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(54) **Weft yarn presenting device for weaving looms**

(57) The invention concerns a device to select and present weft yarns to a carrying gripper in looms, of the type comprising a set of rods (1) having an eyelet (2) to let the weft yarns through, rod guiding elements (3) and a rotary driving motor (M) for each rod (1). In said device, an exact straight-line guide mechanism (11) is interposed between the driving motors (M) and the rods (1).

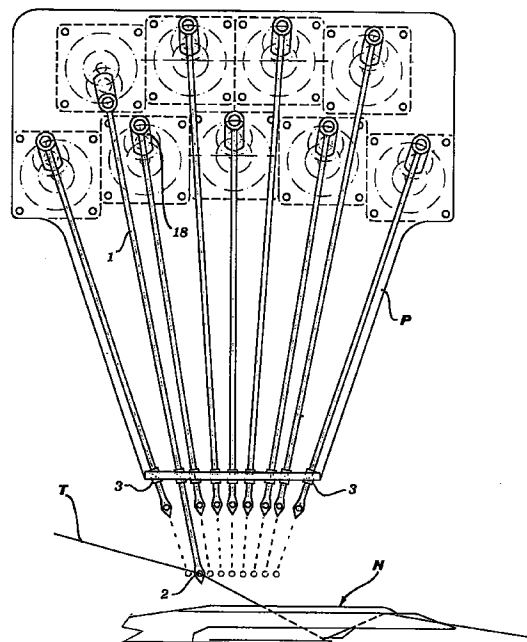


Fig. 3

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Description

[0001] The present invention concerns a weft presenting device for looms.

[0002] As known, in looms of the type with grippers one or more weft yarns are inserted, by a pair of grippers with reciprocating motion cooperating at the centre of the shed, into the ordered and parallel sequence of warp yarns forming the shed.

[0003] The weft yarn insertions, and the exchanges of position of the warp yarns obtained through the weave devices, suitably follow one another and lead to the forming of the desired fabric. The need thus arises to insert into the warp shed a certain sequence of weft yarns which, according to the fabric being produced, may differ in colour, type and count.

[0004] For this purpose, in gripper looms, the use of "presenting devices" has now become common and widespread: they consist of devices performing the function to select the weft yarns to be inserted, and present them to the carrying grippers which provide for their insertion. Such devices substantially comprise one or more rods provided, at their working end, with an eyelet through which is let a respective weft yarn: the movement of the rods involves shifting the eyelets and thus the position of the corresponding weft yarns sliding therethrough. The weft yarns are thereby alternately shifted from a position of rest, away from the trajectory of the gripper, into a "presenting" position in which they can be caught by the carrying gripper and carried towards and into the warp shed.

[0005] In the past, wide use has been made of mechanical presenting devices, which could ideally be split up in two parts: a moving unit, apt to perform a reciprocating straightaway motion thanks to appropriate kinematic mechanisms and/or suitable cams coupled with the working motion of the loom, and a selecting unit apt to select the specific rod, out of the weft yarn carrying rods, which has to be shifted by the moving unit. Such mechanical presenting devices involve however different drawbacks: - The motion law to present each weft yarn is a fixed law; to change said law it is necessary to replace some mechanical elements or carry out some manual adjustments; consequently, each time one needs to change the type of article being woven, it is necessary to substantially operate on the mechanics of the device;

- The fixed coupling between loom and presenting device sets limits in their mutual positioning - in that it requires a specific kinematic chain involving special planning requirements - and prevents the presenting device from working independently from the loom, forcing to adopt complicated procedures, in order to move the weave machine independently from the presenting device, when the loom is in slow running conditions and while resetting the steady state.

- Finally, the mechanical selection units are rather noisy and bulky, such as to hamper the weaver's work on the loom and the insertion of the weft yarns into the eyelets of the weft carrying rods.

[0006] To overcome these drawbacks or at least part thereof, in the last years presenting devices have been conceived, in which the movement of the rods can be made independent from the working motion of the loom, in that a fixed mechanical coupling no longer exists between them.

[0007] The EP-A1-598.264, in the name of PICANOL N.V., discloses a presenting device wherein the single rods are independently controlled by electric motors, through cam mechanisms.

[0008] This solution, however, also involves a number of drawbacks.

[0009] The electric motors do not perform continuous, but alternate rotations, in one direction and in the other, between a position corresponding to the top dead center and a position corresponding to the bottom dead center of the respective rod. Hence, the adjustment of such motors requires a complicated electronic control system.

[0010] Furthermore, the head of the rod, namely its end connected to the cam mechanism, follows a curved trajectory involving the surrounding area: it is thus necessary to provide for a sufficient lateral spacing between one rod and the next, in order to prevent a mutual interference thereof. For this purpose the EP-A1-598.264 provides for the single rods, with the respective drive mechanisms, to be mounted on corresponding support plates, so as to form modules positioned one next to the other without any interferences: it is evident that such a multiple presenting device covers on the whole a considerable space sidewise, which - as already stated - is highly undesirable.

[0011] Finally, the trajectory of the rod eyelet end is not rectilinear, but is also curved. This, besides determining bounds in the mutual arrangement of the rods, forces to adopt oscillating guide bushes, which may cause seizures and jammings and which anyhow represent a delicate and costly component.

[0012] The EP-B1-461.524, in the name of the present Applicant, discloses a presenting device wherein the rods are singly controlled by electric linear motors. The overall dimensions of a multiple presenting device, constructed according to the teachings of said patent, can be limited (especially in one of the two embodiments described therein) because the rods follow completely rectilinear trajectories, with no mutual interference, and the electric linear motors cover a rather limited specific space. Nevertheless, the use of electric linear motors does not always prove satisfactory, both in terms of costs and due to difficulties of adjustment and of control.

[0013] The object of the present invention is to thus supply a weft presenting device apt to fully overcome the aforesaid drawbacks, and particularly a device

allowing to singly control each weft yarn presenting rod, both in synchronism with the working motion of the loom and independently therefrom, while simultaneously providing an easy control of the device, a simple and economic structure and, at the same time, a modularity and compactedness which allow to obtain a multiple presenting device involving minimum overall dimensions and competitive costs.

[0014] Said objects are reached with a device to select and present weft yarns to a carrying gripper in looms - of the type comprising a set of rods having an eyelet to let the weft yarns through, rod guiding elements and a rotary driving motor for each rod - in which exact straight-line guide mechanisms are interposed between the driving motors and said rods.

[0015] Further characteristics and advantages of the presenting device according to the 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 is a diagrammatic side elevation showing an example of gripper loom on which is mounted the presenting device according to the invention;

Fig. 2A is a partial front elevation of the presenting device according to the invention;

Fig. 2B is a longitudinal section view along the line I-I of fig. 2A;

Fig. 3 is a diagrammatic front elevation showing how a loom gripper interacts with the presenting device of the invention shown in its whole;

Figs. 4A, 4B and 4C are, respectively, a longitudinal part section view, a side elevation and a front elevation of a preferred embodiment of the exact straight-line guide mechanism according to the invention; and

Fig. 5 is a front elevation, with partially removed portions, showing the two end-of-stroke positions (a) and (b) of a rod forming part of the presenting device according to the invention.

[0016] As shown in fig. 1, the weft presenting device is positioned in correspondence of the loom side of weft yarn insertion. It comprises a set of weft carrying rods 1 provided, at their working end 1a (figs. 2A and 2B) with an eyelet 2 to let the weft yarn through, said rods 1 being guided into guide bushes 3. As illustrated in fig. 3, the shifting of a rod 1 leads the corresponding weft yarn T, sliding through the respective eyelet 2, to interfere with the trajectory followed by the loom carrying gripper N, so as to allow this latter to clamp said weft yarn and insert it into the warp shed.

[0017] As shown in fig. 2B, each rod 1 of the presenting device is connected, through its head 1b, to an outlet member 10 of a driving mechanism 11 controlled by a respective electric motor M. The motor M is preferably an electric step-by-step motor.

[0018] According to the invention, the driving mechanism 11 reproduces an exact straight-line guide. Though there are different possibilities to conceive an exact straight-line guide, the mechanism 11 of the present invention is preferably that illustrated in figs. 4 and 5.

[0019] As shown in detail in fig. 4A, a housing C - on which the electric step-by-step motor M is mounted - contains the elements forming the exact straight-line guide. A rotor 12, rotatably mounted on a bearing 13, is fixed to the outlet shaft 14 of the electric motor M. A planetary gear 15 is rotatably mounted on the rotor 12 by way of a support spindle 15a positioned parallel, but eccentric, in respect of the rotation axis of the shaft 14. The gear 15 has an external toothing 16 meshing with an internal gear 17 applied into or formed in one piece with the housing C. Onto an end of the spindle 15a there is fixed a supporting block 18, from which axially projects the outlet member 10 of the mechanism 11 in the form of a pin.

[0020] Said driving mechanism 11, suitably dimensioned, allows to change the purely rotary motion of the motor shaft 14 into a reciprocating straightaway motion of the pin 10 (figs. 4B and 4C); in fact, the rolling of the planetary gear 15 over the internal gear 17 leads the pin 10 to follow a rectilinear trajectory (fig. 4C) while spinning, thus performing a full rotation for each rotation of the motor shaft 14. The pin 10 follows a law which is perfectly sinusoidal in time, if the rotation of the electric motor M is continuous and constant, but it may follow different laws by suitably controlling the electric motor M.

[0021] The great advantage of this mechanism 11 is to be able to perform a reciprocating straightaway motion without the help of cam mechanisms, or other type of eccentrics, which forcedly require to reverse the rotation of the motor in order to obtain a reciprocating motion. This results into a substantially easy control of the motor M, thereby reaching a first object of the present invention.

[0022] Furthermore, the perfectly rectilinear movement of the rods allows to adopt fixed bushes 3 - rather than oscillating bushes, as in prior art - thereby reaching a second object of the present invention.

[0023] Fig. 5 illustrates the two opposite positions of the planetary gear 15, in correspondence of the two end-of-stroke positions of the rod 1. In particular, with the assembly of fig. 5 the rod 1 performs a straightaway motion along a vertical axis (in respect of the plane of the drawing).

[0024] By suitably keying the block 18 onto the spindle 15a it is possible to obtain rectilinear displacements of the rods 1 along axes inclined in respect of the vertical axis - as shown in fig. 3 - so as to draw close, in a same weft presenting device, various rods positioned according to straight convergent lines. Fig. 3 shows a weft presenting device with nine rods, wherein all the units are mounted, drawn close, onto a same support plate P.

The different inclination of the rods 1 allows the various weft yarns, inserted into the single eyelets 2, to substantially converge in the same restricted area (shown by small circles). This last characteristic is very important to make sure that the weft yarns are presented in an optimal zone, to be caught by the carrying gripper N.

[0025] As an alternative to that shown in fig. 3, the keying of the blocks 18 on the respective spindles 15a can be identical for all the rods 1 (as shown, for example, in fig. 5) and the different inclinations of the rods are obtained by mounting the driving mechanisms 11 on the support plate P according to different angles (this condition is not shown) instead of equal angles (as in fig. 3).

[0026] This last mounting arrangement is advantageous, in that it does not require a specific keying of the blocks 18 for each position taken up by the mechanisms 11, and thus allows an easy and prompt interchangeability of such driving mechanisms.

[0027] In both cases one may appreciate the modularity and high compactedness of the multiple weft presenting device according to the invention. In particular, seen that the heads 1b of the rods 1 follow a perfectly rectilinear trajectory, the area which they cover in their movement is very limited, whereby it is no longer necessary to provide - as in the case of the device disclosed by EP-A1-598.264 - for a spacing between the rods, such as to allow a freedom of movement to the rod head following a curved trajectory. In the weft presenting device according to the present invention, even if a rod 1 should cover the area into which is moving a block 18 (for example, the rod 1 and the block 18 shown in fig. 3), no interferences arise, since the rods 1 are anyhow mounted overhanging in respect of the blocks 18 (as shown in fig. 2B), whereby their moving path is always external to said blocks.

[0028] Furthermore, thanks to its modularity and compactedness, the device according to the invention is easy to assemble and disassemble, to the full advantage of its maintenance.

[0029] 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, so as to synchronize the motion of the weft presenting device with the motion of the loom. For example, a proximity sensor S (see fig. 2B) detects the position of the head 1b of the rod 1, then timing the working motion of the loom with the rotation of the motor M.

[0030] The electronic control of the electric step-by-step motor M also allows to obtain motion laws for the rods 1 which perfectly fulfil the requirements of the specific product having to be woven, without having to replace or modify any mechanical component of the system.

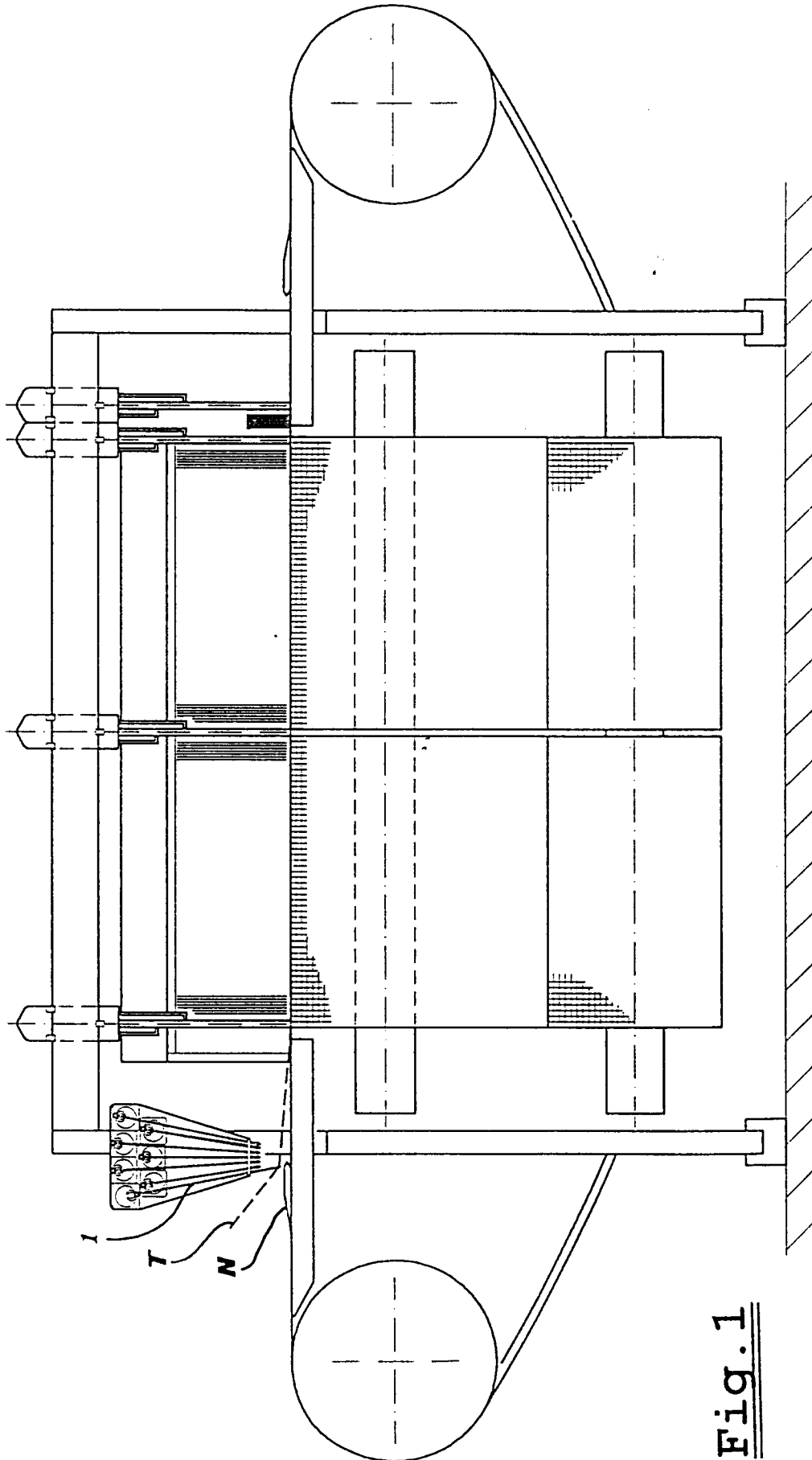
[0031] It is anyhow understood that the invention is not limited to the particular embodiment illustrated heretofore, which merely represents a non-limiting example of its scope, but many variants can be introduced, all within reach of a person skilled in the art, without

thereby departing from the protection field of the present invention.

[0032] For example, the various units of the weft presenting device - instead of being drawn close onto a same support plate, as in fig. 3 - could be positioned according to different geometries, at least partially opposite one to the other, or mutually offset. Moreover, though a single preferred embodiment of the driving mechanism 11 has been described herein, other embodiments can be conceived for the exact straight-line guide, all falling within the protection field of the present invention.

Claims

1. Device to select and present weft yarns to a carrying gripper in looms - of the type comprising a set of rods (1) having an eyelet (2) to let the weft yarns through, rod guiding elements (3) and a rotary driving motor (M) for each rod (1) - characterized in that, exact straight-line guide mechanisms (11) are interposed between the driving motors (M) and said rods (1).
2. Device as in claim 1), wherein said driving motors (M) are electric step-by-step rotary motors.
3. Device as in claim 2), wherein said electric step-by-step motors (M) rotate only in one direction.
4. Device as in claims 1) to 3), wherein said exact straight-line guide mechanism (11) consists of a rotor (12) fixed to the shaft (14) of the driving motor (M) and carrying, eccentric in respect of said shaft, a planetary gear (15) meshing with an internal gear (17), onto said planetary gear (15) there being mounted a spindle (15a) on which there is fixed a supporting block (18) from which projects, eccentric in respect of said spindle, a pin (10) engaging with the head (1b) of the rod (1).
5. Device as in any one of the previous claims, wherein said rod guiding element (3) consists of a fixed bush.
6. Device as in claim 5), wherein the rods (1), the guide bushes (3), the exact straight-line guide mechanisms (11) and the driving motors (M) are all mounted onto a same support plate (P), so that the rods (1) may converge towards the zone where the weft yarns are clamped by the loom carrying gripper (N).



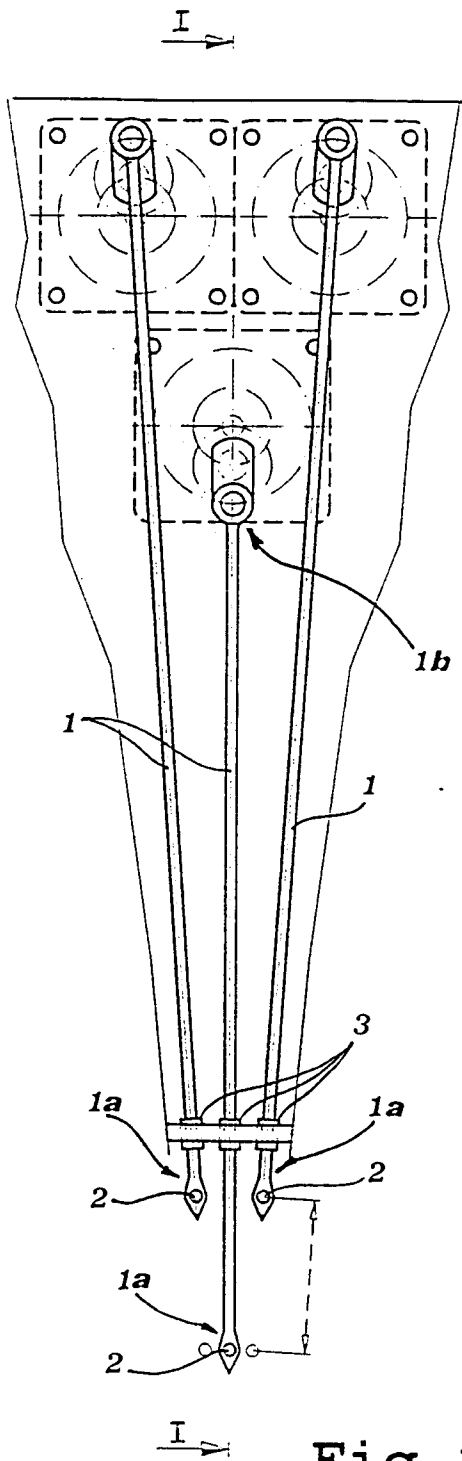


Fig. 2A

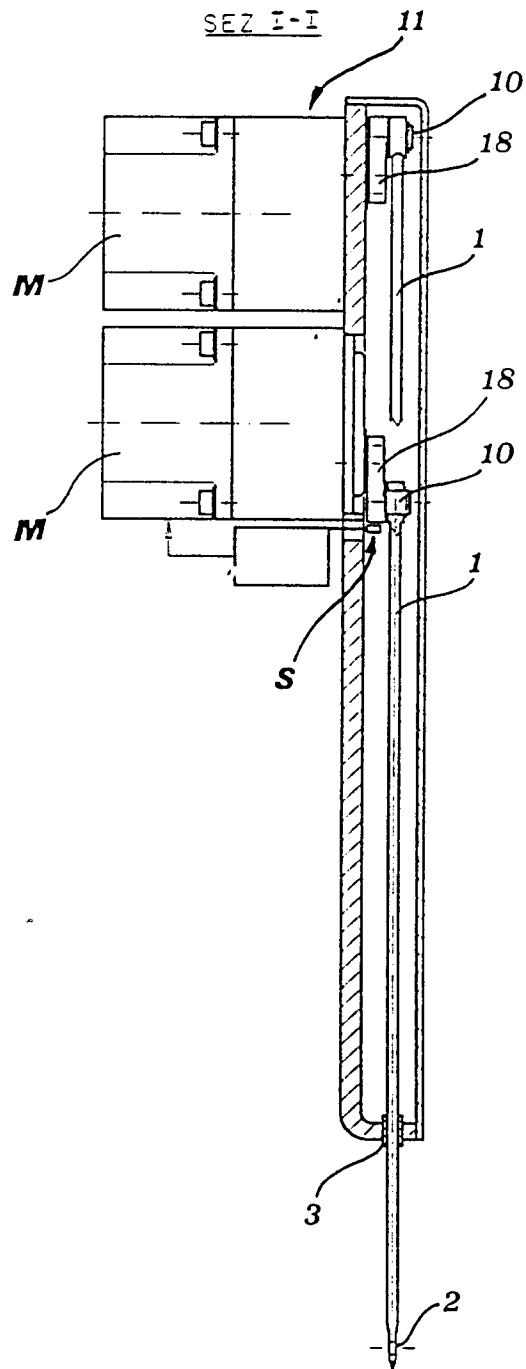


Fig. 2B

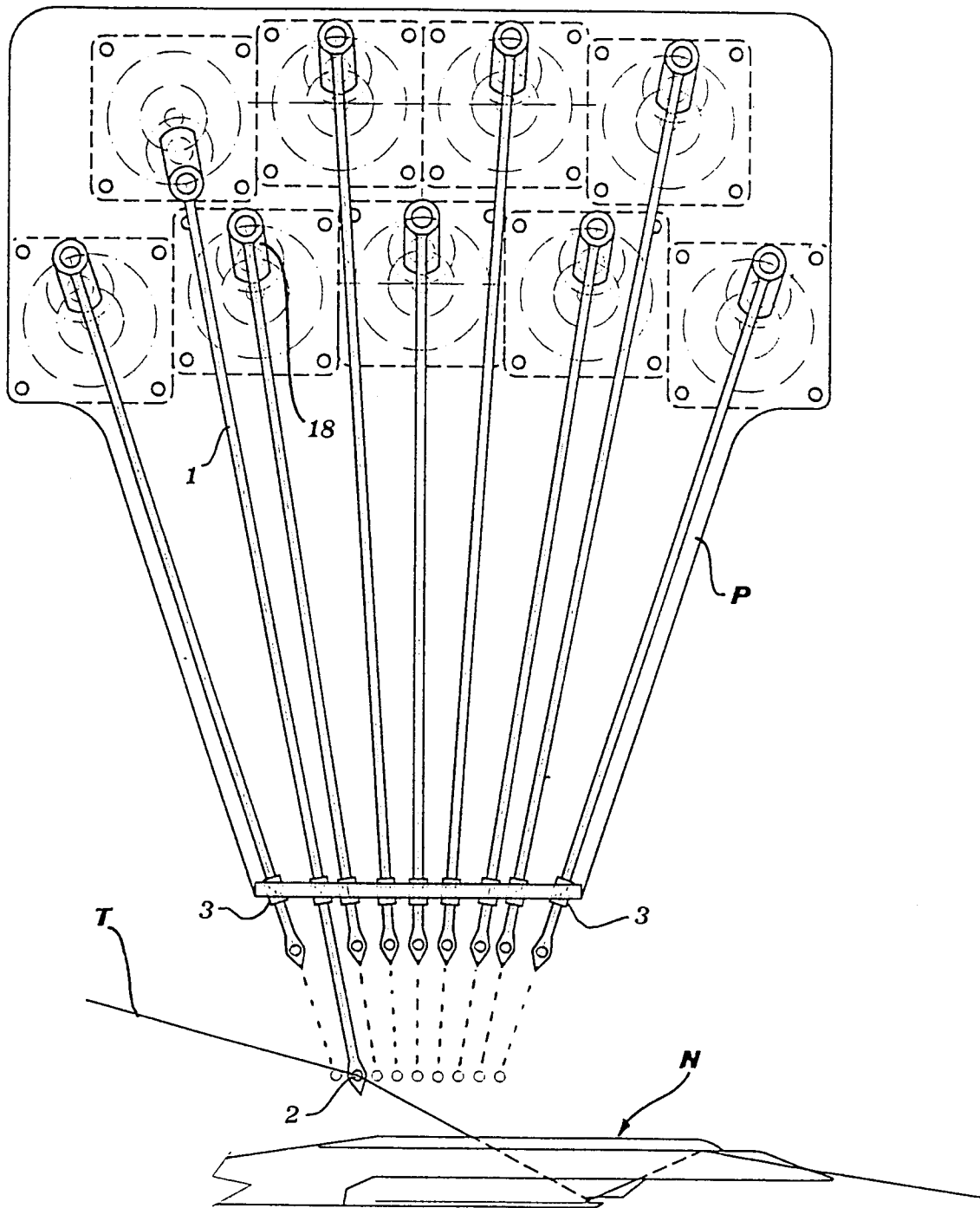


Fig. 3

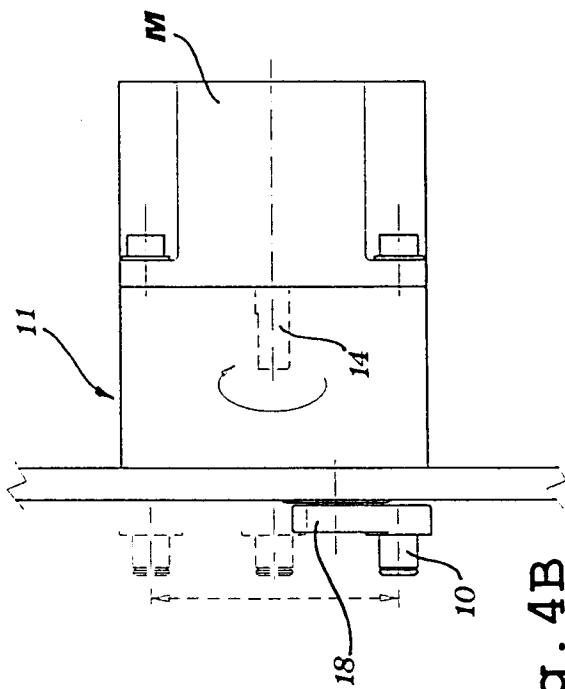


Fig. 4B

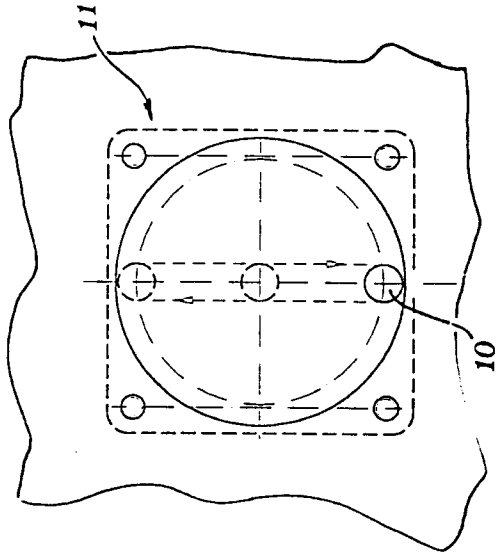


Fig. 4C

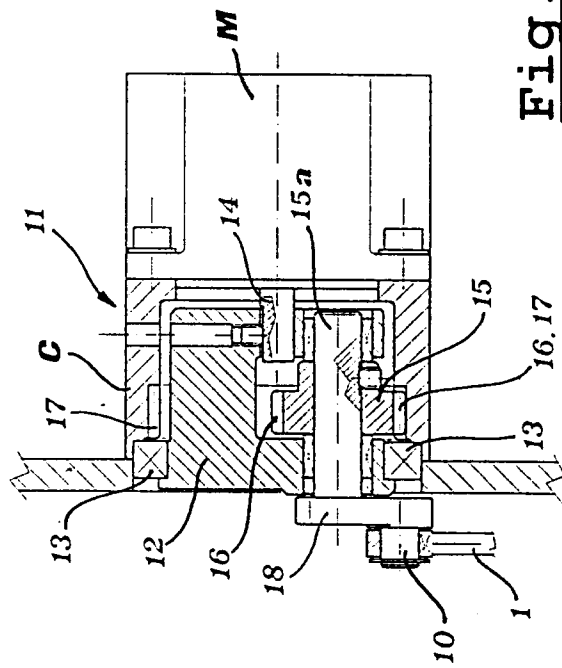


Fig. 4A

