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(54) IMPROVED MOTOR-DRIVEN GRIPPER OPENING DEVICE

(57) The invention relates to a gripper-opening device for grippers of a weaving loom, comprising a shaped-profile slider (3), capable of engaging with an operating lever of a weaving gripper and movable at least in a direction parallel to the motion of the gripper by means of a driving motor (8), between said motor (8) and the slider (3) there being provided connection means (4, 5, 6, 7, 9) in the form of an exact straight-line guide mechanism (7) whose control pin (9) is pivoted to a base (4) rigidly linked to the slider (3).

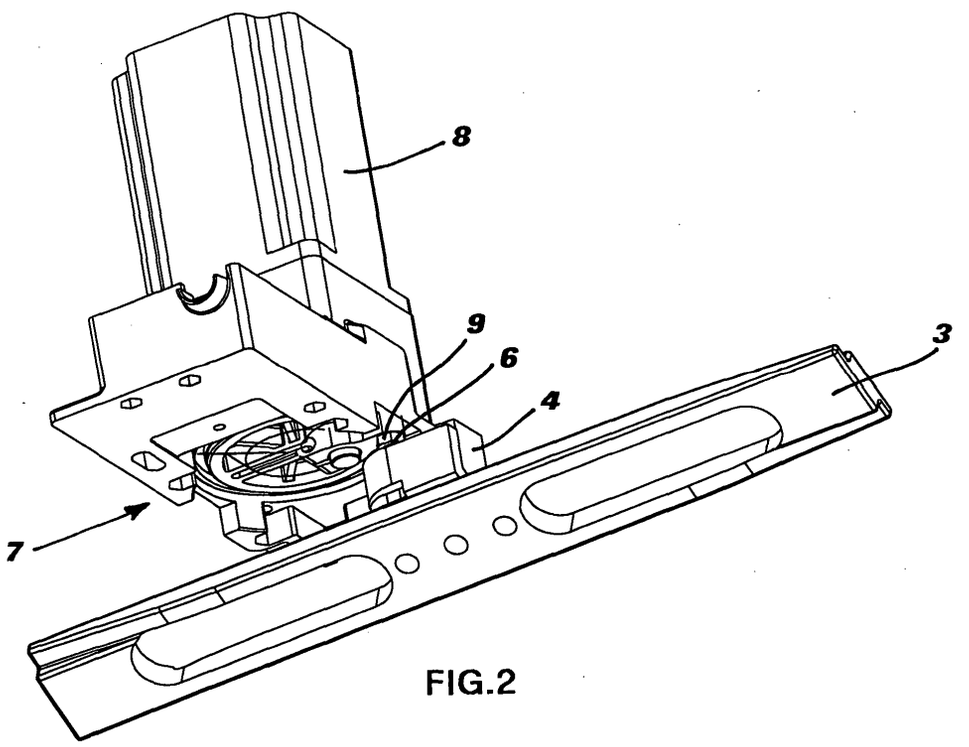


FIG.2

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Description

[0001] The present invention relates to a gripper-opening device for weaving looms, in particular to a motor-driven gripper opening device.

[0002] As known, in gripper weaving looms the weft thread is inserted into the warp shed by a pair of grippers, a carrying one and a drawing one. One of the most sensitive issues affecting the operation of the drawing gripper, however, relates to the weft opening and releasing system.

[0003] In fact, in order to obtain an even edge of the fabric and, at the same time, for the weft thread to always be inserted properly tensioned to avoid defects in the fabric, it is required that the position and the release time of the weft thread from the engagement with the drawing gripper be determined in a thorough and repeatable manner.

[0004] The drawing gripper is opened, in a manner known per se, by means of a gripper-opening device, substantially consisting of a cam device or other reference device engaging with a corresponding element of the gripper during its travel, causing the opening of the gripping system. In order to achieve the aforementioned result, it is required that the intervention position of such gripper-opening device be adjusted as necessary.

[0005] In modern looms, where the need exists to easily adjust gripper opening device operation to the weft thread changes, so-called motor-driven gripper opening devices are employed.

[0006] A motor-driven gripper-opening device allows to flexibly adjust the opening time and position of the drawing gripper, without having to manually modify the mounting position of the gripper-opening system.

[0007] Such a device is disclosed, for example, in W097/40218. There, a gripper-opening device is disclosed in the form of a shaped slider, which is capable of being shifted backwards and forwards, in the gripper movement direction, by means of an electric motor. The rotary control of the driving shaft is transformed in a reciprocating rectilinear movement by means of a kinematic mechanism mode of interconnected small rods. This system, however, is space-consuming in a direction perpendicular to the weaving plane, due to the presence of the rod-and-crank kinematic mechanism, which extends below the weaving plane by a substantial measure.

[0008] The kinematic mechanism using rods is necessarily exposed to the outer environment which, as known, is dusty and full of threads, especially in the area of the loom where the gripper is moved back to upon thread insertion, which tends to affect the mechanism resulting in an increased risk of jamming or malfunctioning.

[0009] Besides, this solution relies on a labile and rather complex kinematic mechanism, and is therefore intended to operate in substantially stationary conditions, for example upon changing the weft thread.

[0010] Again, the entire travel of the gripper-opening slider is accomplished by a very small rotation (certainly smaller than 90°) of the driving shaft, which goes to the detriment of control accuracy.

[0011] For the above-detailed reasons, this mechanism is not considered suitable, also because it was observed that there is a need to vary the condition of the gripper opening device precisely and dynamically. For example, with the current gripper opening device a conflict relating to the adjustment of the intervention time exists between the steady running mode and the slow running condition; in steady running mode, as a matter of fact, the elastic deformations of the gripper control, due to inertia forces, cause an anticipation in the opening of the gripper compared with what happens in the slow running condition: since adjustment is optimised for the steady running condition (to minimise weft misinsertions), in the slow running condition an anticipated opening of the gripper occurs which may lead to defects in the fabric.

[0012] Thus, it is an object of the present invention to provide a gripper-opening device which is compact and has a sufficiently rigid control mechanism to be capable of operating precisely even in dynamic conditions and such that the whole stroke of the gripper opening slider is accomplished by means of a motor rotation greater than 90°, in order to exploit an increased control accuracy.

[0013] Such objects are achieved, according to the invention, by means of a gripper-opening device as described in its essential features in the attached main claim.

[0014] Further inventive features of the gripper opening device are described in the dependent claims.

[0015] Further features and advantages of the device according to the invention will become more apparent from the following detailed description, given by way of example and taken in conjunction with the accompanying drawings, wherein:

[0016] fig. 1 is a perspective bottom view of the rear side of the gripper-opening device according to the invention;

[0017] fig. 2 is a view as shown in fig. 1 with the support bracket missing;

[0018] fig. 3 is a view as shown in fig. 2 with a further transmission component missing;

[0019] fig. 4 is a front elevation view of the device shown in fig. 1;

[0020] fig. 5 is an elevation rear view of the device shown in fig. 1;

[0021] fig. 6 is a plan bottom view of the device shown in fig. 5; and

[0022] fig. 7 is a top plan view of the device shown in fig. 5.

[0023] In a weaving loom, a support rail (not shown) is provided to guide a drawing gripper (not shown) and to support a respective gripper-opening device 1.

[0024] This latter device consists of, in a manner

known per se, a sliding bracket 2 supporting and guiding an adjusting slider 3. The slider has a shaped edge capable of, according to a substantially known method, progressively engaging with a gripper-opening lever causing the opening of the gripping elements and the release of the weft thread.

[0025] The slider 3 slides backwards and forwards on the bracket 2, in the running direction of the gripper. The slider 3 has a fixed position (except for the clearance required for the sliding motion) on the bracket 2 perpendicularly to the movement direction of the gripper.

[0026] From the bracket 2 projects a fixing base 2a, by means of which the whole device is fixed to the aforementioned support rail. The base 2a is fixed to the loom in a transversally adjustable manner, i.e. perpendicularly to the gripper trajectory. For example, the base has slots 2a' which are eccentric with respect to a threaded hole where a cam knob (not shown) is screwed in.

[0027] This solution will not be further described, as it is substantially known in the field.

[0028] In this way it is possible to manually adjust the distance between the gripper and the opening slider 3, albeit constraining the latter to a purely longitudinal movement during normal operation. In fact, this "transversal" adjustment simply determines the extent of the gripper opening which, as known, must be as small as admitted by weft release requirements: should different wefts be introduced, such opening is adjusted according to the weft having the largest count.

[0029] The arrangement of bracket 2 and base 2a causes the slider 3, as well as the motor 8, to be inclined, with respect of the weaving plane. It is therefore provided that the same device may be mounted onto different embodiments of the bracket/base element, in order to adapt the attitude of the slider to the specific gripper employed. There are grippers, in fact, requiring the slider to slide on a parallel plane (for example, the loom AlphaGFG™ marketed by Prematech S.p.A.), or on an orthogonal plane (for example, the loom AlphaMFG™ marketed by Prematech S.p.A.), or with a slope of about 45° (for example, the loom Leonardo® marketed by Prematech S.p.A.) with respect of the sliding plane of the gripper itself: for each of them, evidently, the bracket/base assembly will have to be chosen accordingly.

[0030] Besides, according to the invention, on one side of the slider 3, preferably near its middle area, a control head 4 projects, which ends with a plane pivot hinge 6 in its upper portion.

[0031] An exact straight-line guide mechanism 7 (referred to also in the following, this type of mechanism being well-represented in EP 893,522 in the name of the same Applicant), equipped with a respective motor 8, is also mounted onto the bracket 2 and engages with its control pin 9 in the plane pivot hinge 6.

[0032] In particular (see fig. 3), the gear box containing the straight-line guide mechanism 7 is mounted at one end of the motor 8, and its plan perimeter - as well as the rectilinear path of the control pin - may be inscribed in the motor plan perimeter. This results in an extremely compact motor/drive assembly.

[0033] With this design, the reciprocating rectilinear movement of the control pin 9 is capable of driving the slider 3 backwards and forwards obtaining the desired adjustment movement of the gripper-opening system in an extremely efficient way.

[0034] The motion law of the motor 8 can then be set and controlled by electronic control drive, which acts according to the logic implemented in suitable software. For example, position adjustment of the slider 3 and timing thereof on the basis of the loom cycle degrees (detectable by the main loom encoder, or by a suitable additional sensor) may be defined in a table according to the weaving parameters involved (fabric height, loom speed, weft count, and so on). The table can be built on a theoretical basis and then corroborated and/or adjusted by field trials.

[0035] A further type of control adjustment may be carried out on the basis of feedback, according to the reading of the weft thread release time (highlighted for example by the weft tension development detected by the weft feeler): the statistical processing of this parameter can be used, for example, to correct the drift of the weft release time due to wear of the slider shim 3. The main control and feedback correction thereof may later be built into a database by means of which the setting data of an item may be transferred from one loom to the other to form a knowledge base which can benefit many users, for example through a central surveillance and control system as described in the European Patent application no. 02425574 in the name of the same Applicant.

[0036] The advantages of the arrangement described here are immediately apparent.

[0037] Firstly, the exact straight-line guide device 7 and the corresponding motor 8 are suitably tilted, which drastically limits the space they occupy on the horizontal or transversal plane. Furthermore, the synergistic coupling of the exact straight-line guide drive and the gripper-opening slider, with no connecting rods hinged to one another, is extremely compact and rigid.

[0038] On one hand, thus, this system allows precise control even in dynamic conditions. For example, the slider 3 may be quickly displaced to delay gripper opening at the time when slow running of the loom is required.

[0039] Moreover, on the other hand, this system is not subject to jamming due to an unfavourable environment. Amongst other things, the control pin of the exact straight-line guide mechanism can be easily protected during its motion along a straight-line track by a suitable shielding, to prevent dirt from penetrating inside the sensitive transmission mechanisms, with the further benefits of an enhanced duration of the device and jam-free operation thereof.

[0040] The compactness of the exact straight-line transmission system also leads to decreased space occupation.

[0041] Finally, by originally exploiting the exact straight-line guide mechanism for this specific application, it is possible to obtain a full stroke of the slider 3 with a wide rotation of the motor 8, even up to 180°, which goes to the benefit of control precision.

[0042] Since even a full rotation of the motor is allowed, according to the current status, the motor control software may even decide whether it is more convenient to perform a certain slider travel by rotating the motor in one sense or in the opposite one. As a matter of fact, it is the logic implemented in the control software which establishes - on the basis of the current position x and of the final position x+n that the slider is to assume to open the gripper in the subsequent loom cycle - whether to continue the rotation in the same sense or whether to reverse it, so that the least time is employed and so as to be in a stationary condition when the gripper arrives.

[0043] As can be guessed from the previous description, the objects described in the preamble are perfectly achieved by the device according to the invention.

[0044] Thanks to the rigidity of the transmission chain and to the original gripper opening system arrangement, stationary and dynamical adjustments of the gripper-opening control may be performed; furthermore, thanks to the original compact design, space occupation is drastically limited. Finally, the presence of the exact straight-line guide transmission allows to achieve a high level of adjustment accuracy and little susceptibility to dirt.

[0045] It is understood, however, that protection of the invention described above is not limited to the particular embodiment illustrated here, but extends to any other equivalent embodiment.

[0046] In particular, although reference was always made to the opening function of the drawing gripper, it is evident that the same device is applicable, with suitable changes within the reach of any skilled person in the field, to the closing of the carrying gripper, too.

Claims

1. Gripper-opening device for grippers of a weaving loom, comprising a shaped-profile slider (3), capable of engaging with an operating lever of a weaving gripper and movable at least in a direction parallel to the motion of the gripper by means of a driving motor (8), connection means being provided between said motor (8) and the slider (3), **characterised in that** said connection means (4, 6, 7, 9) are in the form of an exact straight-line guide mechanism (7) whose control pin (9) is pivoted at a head (4) rigidly linked to said slider (3).

2. Gripper-opening device as claimed in claim 1), wherein said control pin (9) is moveable by a reciprocating rectilinear motion in a direction parallel to the displacement direction of said slider (3).

3. Gripper-opening device as claimed in claim 1) or 2), wherein said slider (3) is moveably supported with an adjustable attitude according to the opening plane of said gripper-operating lever.

4. Gripper-opening device as claimed in claim 1), 2) or 3), wherein said motor (8) and slider (3) are mounted on a common support bracket (2) which is in turn fixed onto the weaving loom in a transversally adjustable manner in respect of the motion of said gripper.

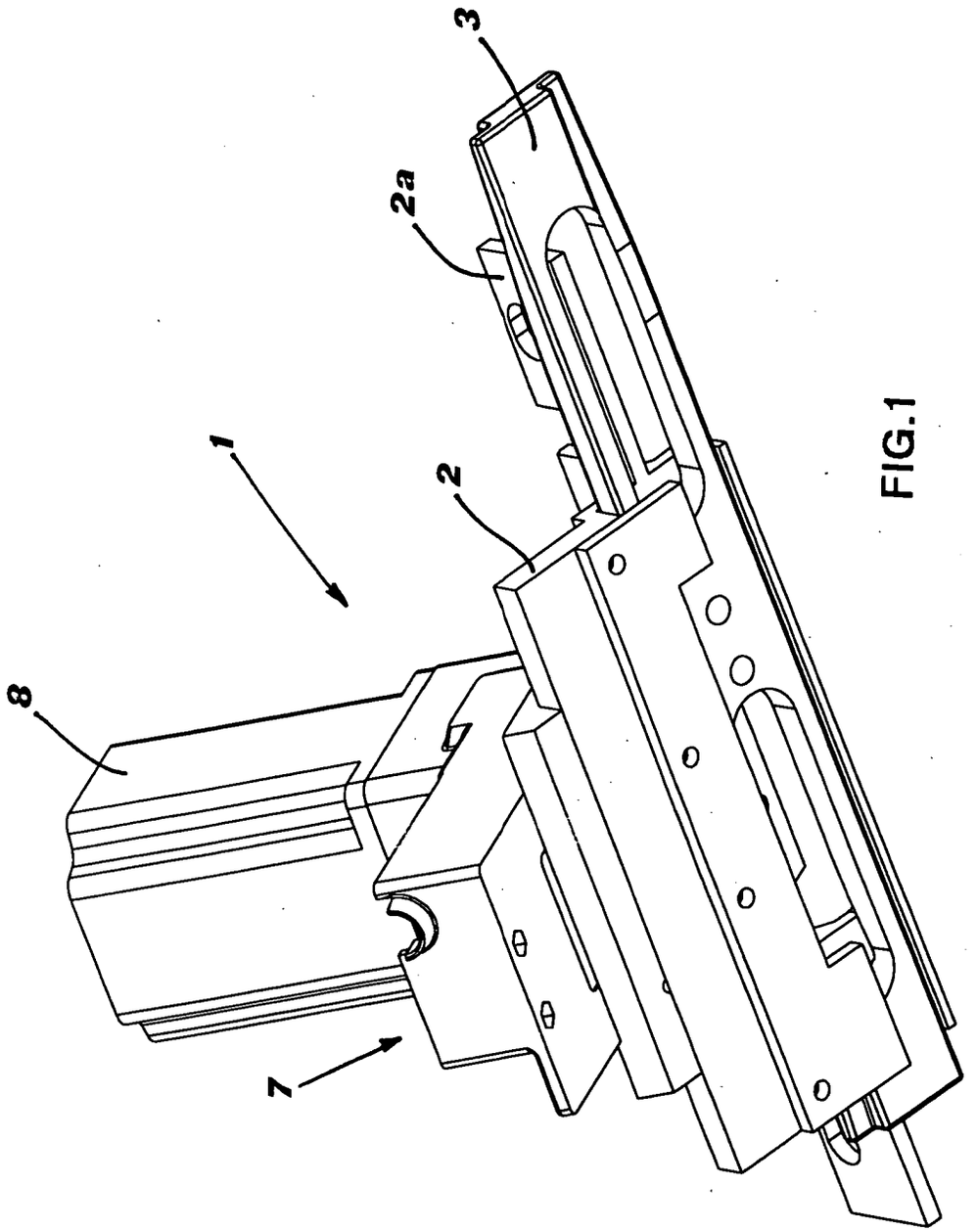


FIG.1

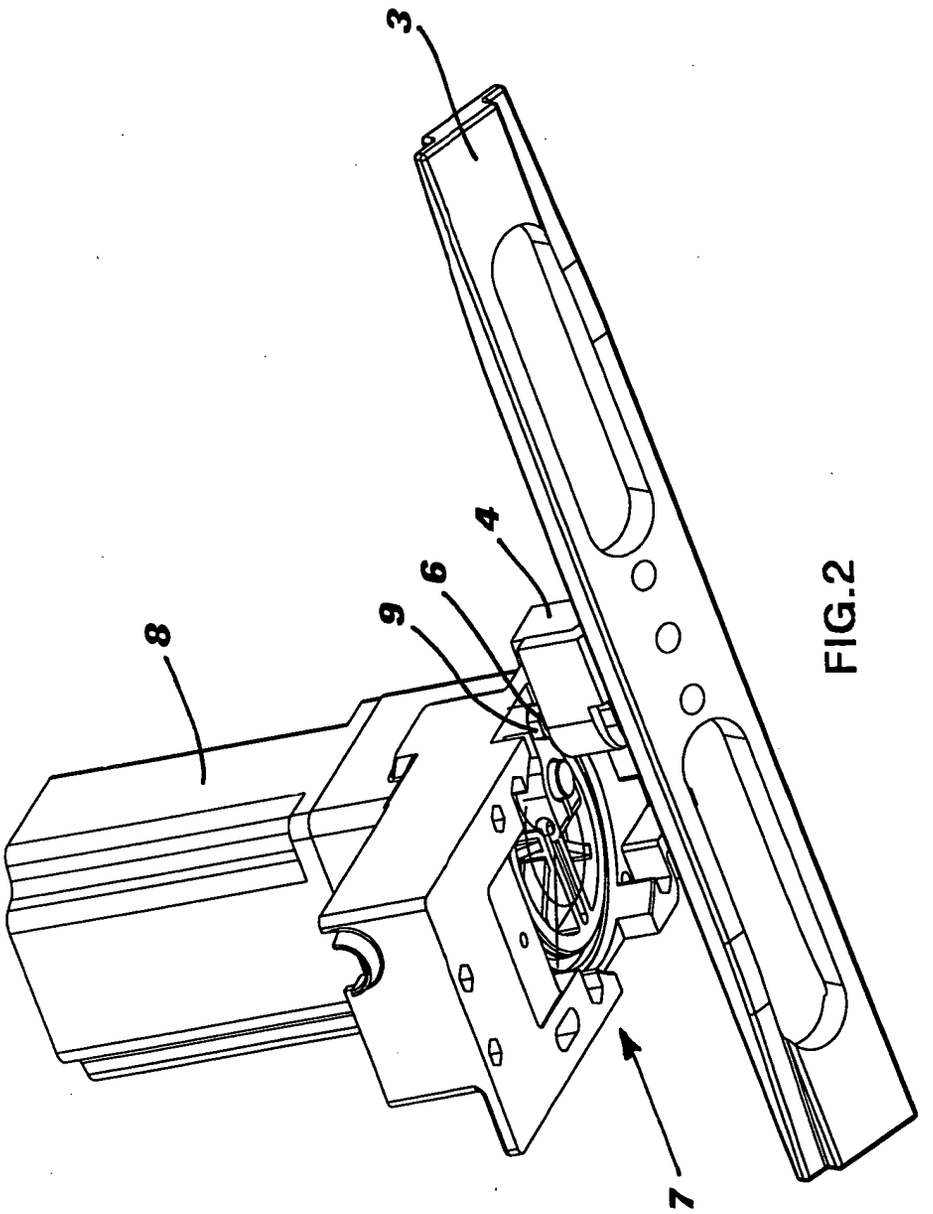


FIG.2

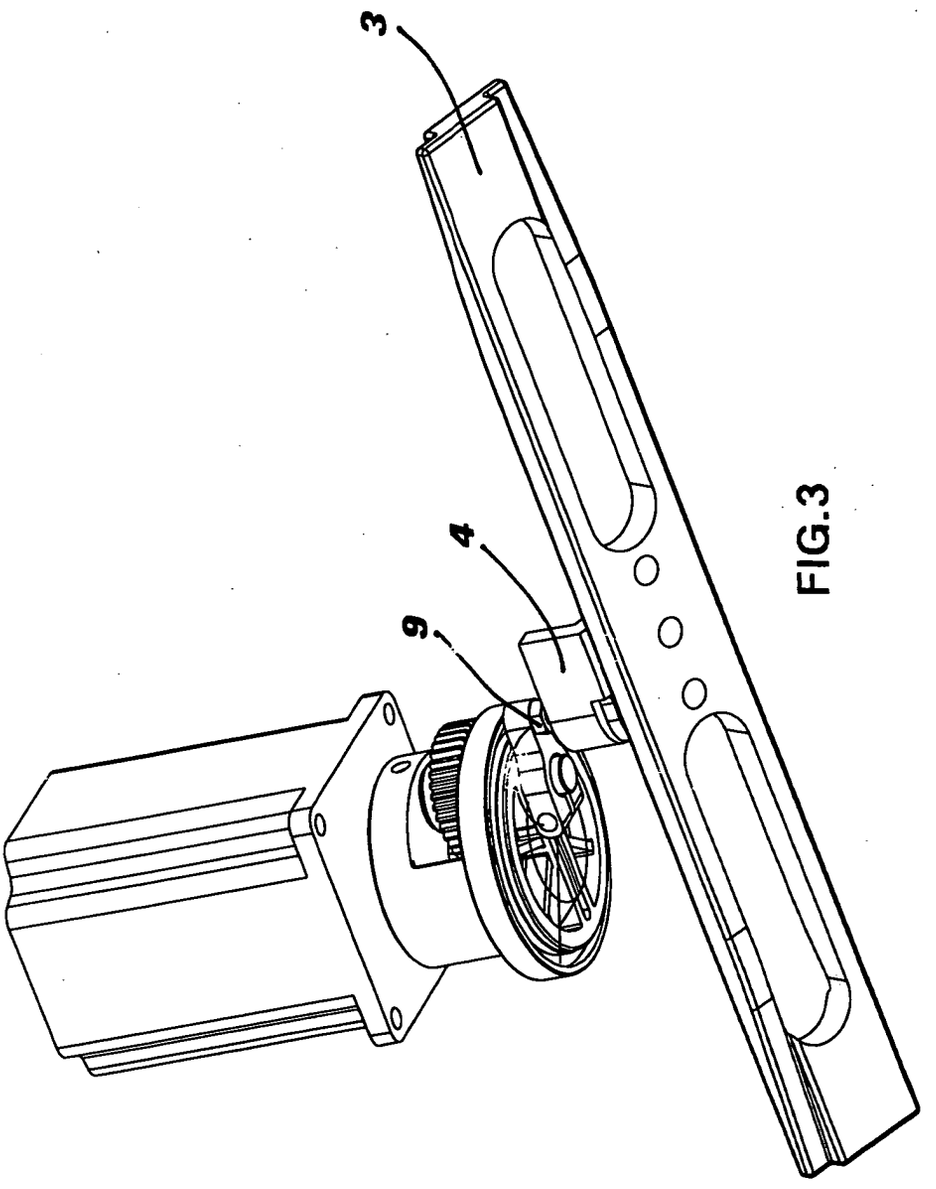


FIG.3

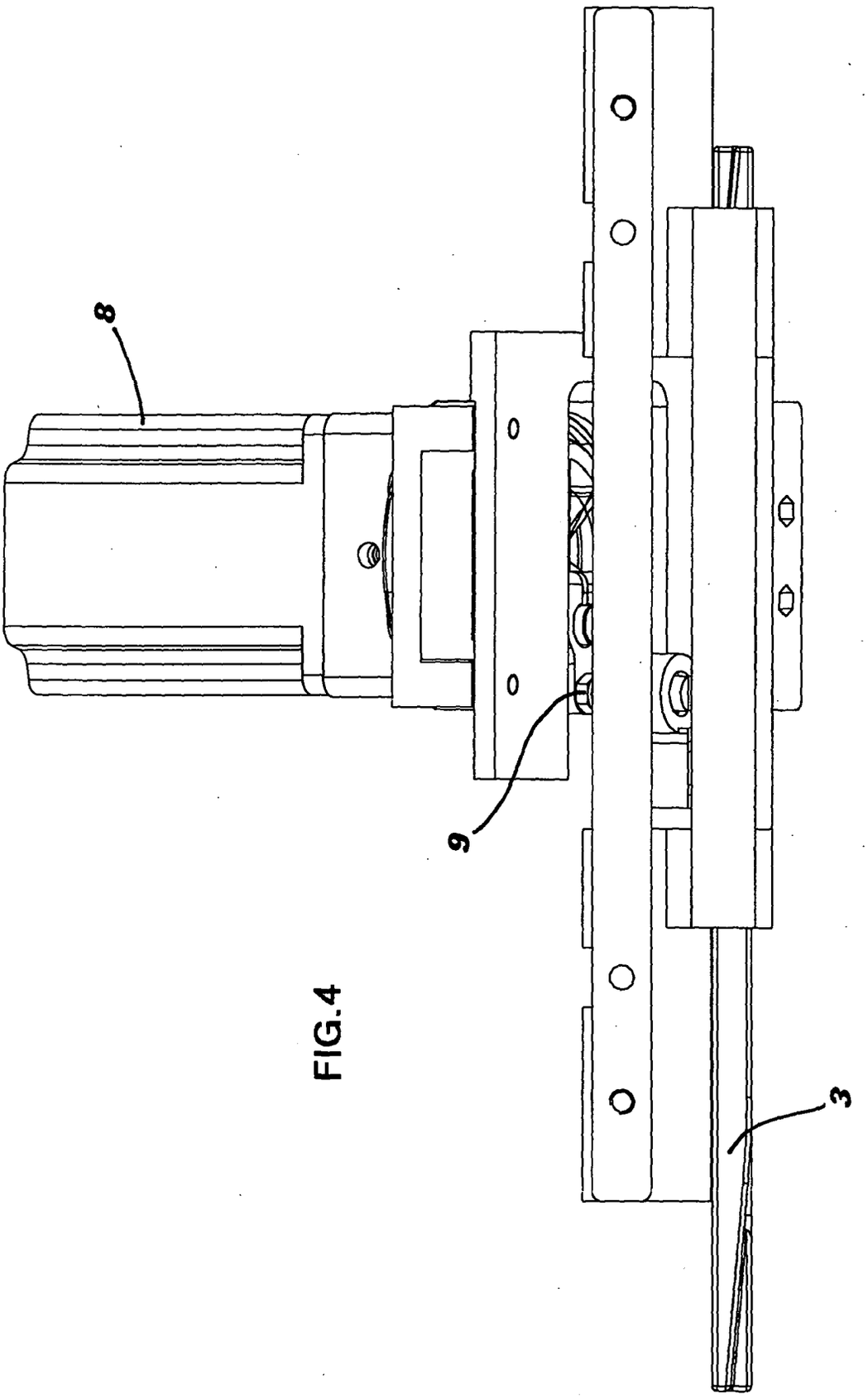


FIG.4

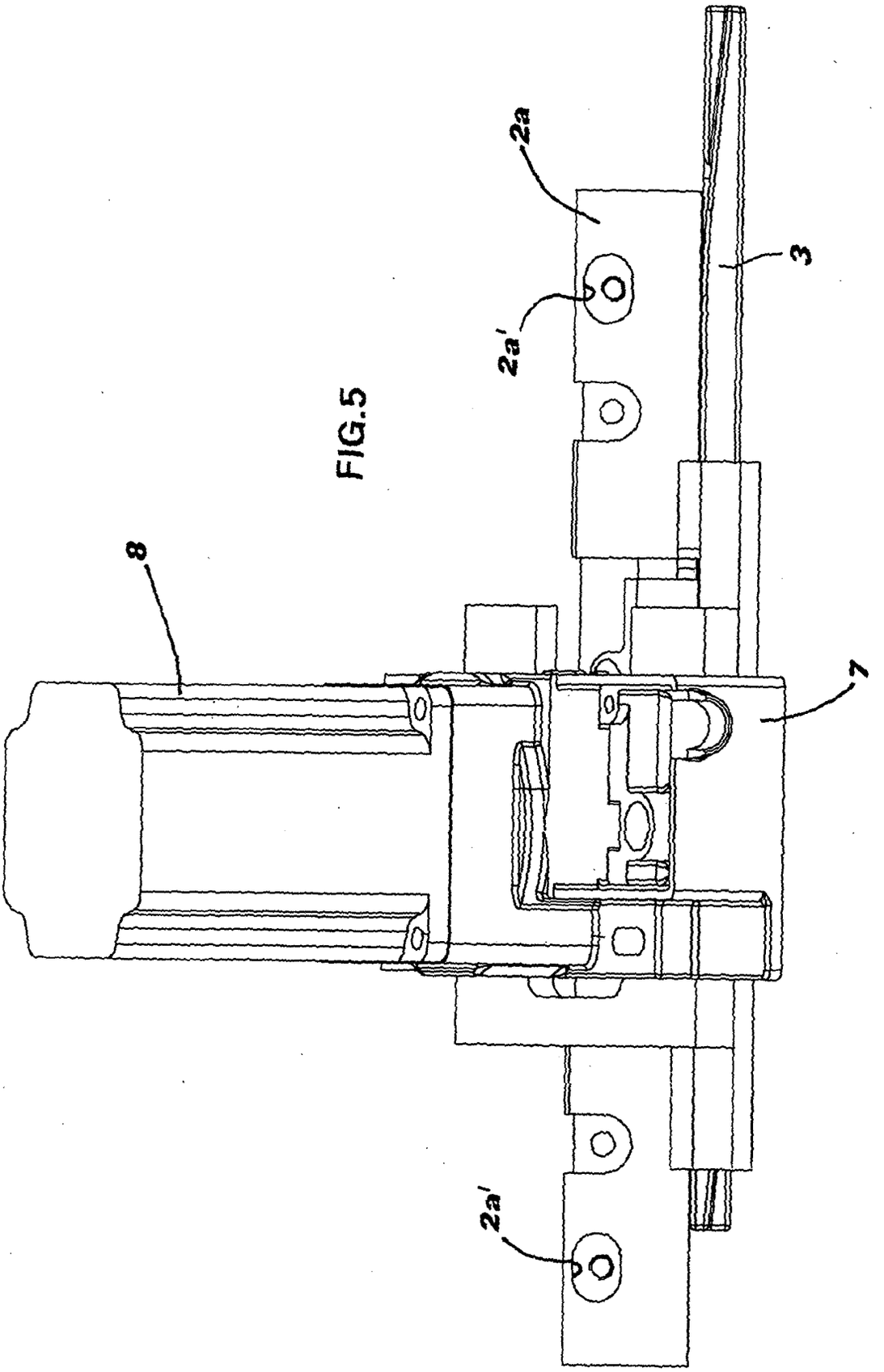


FIG.5

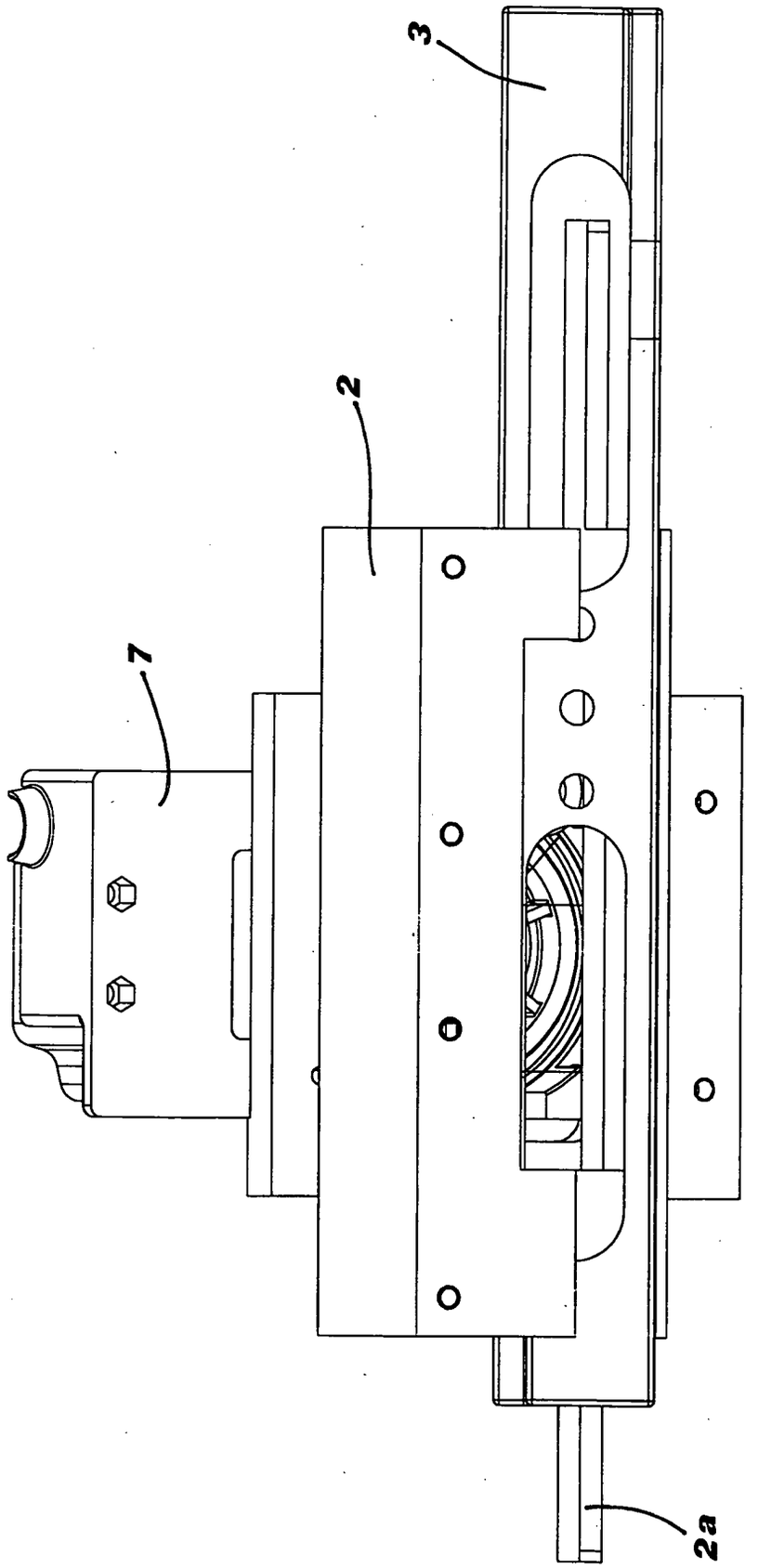


FIG.6

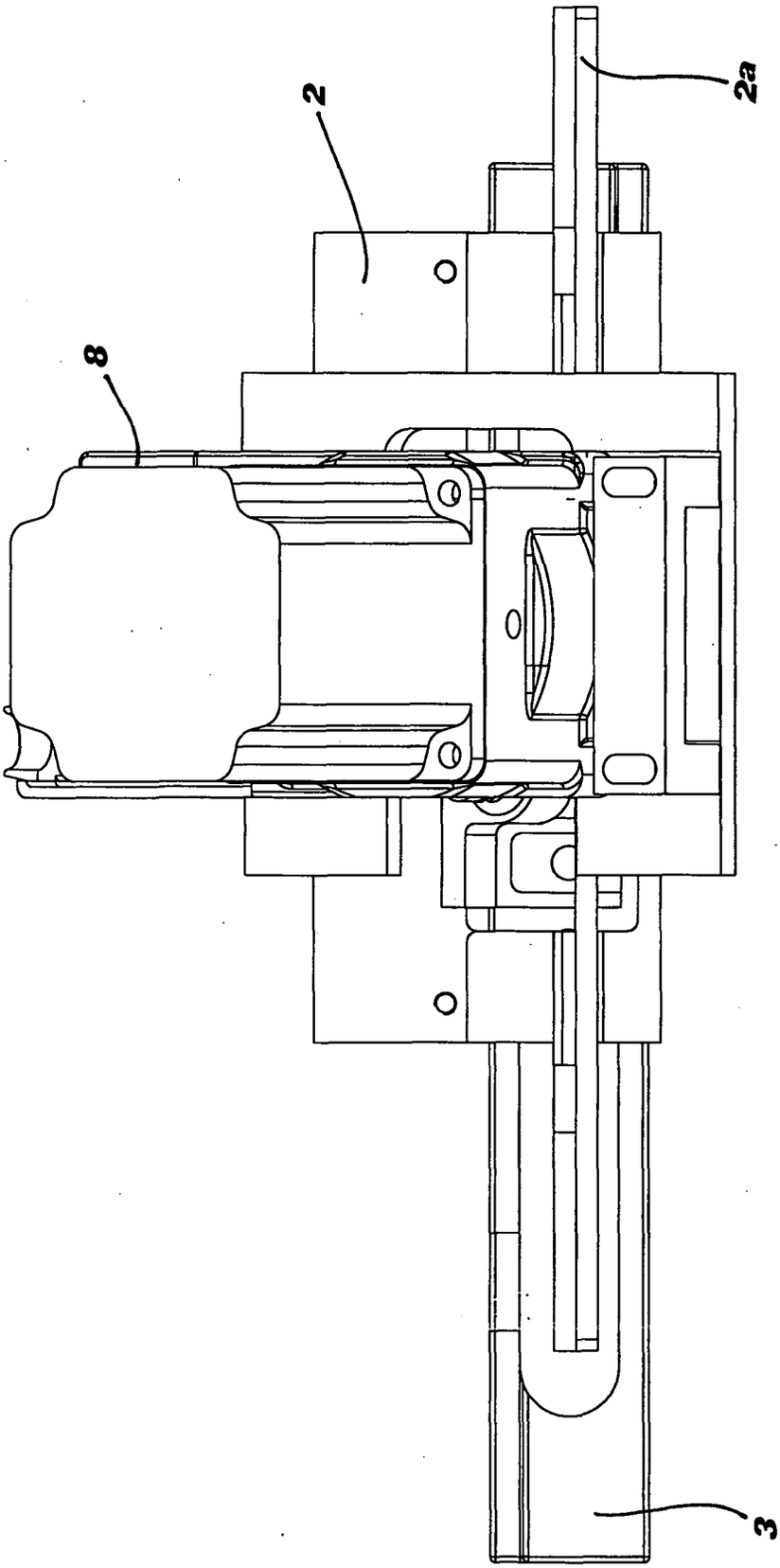


FIG.7