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(54) Presenting device for weaving looms having a single presenting rod

(57) There is disclosed a device for selecting weft yarns in a gripper loom and a control method thereof, comprising a single selecting member (F) which is driven by a mechanism operated by a first presentation motor (M1) and a second selection motor (M2), the selection motor (M2) causing the rotation of said selecting member (F) about pivoting means (4a) and the presentation motor causing the spatial displacement of said pivoting means (4a).

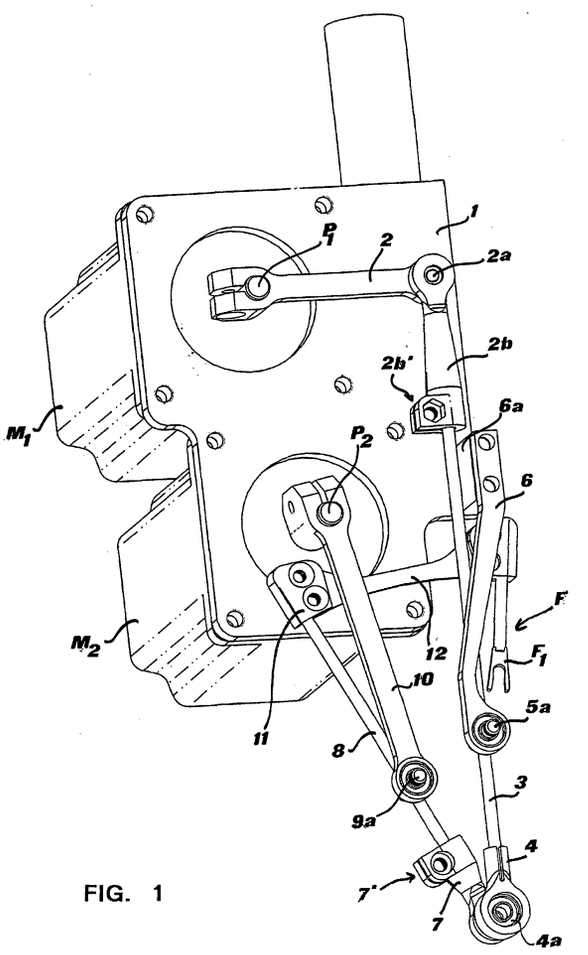

FIG. 1

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Description

Technical field of the invention

[0001] The present invention relates to a selecting device for a loom, in particular a selecting device with a single selecting member.

Background art

[0002] As is known, a selecting device for a weaving loom is a device able to bring a weft yarn to the device for insertion into the shed - typically to the carrying gripper - after selecting said yarn from a plurality of available weft yarns which extend between the piece of fabric and the respective weft delivery devices.

[0003] In order to perform this function, the selecting device must be able to control suitably, in a manner synchronized with operation of the loom, each weft yarn so as to bring it to a specific location - namely along the path of the carrying gripper which is intended to grip it and draw it inside the warp shed - when necessary, or instead keep it raised and away from interference with the gripper and with the other weft yarns for the remainder of the time.

[0004] The selecting devices of the prior art are composed of a plurality of selection rods or fingers which each engage (for example by means of an eyelet) with a respective weft yarn and the movement of which is controlled by respective actuating motors of various types.

[0005] Some selecting devices of the prior art are illustrated, for example, in EP 896,075 in the name of the same Applicant or in EP 461,524 and EP 763,613.

[0006] As can be understood, this type of configuration - which is now well established in the sector - has an obvious major disadvantage, namely for each weft yarn it is required to provide a selecting member and an associated actuating motor - to the detriment of the costs and overall dimensions.

[0007] Hitherto no valid alternative for overcoming this drawback has been suggested.

[0008] The difficulty of the task addressed to in this field also depends on the fact that it is required to operate yarns which are necessarily spaced from each other and to cause them to converge in a common restricted space which is ideally represented by a point along the sliding path of the carrying gripper of the loom.

[0009] An object of the present invention is therefore that of providing a selecting device which, although using an extremely small number of selecting members, irrespective of the number of weft yarns available is nevertheless able to perform effectively the selection operation, namely to cause all the weft yarns which can be selected in each case to converge in a restricted zone in such a way that they are gripped without error by the carrying gripper of the loom.

[0010] A second object of the present invention is that of providing a selecting device which also requires a minimum number of actuating motors.

[0011] Finally, a further object is that of providing such a device which is controlled so as to reduce in a significant manner the accelerations needed to achieve the weft presentation function so as to advantageously affect the inertia forces of the system.

Summary of the invention

[0012] The abovementioned objects are achieved by means of a device, the main and inventive features of which are illustrated in the accompanying claims.

[0013] Namely, according to a first aspect of the invention, a selecting device for weft yarns is provided, said device comprising a first presentation motor and a second selection motor and a single selecting member which is driven by a kinematic mechanism operated by said presentation and selection motors, the selection motor causing the rotation of said selecting member about pivoting means and the presentation motor causing the spatial displacement of said pivoting means.

[0014] According to another aspect, a selecting device is provided where the selecting member is integral with a first selection rod pivoting at one end of a second selecting rod, the first selection rod being constrained rotationally and slideably at a point movable along a circular path and the second presenting rod being constrained rotationally and slideably to a fixed point.

[0015] According to another aspect of the invention, a selecting device as defined above is provided, in which the two motors are mounted at a fixed relative distance on a support plate, one operating the first selection rod and the other the second presenting rod.

[0016] According to yet another aspect, the selecting member has an end for capturing the weft yarns which is fork-shaped.

[0017] According to yet another aspect, a method for controlling a selecting device as defined above is provided, wherein the two motors are operated in a co-ordinated and combined manner so as to achieve the desired path of the fork-shaped end and so that the selecting member performs an initial extra travel movement and a final extra travel movement, the central part of the travel movement being that which is useful for the purpose of presenting the weft yarn to the carrying gripper.

Brief description of the drawings

[0018] Further characteristic features and advantages of the system according to the invention will nevertheless emerge more clearly from the detailed description which follows of a preferred embodiment thereof, provided by way of example and illustrated in the accompanying drawings in which:

[0019] Fig. 1 is a perspective view of the front side of a selecting device according to the invention;

[0020] Fig. 2 is a perspective view of the rear side of

the selecting device according to Fig. 1;

[0021] Fig. 3 is a partial perspective view of a possible arrangement of the selecting device according to the invention on a weaving loom shown by way of example;

[0022] Figs. 4A-4C are schematic views which illustrate the kinematic mechanism of the device according to the invention during three different stages of presentation of a first weft yarn;

[0023] Figs. 5A-5C are views similar to those of Figs. 4A-4B for a second weft yarn;

[0024] Figs. 6A-6C are views similar to those of Figs. 4A-4B for a third weft yarn;

[0025] Fig. 7 is a front elevation view of the device according to the invention; and

[0026] Fig. 8 is a side elevation view of the device according to Fig. 7.

Detailed description of a preferred embodiment

[0027] As shown in Fig. 1, the selecting device according to the invention is composed of a drive body consisting of a support plate 1 having a first motor M1 and a second motor M2 fixed thereon, with respective driving axes P1 and P2 from which a complex kinematic system extends.

[0028] The kinematic system is driven by the two actuating axes P1 and P2 and suitably transfers the motion to a fork member F.

[0029] The motors M1 and M2 of the drive body are independent and are controlled in a co-ordinated manner in a way which will be illustrated further below. Preferably, the motors are of the stepper type since in this way it is possible to achieve more easily the desired type of control, but it is also possible for the motors to be of another type, for example of the linear type.

[0030] The first motor M1, which is situated at the top of the plate 1, is assigned mainly the presentation function and will be referred to as such below; the second motor M2, on the other hand, is assigned mainly the selection function and will also be referred to as such below.

[0031] An operating arm 2 of a presentation lever system is fixed onto the driving axis P1 of the presentation motor M1. The proximal end of the operating arm 2 is fixed integrally to the spindle P1 in any manner known per se, preferably in manner adjustable in terms of the angular position, for example by means of a clamp which can be champed on the spindle P1 (as shown in Fig. 1).

[0032] At its distal end, the operating arm 2 is pivoted to an engaging shank 2b inside which the end of a first rod 3 can be firmly engaged, with the possibility of axial adjustment. The opposite end of the rod 3 is also engaged in a similar engaging shank 4, terminating in a pivoting element 4a.

[0033] The rod 3 is moreover slidably inserted inside a bush 5 which is mounted on a pivot 5a and therefore freely rotatable on a constraining bracket 6 integrally fixed to the plate 1. With this configuration, as is obvious, the bush 5 acts as rototranslation constraint (sliding plus pivot) for a rotating sliding movement of the rod body 3 with respect to the fixed reference represented by the plate 1.

[0034] Preferably, as can be noted in Figs. 1, 2 and 8, the constraining bracket 6 is not fixed directly to the plate 1, but by means of a spacer 6a. This enables the bush 5 to be arranged at the correct distance from the plate 1, so as to distribute in the most efficient manner all the members of the kinematic mechanism in the direction perpendicular to the plate 1, without mutual interference occurring. A clear idea of this distribution in the direction perpendicular to the plate 1 can be obtained from Fig. 8.

[0035] A further engaging shank 7, inside which the bottom end of a second rod 8 engages, is pivotably mounted on the pivot 4a.

[0036] The body of the rod 8 is slidable inside a second bush 9 - similar to the bush 5 - which is pivoting at 9a to the distal end of an operating selection arm 10. The proximal end of the operating arm 10 is fixed - similar to the arm 2 - to the spindle P2 of the selection motor M2.

[0037] As can be understood, the bush 9 acts as a rototranslation constraint (sliding plus pivot) for the body of the second rod 8 with respect to the operating selection arm 10.

[0038] The top end of the rod 8 has, fixed to it, a fastening head 11 for an off-set cross-member 12 which supports, at its other cantilevered end, a fork member F intended to engage precisely with the weft yarns.

[0039] The off-set cross-member 12 has the function of locating the fork member F in the correct position and with the desired attitude with respect to the top end of the rod 8 so as to allow it to operate effectively in the area where the weft yarns pass, as shown schematically in Fig. 3.

[0040] As can be understood, since the fork member is intended to interact with a plurality of weft yarns (for example the eight yarns schematically shown in Fig. 3), it cannot terminate in the conventional eyelet of the selecting devices according to the known art. Therefore, according to the invention, the fork member F terminates in an end F1 having the characteristic shape of an inverted fork which is slightly open and rounded so as to favour engagement with the weft yarns.

[0041] The fork member may advantageously be made of composite material, which is sufficiently strong, but also suitably light so as not to induce too high inertia-related stresses. Preferably, the fork-shaped end F1 is designed as a separate and replaceable element, for example made of a material which is abrasion-resistant such as a ceramic material.

[0042] A preferred embodiment envisages that the fork member is made of carbon fibre and the end is formed as an insert of ceramic material.

[0043] The kinematic mechanism described above, as will be illustrated more clearly below, has precisely

the function of displacing along a substantially horizontal path the end F1 during selection, transferring it above the desired weft yarn, and - in a suitably co-ordinated manner - lowering this end, during the presentation stage, in order to engage with the underlying weft yarn and push it so as to interfere with the capture path of the carrying gripper (indicated by G in Fig. 3).

[0044] In order to allow a certain degree of adjustment in the overall geometry, during assembly and correction of the play, at least some of the members of the kinematic mechanism preferably have an adjusting capacity. For example in the preferred embodiment shown, the engaging shanks 2b and 7 have a seat for insertion of the respective rods 3 and 8, which is sufficiently deep to allow a certain degree of longitudinal displacement of the rods inside them: a shortening or lengthening of the distance between the pivots 2a and 4a as well as between the fastening head 11 and the pivot 4a is thus permitted; for this purpose, these shanks also comprise a portion which can be tightened or slackened - respectively 2b' and 7' - which is shown without the tightening screw.

[0045] As seen above, the selection member, intended to engage with the weft yarns, cannot have the form of an eyelet (as in the prior art), but is instead fork-shaped; therefore, in order to ensure the certainty of selection and presentation of the weft yarns spaced from each other, according to a preferred embodiment, a spacing template D is associated with the selecting device, said template being intended to define in a suitable and repeatable manner the spacing between yarns and their path. In this way it is possible to ensure that the fork-shaped end F1 is always able to capture and present correctly the various weft yarns, without the need for excessively large mutual spacing, which would result in many other problems.

[0046] The spacing template D may be in the form of a plate provided with a series of holes, into which the weft yarns are passed. The plate D may be mounted preferably integral with the plate 1 of the selecting device or is mounted on a suitable bracket integral with the loom, as illustrated in Fig. 3.

[0047] In order to improve further the definition of "weft paths", it is possible to envisage a further guiding fork (not shown), on the inner side of the gripper path, against which the weft yarns are made to pass before being directed towards the insertion point in the fabric: in this way, the weft yarns always pass between two given points (the hole in the plate D and the point of contact with the guide fork), thus ensuring perfect repeatability of their position and improved operation of the selecting device.

[0048] It must be commented in this connection that, if the position of the weft yarns is certainly reliable and repeatable, implementation and design of the kinematic mechanism and its control sequence may be advantageously focused on another important task, namely that of ensuring that all the wefts are presented to the gripper in a restricted zone, which ideally coincides in a single point.

[0049] The operation of the device according to the invention will be described below.

[0050] Assuming, for the sake of simplicity of description, that the motor M1 is stopped, the structure composed of the operating arm 2, the pivot 2a, the rod 3, the pivot 5a and the bracket 6 form a not-labile and thus fixed articulated system. Therefore, the pivot 5a is fixed spatially. As a consequence, the rotation of the motor M2, via the arm 10 which is rotationally and translatably constrained to the rod 8, produces only the angular displacement of the fork member F about the pivot 4a.

[0051] In this way, it can be understood that the motor M2 determines the component of displacement of the member F about the pivot 4a. Since the forked end F1 is arranged geometrically above the pivot 4a, it describes a wide circle arc which is substantially equal to a horizontal trajectory above the weft yarns: ultimately, therefore, control of rotation of the motor M2 determines selection of the weft yarn intended to be then inserted into the warp shed by the carrying gripper G.

[0052] On the other hand, assuming that the motor M2 is stopped, rotation of the presentation motor M1 causes the displacement of the pivot 4a and therefore a complex rototranslation movement of the fork member F about the sliding 9 and pivoting 9a constrain. This movement results mainly in a component of vertical displacement of the fork F1 which is thus able to engage with or disengage from the underlying weft yarn.

[0053] Three successive positions assumed by the fork member F, depending on the gradual co-ordinated rotation of the motors M1 and M2, are illustrated in Figs. 4A-4D. Figs. 5A-5D and Figs. 6A-6D show corresponding sequences for different angular positions assumed at starting by the selection motor M2 (namely for the presentation of different weft yarns).

[0054] The above have been shown in simplified schematic form solely for the explanatory purposes. The Applicant has in fact established that it is convenient to control always both motors in a co-ordinated manner, in order to achieve a selection and presentation sequence which is more suitable in practical terms. In particular, co-ordination of the two motors varies depending on the specific weft selected (namely on the position thereof) and on the path which the fork member F must follow when passing from selection of one weft yarn to that of the next yarn.

[0055] A preferred optimization of this co-ordinated control of the two motors envisages is based on the task of obtaining the shortest total time between the weft selection signal (depending on the woven article) and the actual time of presentation for that weft (depending on the motion law of the gripper).

[0056] Moreover, although the geometry of the kinematic mechanism may be optimized per se, during the design stage, in order to ensure that all the wefts converge into a restricted zone (ideally at one point), the

combination of the two motors motion may also contribute in a relevant manner to achieving this goal.

[0057] Among other things, it has been found to be particularly advantageous if the movement sequence of the selecting device - namely the overall actuating sequence wherein the presentation motion (able to be determined by the motor M1) is partially superimposed on and combined with the selection motion (able to be determined by the motor M2) - provides an initial extra travel (the fork member F starts from a position which is a few millimetres higher than necessary) and a final extra travel (the fork member F continues its travel movement a few more millimetres than necessary), so as to make use, for the working stroke, of the central section of the movement sequence which has the greater mean speed. As a result it is possible to achieve, for the same working time and stroke, smaller accelerations and therefore a smaller degree of dynamic stressing of the kinematic mechanism and also a smaller starting torque demand for the motors (the inertia forces being the most relevant ones).

[0058] All the possible combinations, once they have been optimized in accordance with the criteria described above, are implemented in the control logic of the two motors which then co-ordinates the general movement of the selecting device with the main motion of the loom, in particular with that of the carrying gripper.

[0059] It is envisaged that definition of the movement sequence may also be performed by means of "teaching", namely by driving the fork-shaped end F1 along a desired path and memorizing, in function of the angular position of one of the motors, the angular position of the other motor. This procedure is repeated for each weft yarn and for the various configurations of the loom so as to create a control matrix which can be used again during the next automated procedure.

[0060] This movement sequence obtained by means of teaching is then advantageously combined and optimized with other requirements arising from dynamic operation of the system. Namely, for example, the operational limits of the motors or limitation of the inertia stresses permitted in the kinematic mechanism may require a certain degree of modification of the previously defined sequence obtained by teaching.

[0061] It can be understood that the objects described in the introduction are perfectly achieved with the selecting device according to the invention.

[0062] In fact, with the innovative configuration of the invention it is possible, even with a single pair of motors and a single fork member, to perform the entire function of selecting and presenting a given number of wefts, including up to 8 to 12, meeting the requirement of causing them to converge all towards a restricted gripping zone of the carrying gripper.

[0063] Advantageously the flexibility of the device is also increased since, by means of simple programming of the control logic, it is possible to adapt the same selecting device so as to operate with a different number of weft yarns, which number may vary with continuity for example from 1 to 8 and even up to 12. In this way, the modularity based on units of 4 (namely, 4, 8 or 12 wefts/colours), which was adopted in the prior art in order to reduce costs, it not any longer a requirement.

[0064] Owing to the simplicity and minimum number of parts which form the selecting device according to the invention, its cost is extremely limited and substantially independent of the number of weft yarns to be managed.

[0065] Moreover, the overall dimensions of the selecting device, when compared to those of similar devices of the prior art intended for several weft yarns, are decidedly smaller, thereby making installation more practical and improving the accessibility for the loom operator in the event, for example, of a weft being broken and requiring repair.

[0066] Finally, owing to the method of control of the two motors, which envisages an initial extra travel and final extra travel of the fork member as well as combined operation of the two motors, it is possible to obtain excellent convergence of the fork-shaped end for all the weft yarns, to reduce the inertia forces and therefore the necessary power of the motors, as well as to increase the overall duration of the mechanism.

[0067] It is nevertheless understood that the invention is not limited to the particular configuration illustrated above, which forms only a non-limiting example of the scope of the invention, but that numerous variations are possible, all within the reach of a person skilled in the field, without thereby departing from the scope of the said invention.

[0068] In particular, as mentioned, it is possible to envisage that linear motors are used instead of two stepper motors.

Claims

1. Weft yarns selecting device in a gripper loom, of the type comprising a selecting member (F) and at least one motor for driving said selecting member, **characterized in that** it comprises a first presentation motor (M1) and a second selection motor (M2) and **in that** said selecting member (F) is one and is driven by a kinematic mechanism operated by said presentation and selection motors, the selection motor (M2) causing the rotation of said selecting member (F) about pivoting means (4a) and the presentation motor causing the spatial displacement of said pivoting means (4a).

2. Selecting device according to Claim 1), wherein said displacement of the pivoting means (4a) occurs in a plane.

3. Selecting device according to Claim 2), wherein said displacement of the pivoting means (4a) occurs as a rototranslation about a fixed point (5, 5a)

in the plane.

4. Selecting device according to Claim 1, 2 or 3, wherein said selecting member (F) is fixed to a cross-member (12) apt to define the attitude and position thereof with respect to the end of a selection rod (8) oscillating about said pivoting means (4a).

5. Selecting device according to Claim 4, wherein said selection motor (M2) causes rotation of an operating arm (10), the end of which is joined by pivoting/sliding means (9, 9a) to said oscillating rod (8).

6. Selecting device according to any one of Claims 3 to 5, wherein said pivoting means (4a) are fixed to the end of a connecting rod/crank assembly which is driven by said presentation motor (M1), the connecting rod of which is rototranslation constrained to said fixed point (5, 5a).

7. Selecting device according to Claim 6, wherein said connecting rod is a presenting rod (3).

8. Selecting device according to Claim 6 or 7, wherein said crank is an arm (2) rotated by said first presentation motor (M1).

9. Selecting device according to any one of Claims 5 to 8, wherein said presenting rod (3) and said selection rod (8) have means (7, 2b) for adjusting the position of the hinging pivoting (4a) with respect to one end (11, 2a) of the rod.

10. Selecting device according to Claim 1), wherein said selecting member (F) is integral with a first selection rod (8) pivoted (4a) to a second presenting rod (3), the first selection rod (8) being rototranslationally constrained in a point (9, 9a) movable along a circular path and the second presenting rod (3) being rototranslationally constrained in a fixed point.

11. Selecting device according to Claim 10, wherein said second rod (3) is furthermore constrained at a pivot (2a) movable along a circular path.

12. Selecting device according to Claim 11, wherein the displacement, along the circular path, of said movable point (9, 9a), is determined by said selection motor (M2) and the displacement, along the circular path, of said pivot (2a) is determined by said presentation motor (M1).

13. Selecting device according to any one of the preceding claims, wherein said motors (M1, M2) are mounted at a fixed relative distance.

14. Selecting device according to any one of the preceding claims, wherein said selecting member (F) has one end for capturing the weft yarns in the form of a fork (F1).

15. Selecting device according to Claim 14, wherein said fork-shaped end (F1) is formed as a removable element and is made of abrasion-resistant material.

16. Method for controlling a selecting device according to any one of the preceding claims, wherein said motors are operated in a co-ordinated and combined manner so that said selecting member (F) performs an initial extra travel and a final extra travel, the central section of the travel stroke being that which is useful for the purposes of presenting the weft yarn to a carrying gripper of the loom.

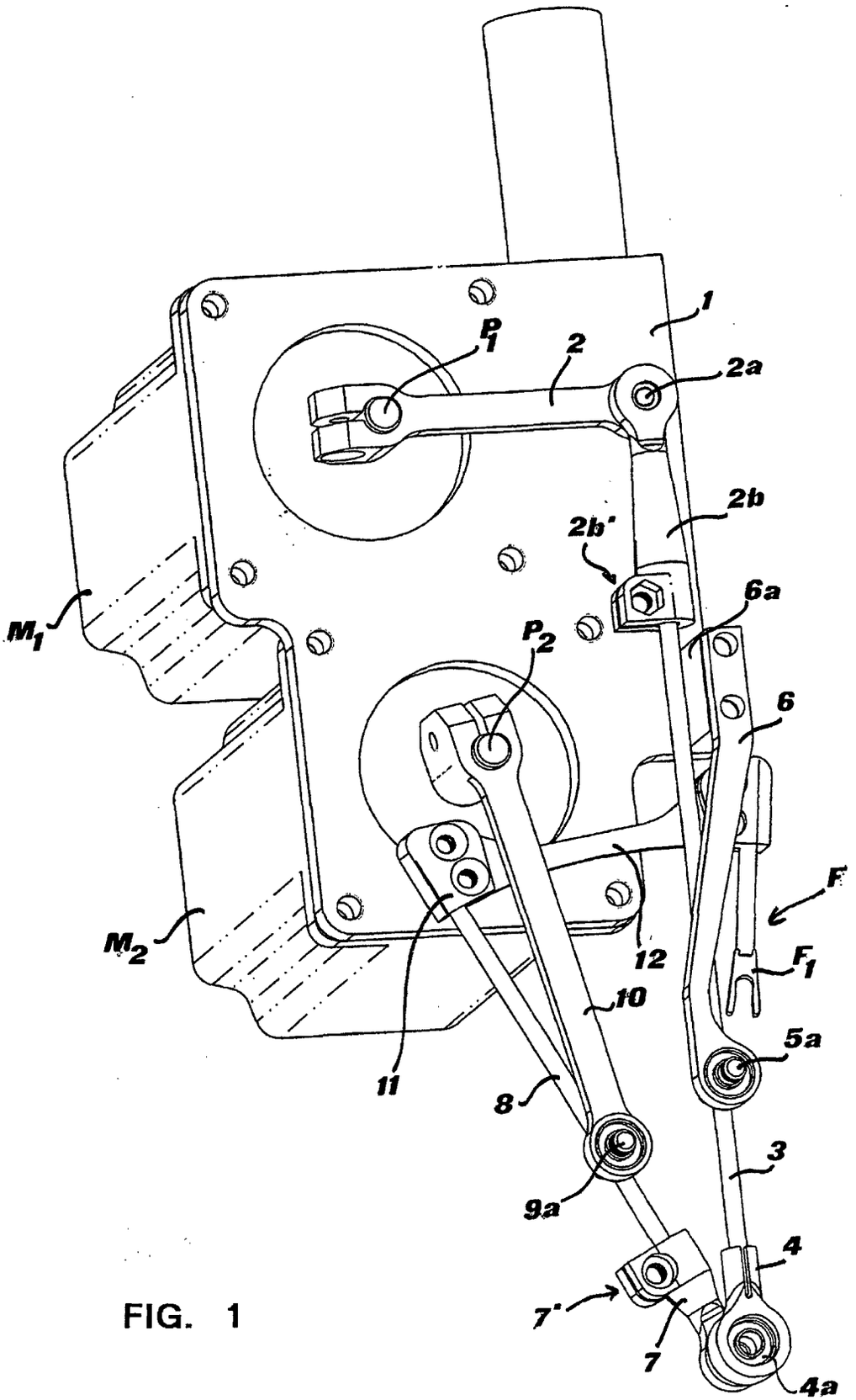


FIG. 1

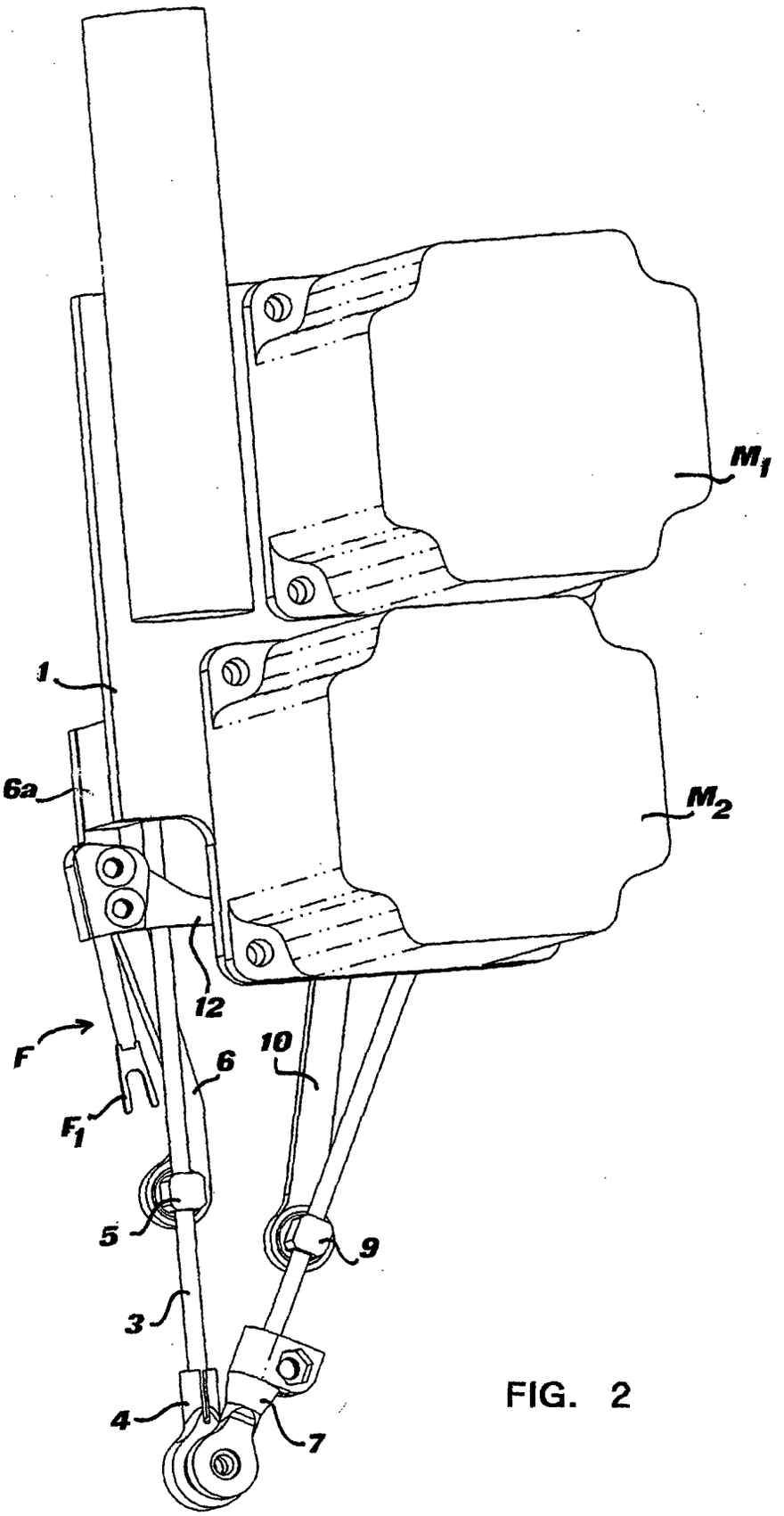
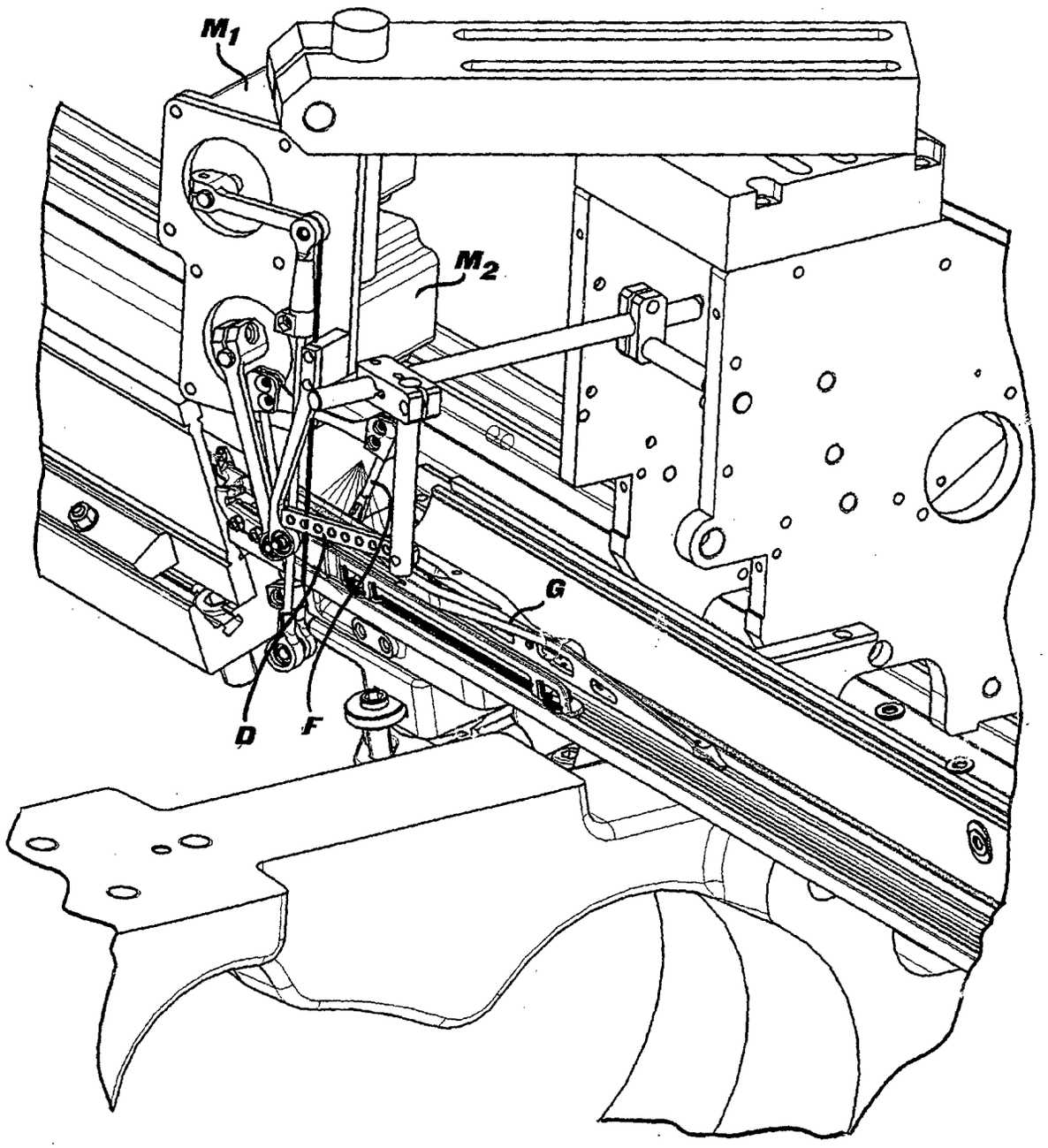


FIG. 2

FIG. 3



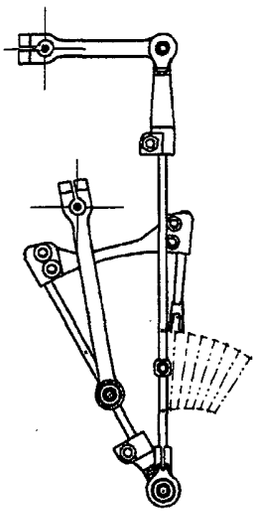


FIG. 4A

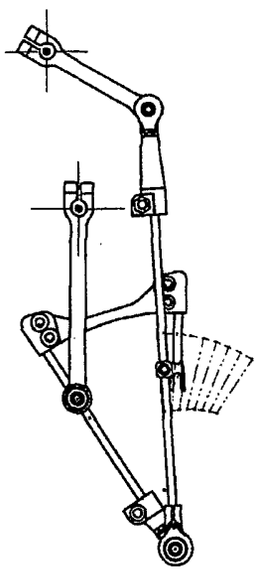


FIG. 4B

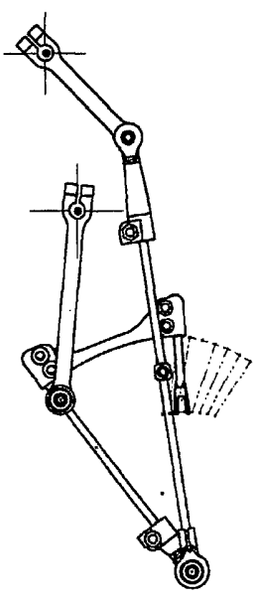


FIG. 4C

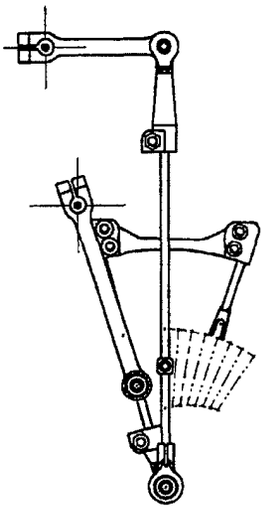


FIG. 5A

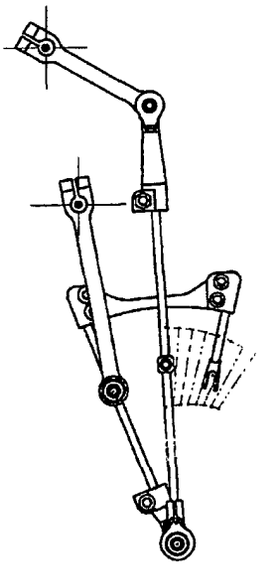


FIG. 5B

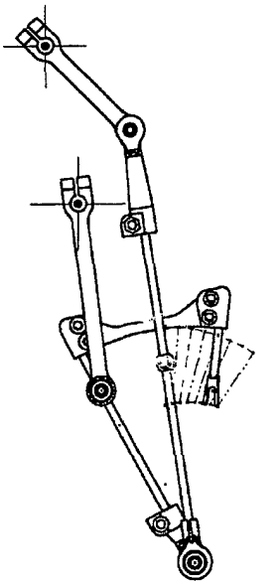


FIG. 5C

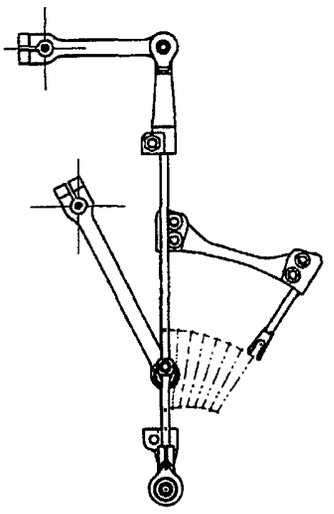


FIG. 6A

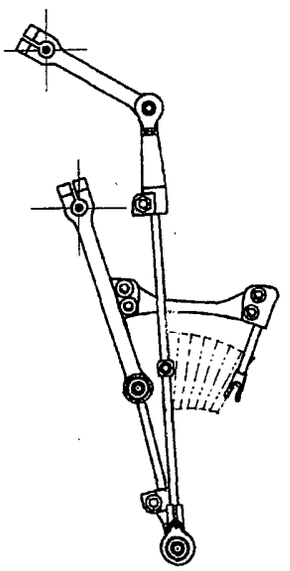


FIG. 6B

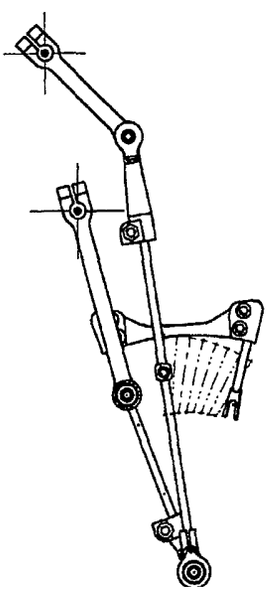


FIG. 6C

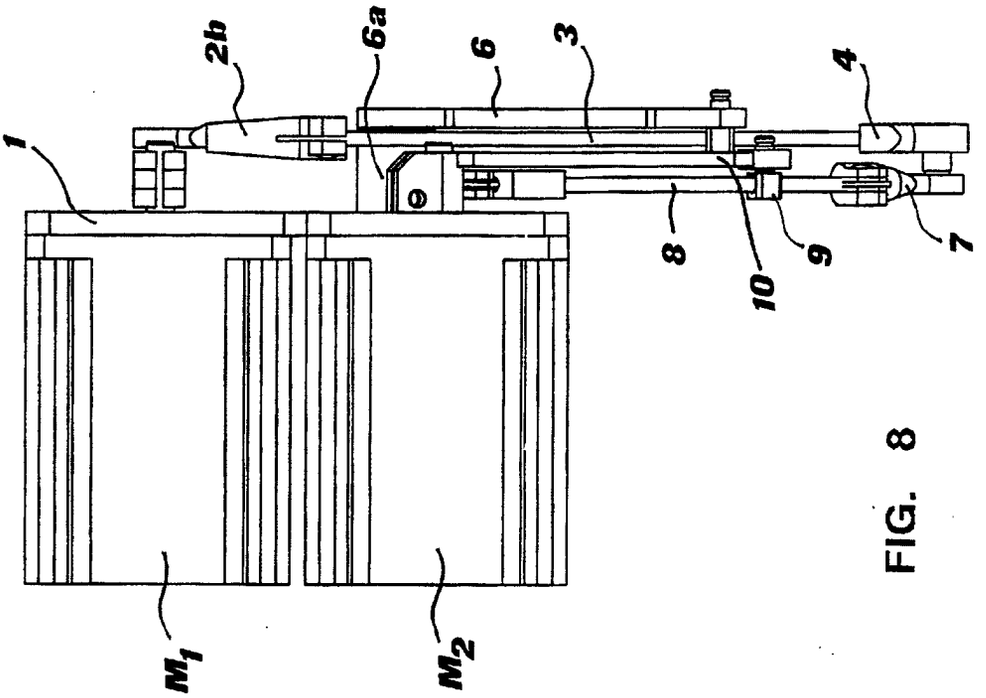


FIG. 8

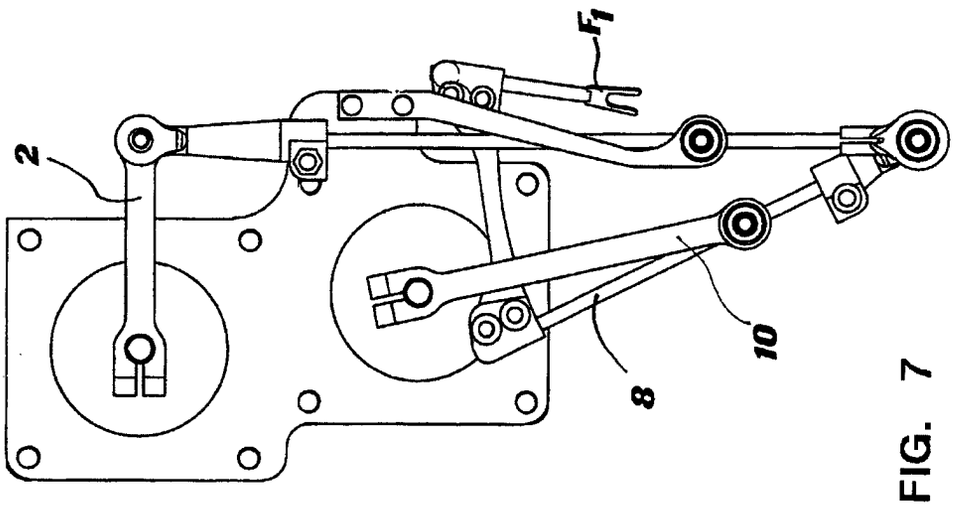


FIG. 7

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 03 42 5453

DOCUMENTS CONSIDERED TO BE RELEVANT

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Place of search	Date of completion of the search	Examiner
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CATEGORY OF CITED DOCUMENTS

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