, thereby accomplishing another important object of the present invention.

Moreover, thanks to its modularity and compactness, the control device according to the invention is easy to assemble and disassemble, to the full advantage of its maintenance.

In a preferred embodiment of the invention, the drive mechanism 1, together with the reciprocating motion system 2, are mounted on the support plate S, which is in turn fixed onto the cross member T by means of dog spikes D. Said dog spikes D are screwed onto the support plate S, so as to facilitate their removal and, thus, the disassembly of the whole device from the cross member T.

Finally, through an appropriate electronic control system, it is possible to reset the electrical axis between

the motor M and the working motion of the loom. For example, a position sensor (not shown) detects the angular position of the driving shaft 14, timing it with the working of the loom.

Preferably, the operator may shift at will the working phase of the motor M, in respect of the motion of the loom, by manually acting onto a suitable control (for instance a manually controlled electronic encoder) positioned close to the loom; the operator thereby anticipates or delays the final step of the slotted leno heald weave, so as to visually and empirically preset the optimal working of the device.

The electronic control of the electric step-by-step motor M also allows to obtain time motion laws for the sliders C1 and C2, which are not simply sinusoidal but are apt to advantageously provide alternate idle and active steps.

It is anyhow understood that the invention is not limited to the particular embodiment described heretofore, which merely represents a non-limiting example of its scope, but that many modifications can be introduced, all within reach of a person skilled in the art, without thereby departing from the protection field of the present invention.

Claims

1. Control device for a slotted leno heald weave mechanism, to form fabric selvages in looms - of the type wherein a continuously rotating driving shaft controls, through a drive mechanism, at least two sliders causing the straightaway reciprocating motion of weave healds - characterized in that, said drive mechanism consists of at least one exact straight-line guide mechanism, interposed between said driving shaft and said sliders.
2. Control device as in claim 1), comprising a single exact straight-line guide mechanism to control both said sliders.
3. Control device as in claim 2), wherein said sliders are fixed onto the opposite lengths of an endless belt winding around at least two idle pulleys with fixed axis, one of said sliders being connected to the outlet member of said exact straight-line guide mechanism.
4. Control device as in claim 3), wherein said pulleys are rotatably mounted onto a casing which houses said exact straight-line guide mechanism.
5. Control device as in any one of the previous claims, wherein said exact straight-line guide mechanism consists of a rotor connected to the driving shaft and carrying, eccentric, a planetary gear meshing with an internal gear, said planetary gear comprising a spindle fixed thereto, onto which there is

mounted a supporting block from which projects a pin, eccentric in respect of the spindle, said pin being apt to transmit the motion to said slider.

6. Control device for a slotted leno heald weave mechanism, to form fabric selvages in looms - of the type wherein a continuously rotating driving shaft drives at least two sliders causing the motion of weave healds, by means of a motion changing mechanism apt to change the rotary motion into a straightaway reciprocating motion - characterized in that, said motion changing mechanism controls only a first slider, fixed onto an endless belt winding around at least two idle pulleys with fixed axis, to said belt there being fixed also the second slider, said sliders being blocked on the two opposite lengths of said belt.
7. Control device as in any one of the previous claims, wherein said driving mechanism and said sliders are mounted on a support plate, removably fixed to a horizontal cross member positioned above the weaving zone of the loom.

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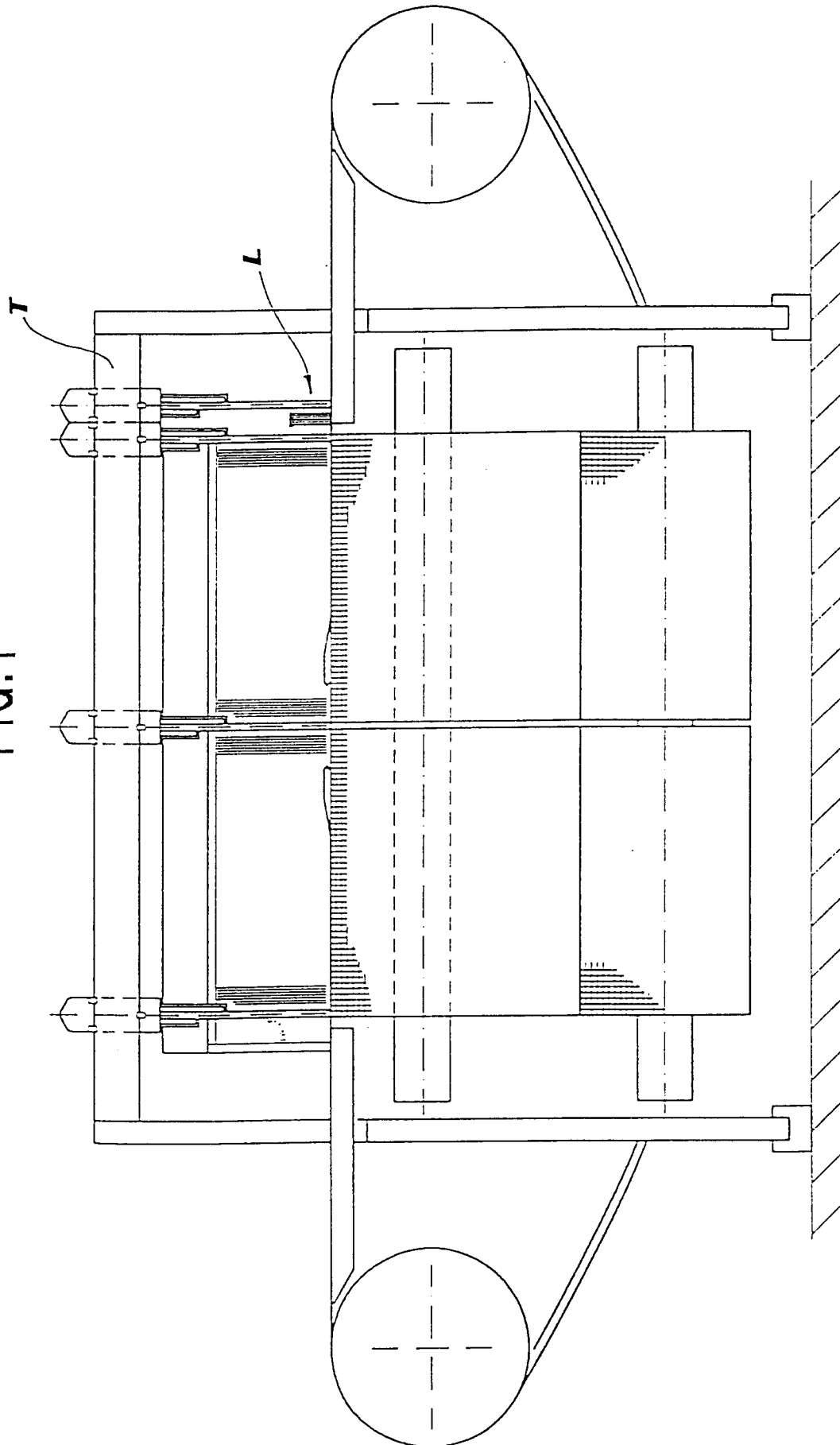
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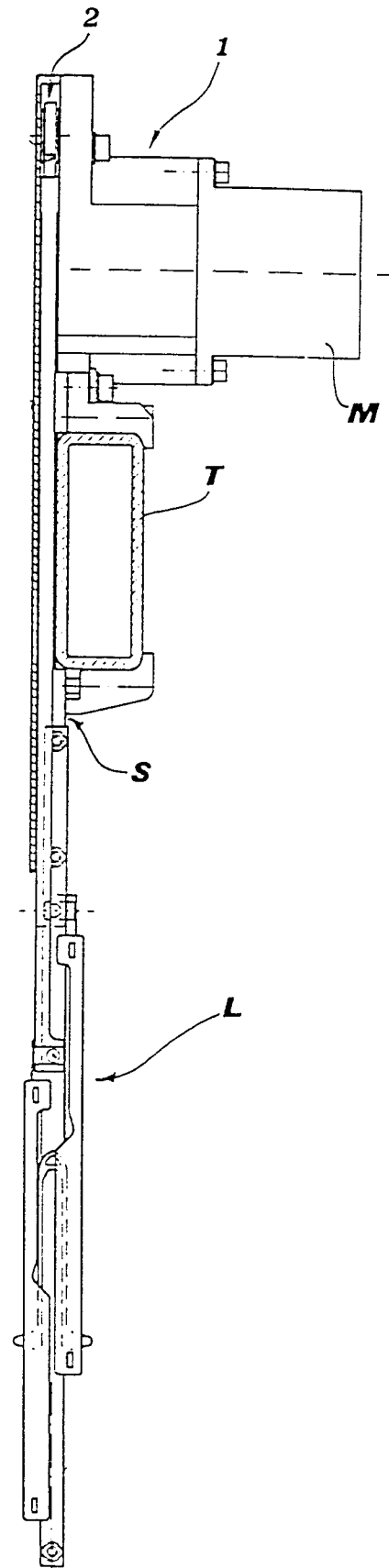
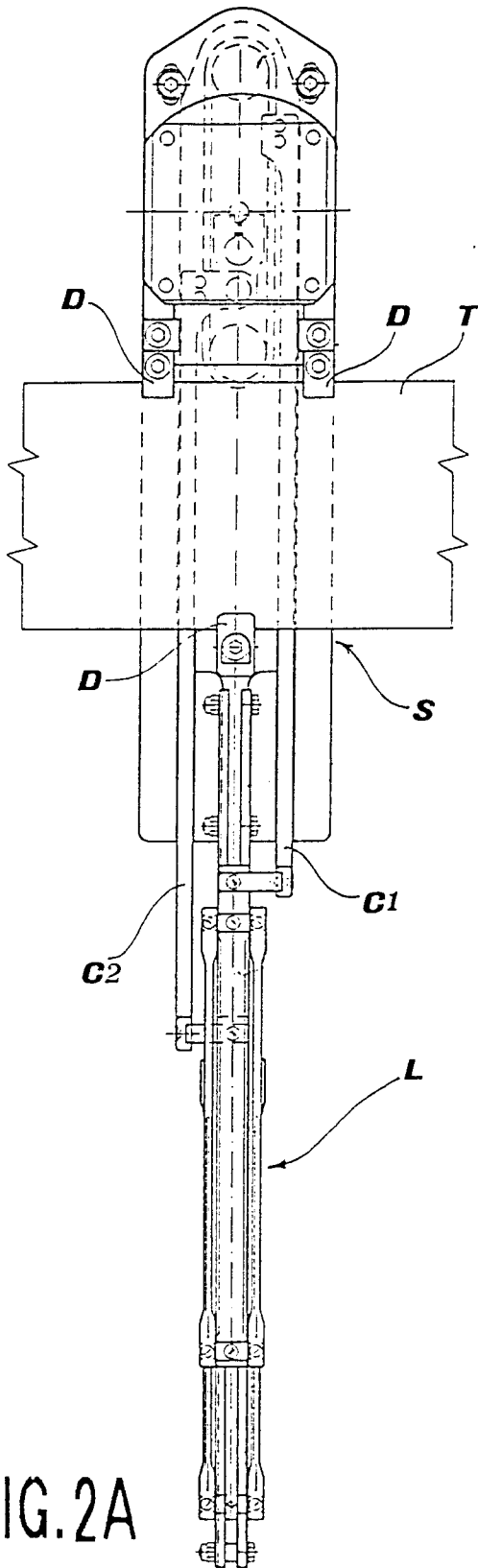
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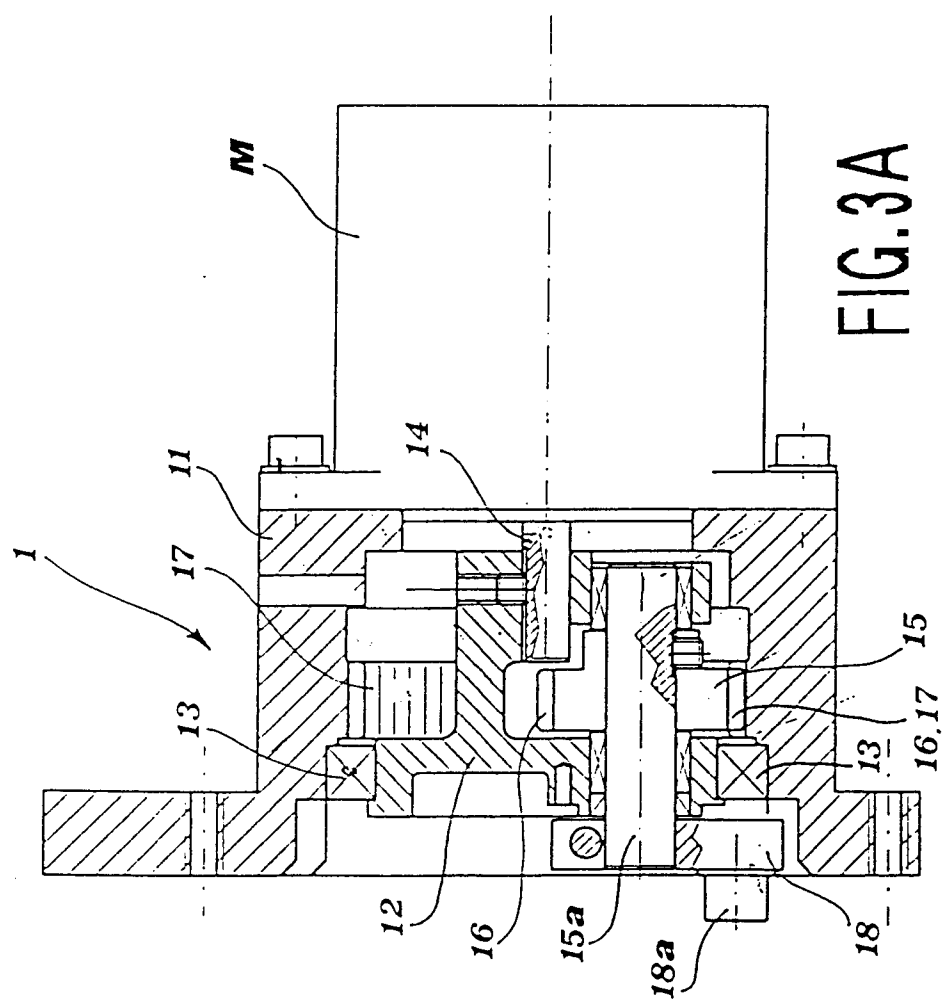
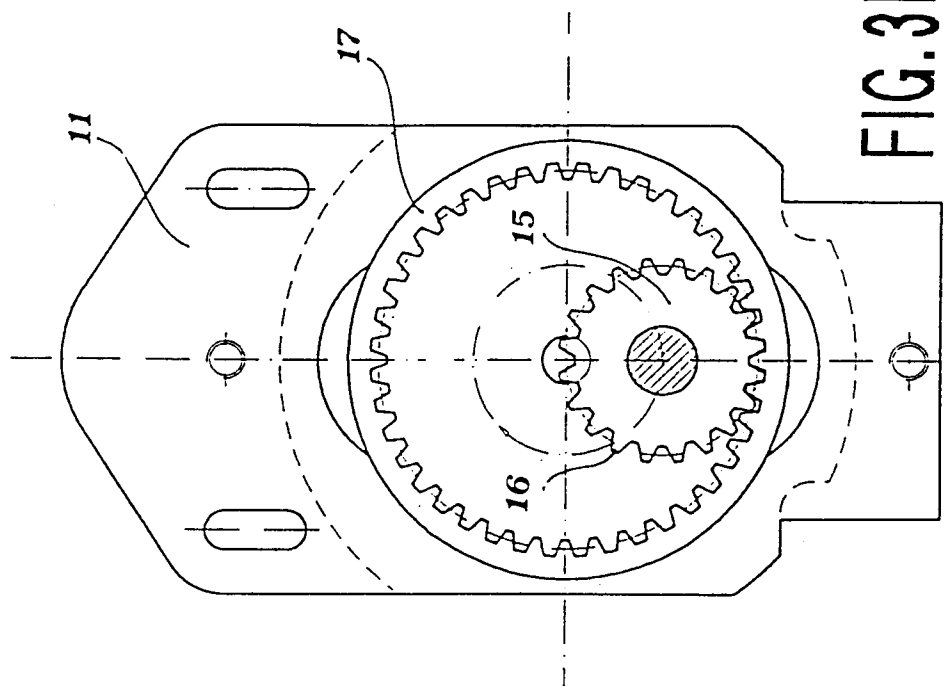
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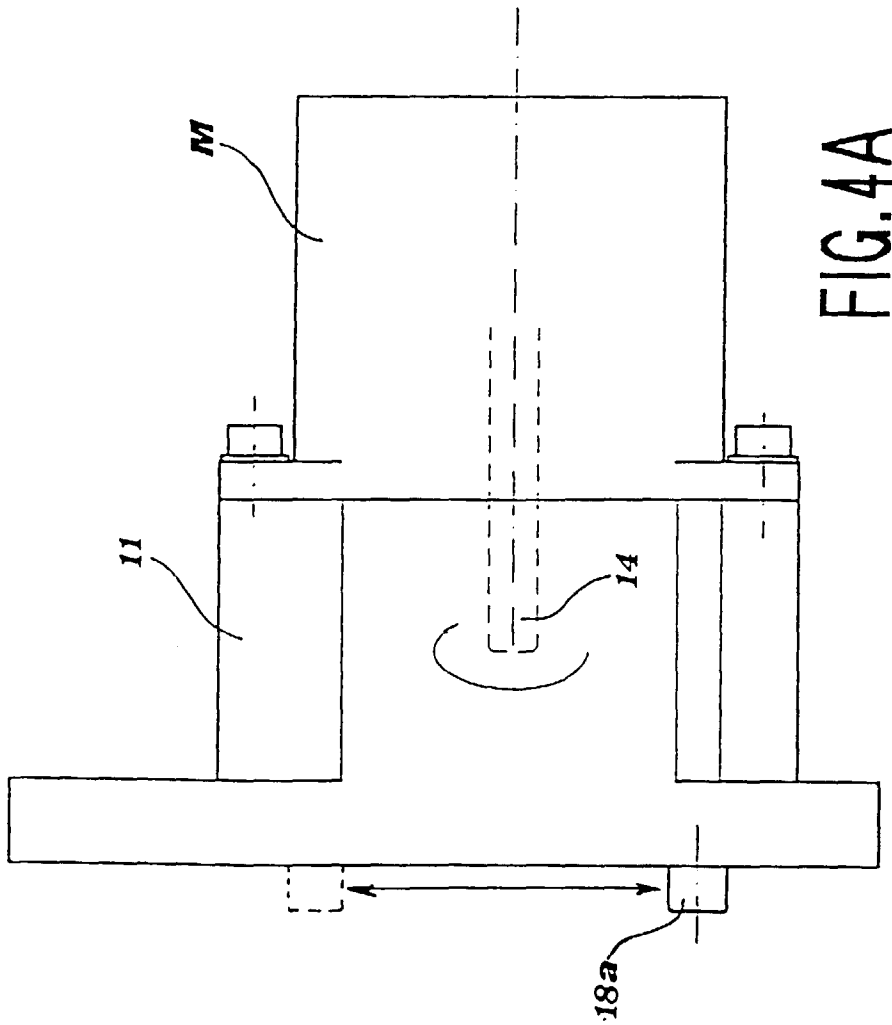
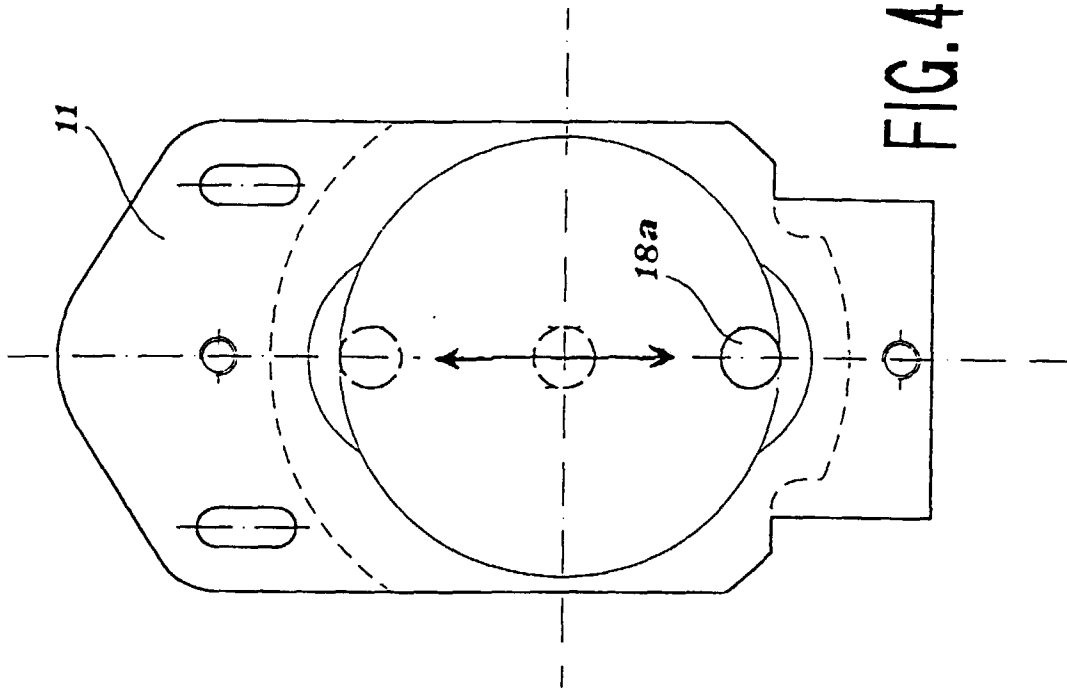
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FIG.1









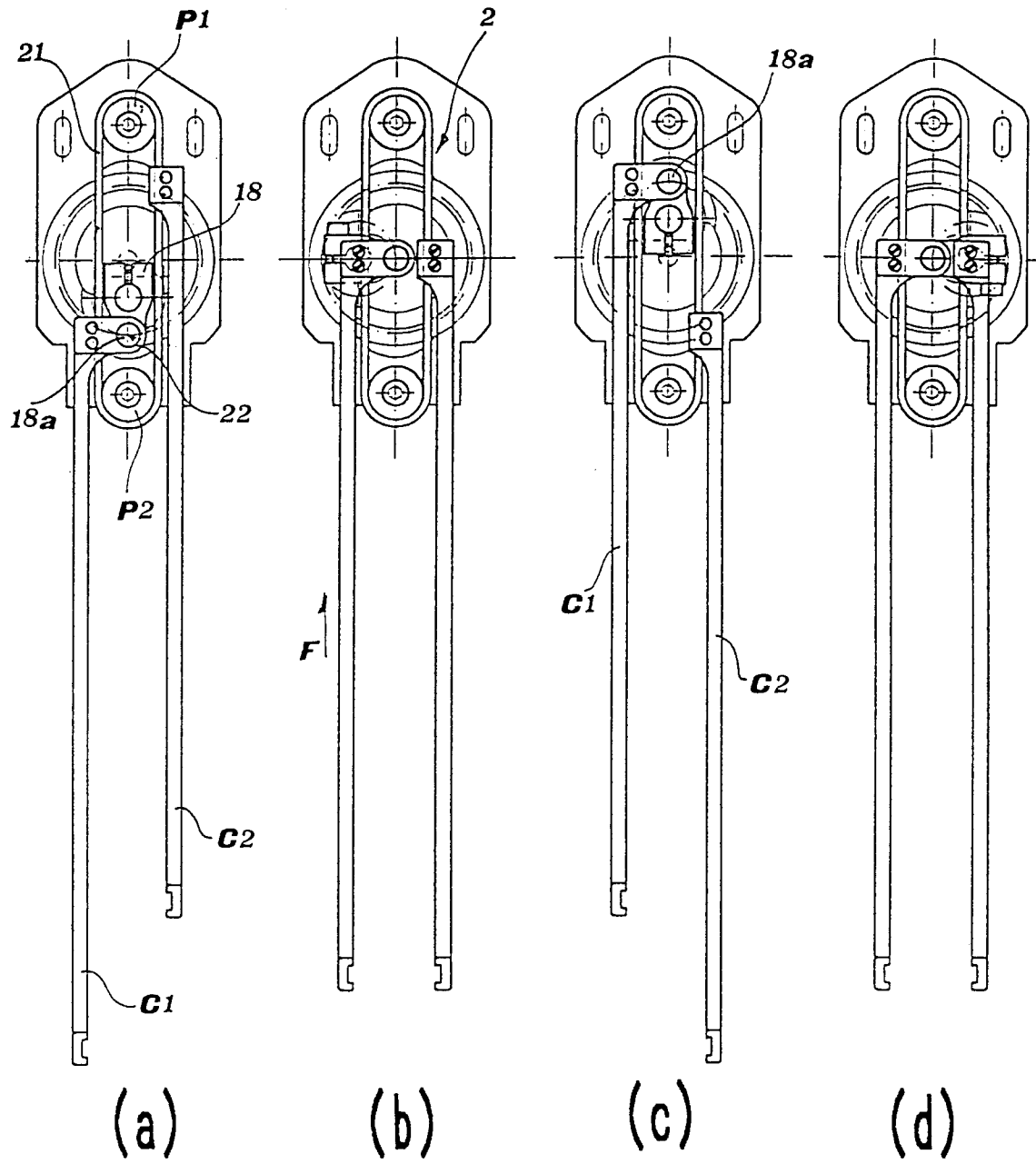


FIG. 5



European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 98 11 2069

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)
A	EP 0 750 061 A (DIEDERICHS) 27 December 1996 * the whole document *	1-4	D03C11/00 D03C7/00
A	BE 1 007 897 A (PICANOL) 14 November 1995 * figures 1-8 *	1	
A,D	WO 96 38608 A (PICANOL) 5 December 1996 * the whole document *	1	
A,D	EP 0 393 467 A (SOMET) 24 October 1990		
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			D03C
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
THE HAGUE		26 October 1998	Boutelegier, C
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