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Remarks:
Amended claims in accordance with Rule 137(2) EPC.

(54) **Abutting apparatus of a spring manufacturing machine**

(57) The invention provides an abutting apparatus (2) of a spring manufacturing machine (1), wherein the spring manufacturing machine (1) has a machine platform (10), while the abutting apparatus (2) comprises a fist and second axial transmission mechanism (20, 30) and an abutting assembly (40). The first axial transmission mechanism (20) comprises a first actuator (21), a first lead screw (22) and a first sliding seat (23) engaging with the first lead screw (22). The second axial transmission mechanism (30) comprises a second actuator (31) fixed to the first sliding seat (23), a second lead screw (32) driven to be rotated by the second actuator (31) and a second sliding seat (33) engaging with the second lead screw (32) and configured to be linearly moved relatively to the first sliding seat (23). Via the first and second axial transmission mechanisms (20, 30), the abutting assembly (40) fixed to the second sliding seat (33) can perform a 2-D movement in vertical and/or horizontal directions relative to the machine platform (10), such that the degree of freedom to adjust the abutting assembly (40) can be enhanced significantly.

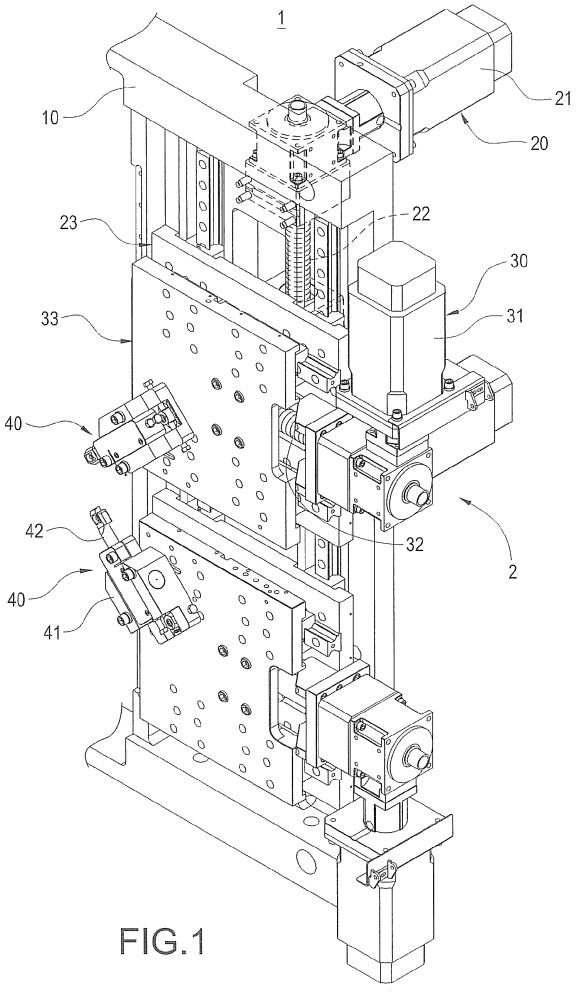

FIG.1

EP 2 324 940 A1

Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention in general relates to an abutting apparatus, in particular, to an abutting apparatus of a spring manufacturing machine.

Description of Prior Art

[0002] According to the prior art, common spring manufacturing machines all have a so-called abutting apparatus adapted for forming a wire into the configuration of a coil spring by means of abutment with a wire forming tool. During the process of forming a coil spring or curled spring, wire is fed into the spring manufacturing machine via a feeding mechanism; in the meantime, an abutting apparatus is adapted for curling the wire into a spring, in particular a coil spring; finally, a cutting knife apparatus is applied to cut off the wire to complete the procedure of manufacturing a coil spring or curled spring. During the process, the function of the abutting apparatus is to curl a linear wire into a curled spring by abutment with a wire forming tool. According to common practices, a spring manufacturing machine usually has two abutting assemblies arranged corresponding to each other at two sides thereof. By adjusting the positions of these two abutting assemblies it is possible to properly adjust the magnitude of the radius of the coil spring.

[0003] According to the prior art, the abutting apparatus of a spring manufacturing machine usually includes a sliding seat and an abutting unit connected to be slidable on the sliding seat, such that the abutting unit can make a 1-D linear movement in an oblique direction relative to the spring manufacturing machine, whereby the magnitude of the radius of the manufacture coil spring can be adjusted. However, with such an abutting apparatus not only the degree of freedom is insufficient, but also it is uneasy for the purpose of adjustment, when a 1-D linear movement is used to adjust the obliqueness relative to the spring manufacturing machine and to thereby properly adjust the magnitude of the radius of the coil spring to be manufactured.

[0004] Therefore, another kind of abutting apparatus for a spring manufacturing machine has been developed, in which not only the abutting unit can make an oblique motion relative to the spring manufacturing machine, but the abutting apparatus can also make a vertically linear motion in one dimension relative to the spring manufacturing machine. However, this kind of linear movement in two directions is still inadequate to adjust the positions of the abutting unit. In this prior art, the abutting unit can only make a small adjustment of the position relative to the spring manufacturing machine. Besides, the two abutting units of the spring manufacturing machine can also make two independent 2-D motions, whereby the positions of the abutting units relative to the wire feeding axle of the spring manufacturing machine can be adjusted at random, which indeed causes an inadequate flexibility in terms of the process of manufacturing a coil spring.

[0005] Accordingly, after a substantially devoted study, in cooperation with the application of relative academic principles, the inventor has finally proposed the present invention designed reasonably to possess the capability to improve the drawbacks of the prior arts significantly.

SUMMARY OF THE INVENTION

[0006] Therefore, in order to solve aforementioned problems, a primary objection of the present invention is to provide an improved abutting apparatus of a spring manufacturing machine. Via a first and second axial transmission mechanisms, the abutting assembly can be randomly moved in vertical and/or horizontal directions relative to the machine platform, such that the degree of freedom to adjust the abutting assembly can be enhanced significantly.

[0007] A second objective of the present invention is to provide an improved abutting apparatus of a spring manufacturing machine, in which the spring manufacturing machine has a machine platform, while the abutting apparatus comprises a fist and second axial transmission mechanism and an abutting assembly. The first axial transmission mechanism comprises a first actuator, a first lead screw driven by the first actuator to rotate and a first sliding seat engaging with the first lead screw and being capable to perform a linear movement relative to the machine platform. The second axial transmission mechanism comprises a second actuator fixed to the first sliding seat, a second lead screw driven to be rotated by the second actuator and a second sliding seat engaging with the second lead screw and being configured to be moved linearly relative to the first sliding seat. Via the first and second axial transmission mechanisms, the abutting assembly fixed to the second sliding seat can perform a 2-D movement in vertical and/or horizontal directions relative to the machine platform as desired and in accordance with the geometrical configuration of the coil spring to be manufactured.

[0008] According to another embodiment the present invention provides an abutting apparatus of a spring manufacturing machine, in which the spring manufacturing machine has a machine platform and a spring wire feeding axle, while the abutting apparatus comprises a pair of first axial transmission mechanisms, a pair of second axial transmission mechanisms and a pair of abutting assemblies. The pair of first axial transmission mechanisms, which are respectively formed at an upper and lower sides of a central line of the spring wire feeding axle, are of substantially identical configuration and each comprises a first actuator fixed to the machine platform, a first lead screw driven by the first actuator to rotate and

a first sliding seat engaging with the first lead screw and being capable to perform a linear movement relative to the machine platform. Each of the pair of second axial transmission mechanisms comprises a second actuator fixed to the first sliding seat, a second lead screw driven to rotate by the second actuator and a second sliding seat engaging with the second lead screw and linearly moved relatively to the first sliding seat. Via the pair of first axial transmission mechanisms and the pair of second transmission mechanisms, the pair of abutting assemblies respectively fixed to the second sliding seat can independently make a 2-D movement in vertical and horizontal directions relative to the machine platform.

[0009] In comparison with the prior art, the invention accomplishes in particular the following functions and advantages. Firstly, the drawback of the spring manufacturing machines according to the prior art, according to which the abutting apparatus can only be adjusted by a linear movement in a single direction, can be overcome according to the present invention by an arbitrarily adjustable 2-D movement in vertical and/or horizontal directions, so that according to the present invention the positions of the abutting assemblies can be conveniently adjusted relative to the machine platform and the spring wire feeding axle to enhance the flexibility in the spring manufacturing process. Secondly, since the pair of abutting assemblies can be moved independently and simultaneously to thereby enable many different directions of movement, coil springs with a more complicated 3-D configuration can be manufactured. Thirdly, the first and second transmission mechanisms can enhance the variability of the locations and angles of the movement of the abutting assemblies. Fourthly, since the first and second axial transmission mechanisms can be moved in a linear motion, according to the present invention a more accurate positioning can be achieved and it is easier in terms of operation. Finally, the movement of the pair of abutting assemblies can be respectively and independently controlled by using a computer, so that according to the present invention the flexibility in manufacturing the spring can be enhanced significantly and the difficulty of configuration can be also lowered down in great scale.

BRIEF DESCRIPTION OF DRAWINGS

[0010] The features of the invention believed to be novel are set forth with particularity in the appended claims. The invention itself, however, may be best understood by reference to the following detailed description, which describes a number of embodiments of the invention, taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a perspective outer view according to the present invention;

Fig. 2 is a perspective view from another viewing angle according to the present invention;

Fig. 3 is a perspective view (1) according to the present invention;

Fig. 4 is a perspective view (2) according to the present invention;

Fig. 5 is an actuating illustration (1) by viewing from the front of the invention;

Fig. 6 is an actuating illustration (2) by viewing from the front of the invention;

Fig. 7 is an actuating illustration (3) by viewing from the front of the invention;

Fig. 8 is a front view according one preferable embodiment of the present invention;

Fig. 9 is another front view according to one preferable embodiment of the present invention;

Fig. 10 is a perspective outer view according to another preferable embodiment of the present invention;

Fig. 11 is an actuation status illustration (1) of a cross-sectional view along the line "11-11" in Fig. 10; and

Fig. 12 is an actuation status illustration (2) of a cross-sectional view along the line "11-11" in Fig. 10.

DETAILED DESCRIPTION OF THE INVENTION

[0011] In cooperation with attached drawings, the technical contents and detailed description of the present invention are described thereinafter according to a number of preferable embodiments, not used to limit its executing scope. Any equivalent variation and modification made according to appended claims is all covered by the claims claimed by the present invention.

[0012] Please refer to Fig. 1 and Fig. 2, which respectively are a perspective outer view of the abutting apparatus according to the present invention and a perspective outer view from another viewing angle of the abutting apparatus according to the present invention. The invention is to provide an abutting apparatus 2 of a spring manufacturing machine, wherein the spring manufacturing machine 1 has a machine platform 10 and a spring wire feeding axle 11 (as shown in Fig. 8). The abutting apparatus 2 includes a pair of first axial transmission mechanisms 20, a pair of second axial transmission mechanisms 30 and a pair of abutting assemblies 40 configured to curl a linear metal wire into a curled spring or coil spring by means of abutment of the wire against a wire forming tool.

[0013] The pair of first axial transmission mechanisms 20 are respectively formed at an upper and lower side of a central line of the spring wire feeding axle 11 and are of substantially identical configuration. In the meantime, the first axial transmission mechanism 20 includes a first actuator 21 fixed to the machine platform 10, a first lead screw 22 driven by the first actuator 21 to rotate and a first sliding seat 23 connected to the first lead screw 22 and able to make a linear movement relative to the machine platform 10.

[0014] The pair of second axial transmission mechanisms 30 are of substantially identical configuration and

respectively include a second actuator 31 fixed to the first sliding seat 23, a second lead screw 32 driven by the second actuator 31 to rotate and a second sliding seat 33 connected to the second lead screw 32 and can make a linear movement relative to the first sliding seat 23.

[0015] The pair of abutting assemblies 40 are respectively fixed to the second sliding seat. Via the first axial transmission mechanism 20 and the second axial transmission mechanism 30, the abutting assembly 40 can perform vertical and horizontal movements, in particular linear movements in vertical and horizontal directions, relative to the machine platform 10. In addition, the abutting assembly 40 includes a fixing seat 41 fixed to the second sliding seat 33 and an abutting telescopic rod 42 screwed with the fixing seat 41, such that the abutting telescopic rod 42 can make an oblique movement relative to the second sliding seat 33 to adjust the position thereof:

[0016] Furthermore, the first actuator 21 and the second actuator 31 can be a stepping motor or a servo motor; however, the present invention shall not be limited to these two kinds of exemplary embodiments only.

[0017] Please refer to Fig. 3 and Fig. 4, which respectively are a perspective view (1) and a perspective view (2) of the abutting apparatus according to the present invention. Please study these drawings together with Fig. 2. The first sliding seat 23 includes a first plate body 231 and a first nut 232 connected fixedly to the first plate body 231 and screwed with the first lead screw 22 correspondingly.

[0018] The second sliding seat 33 includes a second plate body 331 and a second nut 332 connected fixedly to the second plate body 331 and screwed with the second lead screw 32 correspondingly.

[0019] In addition, the first sliding seat 23 further includes a first sliding block 233 fixed to the first plate body 231 and located at the same side of the first nut 232. The first sliding block 233 is provided with a first sliding slot 2331. The machine platform 10, in the meantime, has a slide 12. The first sliding slot 2331 is configured for the slide 12 to be slid and inset therein.

[0020] The first sliding seat 23 also includes a first slide 234 connected fixedly to another side of the first plate body 231. The second sliding seat 33 includes a second sliding block 333 fixed to the second plate body 331 and located at the same side of the second nut 332. The second sliding block 333 is provided with a second sliding slot 3331 configured for the first slide 234 to be inset therein.

[0021] Please refer to Fig. 5 and Fig. 6, which respectively are an actuating illustration (1) and an actuating illustrate (2) by viewing from the front of the abutting apparatus according to the present invention. By moving the first axial transmission mechanism 20 relative to the machine platform 10, the abutting assembly 40 can be moved vertically. By moving the second axial transmission mechanism 30 relative to the first axial transmission mechanism 20, the abutting assembly 40 can be moved horizontally. By so doing, the abutting assembly 40 can be moved in a 2-D rectangular coordinate system. The degree of freedom to adjust the abutting assembly 40 can be thus enhanced.

[0022] More specifically, the pair of abutting assemblies 40 can be moved independently in a 2-D rectangular coordinate system. For example, when processing a linear metal wire to form a curled spring or a coil spring, the abutting assembly 40 is directed towards the spring wire feeding axle 11 (as shown in Fig. 8) and only performs a horizontal movement relative to the spring wire feeding axle 11 without any vertical movement. On the other hand, the abutting assembly 40 located above the spring wire feeding axle 11 then can perform a horizontal, vertical or oblique movement. An "oblique movement" mentioned here means that the tracks of the abutting assembly 40 can be linear or curved, including an are-shaped or parabola-shaped course of the guiding tracks.

[0023] Moreover, via the simultaneous actuations of the first axial transmission mechanism 20 and the second axial transmission mechanism 30, the abutting assembly 40 can be moved obliquely so that the wire forming tools can finally get into abutment with the linear metal wire to be curled to the desired coil spring. In other words, the movement of the abutting assembly 40 can be controlled at random, in accordance with the shape of the coil spring to be manufactured. For example, if the proportion between the rightward movement of the second sliding seat 33 and the upward movement of the first sliding seat 23 is 1:1, then the abutting assembly 40 will be moved to the right with a lifting angle of 45 degrees. If the proportion is 1: $\sqrt{3}$, then the abutting assembly 40 will be moved to the right with a lifting angle of 60 degrees. As will become apparent to a person skilled in the art, by means of the above configuration an arbitrary 2D-movement of the abutting assembly 40 can be achieved, which significantly enhances the degree of freedom in manufacturing coil springs.

[0024] Please refer to Fig. 7, which is illustrates possible exemplary movements of the abutting assemblies in an abutting apparatus of the present invention. As shown in this figure, the abutting assembly 40 located above the spring wire feeding axle 11 (as shown in Fig. 8) is moved obliquely, while another abutting assembly 40 directed towards the spring wire feeding axle 11 is moved horizontally.

[0025] Please refer to Fig. 8 and Fig. 9, showing two front views according to one preferred embodiment of the present invention. As shown in these two figures, a pair of first axial transmission mechanisms 20 and a pair of second axial transmission mechanisms 30 are arranged at an upper and lower side of the spring wire feeding axle 11, respectively. By moving the first axial transmission mechanisms 20 relatively to the machine platform 10 and moving the second axial transmission mechanisms 30 relatively to the first axial transmission mechanism 20, the position of the abutting assembly 40 can be changed, such that the magnitude of the radius

of the configured spring 50 can be determined and properly adjusted.

[0026] Please refer to Fig. 10 through Fig. 12, which separately are a perspective outer view, an actuation status illustration (1) and an actuation status illustration (2) of a cross-sectional view along the line "11-11" in Fig. 10 according to another preferred embodiment of the present invention. In this embodiment, the abutting assembly 40' includes a wire configuration knife seat 41', a wire configuration knife 42' pivoted to the wire configuration knife seat 41' and a driving block 43'.

[0027] The wire configuration knife seat 41' is fixed to the second sliding seat 33, while the driving block 43' is fixed onto the machine platform 10 (not shown in the figures) and abutted against one side of the wire configuration knife 42'. In this case, when the wire configuration knife seat 41' fixed to the second sliding seat 33 is moved relatively to the driving block 43', the wire configuration knife 42' can be swung relatively to the wire configuration knife seat 41'.

[0028] More specifically, one side of the wire configuration knife 42' is arranged a bearing 421'. The driving block 43' is arranged a lead slot 431' that is shown as an oblique configuration and provided for the bearing 421' to be slid therein. The relative movement between the second sliding seat 33 and the machine platform 10 can make the wire configuration knife 42' moved upwardly and downwardly in a third axial direction. Since the wire configuration knife 42' is swung in a third axial direction, a collision phenomenon can be avoided when the spring is configured by being fed out from the spring wire feeding axle 11 (as shown in Fig. 9).

[0029] Therefore, through the constitution of aforementioned assemblies, an abutting apparatus of a spring manufacturing machine according to the present invention is thus obtained.

[0030] Summarizing the aforementioned description, the abutting apparatus according to the present invention is an indispensable component for a spring manufacturing machine indeed, which may positively reach the expected usage objective for solving the drawbacks of the prior arts, and which extremely possesses the innovation and progressiveness to completely fulfill the applying merits of a new type patent, according to which the invention is thereby applied. Please examine the application carefully and grant it as a formal patent for protecting the rights of the inventor.

[0031] However, the aforementioned description only describes a number of preferred embodiments according to the present invention, but shall not be deemed to delimit the patent scope of the invention; to the contrary equivalent structural variations can be made to the contents of the present invention, for example, description and drawings, and shall all be covered by the claims claimed thereinafter.

Claims

1. An abutting apparatus of a spring manufacturing machine, said spring manufacturing machine (1) having a machine platform (10), said abutting apparatus (2) comprising:

   a first axial transmission mechanism (20), which comprises a first actuator (21) fixed to the machine platform (10), a first lead screw (22) driven by the first actuator (21) to rotate and a first sliding seat (23) coupled with the first lead screw (22) and capable of performing a linear movement relative to the machine platform (10);
   a second axial transmission mechanism (30), which comprises a second actuator (31) fixed to the first sliding seat (23), a second lead screw (32) driven by the second actuator (31) to rotate and a second sliding seat (33) coupled with the second lead screw (32) and capable to be moved linearly relative to the first sliding seat (23); and
   an abutting assembly (40 or 40'), which is fixed to the second sliding seat (33) and capable of performing a 2-D movement in vertical and/or horizontal directions relative to the machine platform (10) via the first axial transmission mechanism (20) and the second axial transmission mechanism (30).

2. The abutting apparatus according to claim 1, wherein the first sliding plate (23) comprises a first plate body (231) and a first nut (232) connected fixedly to the first plate body (231) and being in engagement with the first lead screw (22).

3. The abutting apparatus according to claim 1 or 2, wherein the second sliding seat (33) comprises a second plate body (331) and a second nut (332) connected fixedly to the second plate body (331) and being in engagement with the second lead screw (32).

4. The abutting apparatus according to any of the preceding claims, wherein the first sliding seat (23) is configured as a first sliding slot (2331) adapted for engaging with the machine platform (10) so that the first sliding seat (23) can be slidably moved relative to the machine platform (10).

5. The abutting apparatus according to claim 4, wherein the first sliding seat (23) further comprises a first slide (234) connected fixedly to the first plate body (231), and wherein the second sliding seat (33) is configured as a second sliding slot (3331) adapted for receiving and guiding a sliding movement of the first slide (234).

6. The abutting apparatus according to any of the preceding claims, wherein the abutting assembly (40) comprises a fixing seat (41) fixed to the second sliding seat (33) and an abutting telescopic rod (42) screwed with the fixing seat (41), and wherein the abutting telescopic rod (42) can make an oblique movement relative to the second sliding seat (33).

7. The abutting apparatus according to any of the preceding claims, wherein the abutting assembly (40') comprises a wire configuration knife seat (41'), a wire configuration knife (42') pivoted to the wire configuration knife seat (41') and a driving block (43'), and wherein the wire configuration knife seat (41') is fixed to the second sliding seat (33), while the driving block (43') is connected by abutting against one side of the wire configuration knife (42'), and wherein the wire configuration knife seat (41') is configured to be moved to thereby cause the wire configuration knife (42') swing in a third axial direction relative to the wire configuration knife seat(41').

8. The abutting apparatus of claim 7, wherein one side of the wire configuration knife (42') is provided with a bearing (421'), and wherein the driving block (43') is provided with a lead slot (431') adapted for the bearing (421') to be connected by sliding therein.

9. The abutting apparatus of claim 8, wherein the lead slot (431') has an oblique configuration.

10. The abutting apparatus of any of the preceding claims, further comprising:

another axial transmission mechanism (20) associated with and being of identical configuration as said first axial transmission mechanism (20) such that said two axial transmission mechanisms together form a pair of first axial transmission mechanisms (20), which are respectively formed at an upper and lower sides of a central line of the spring wire feeding axle (11) and each being capable of performing a linear movement relative to the machine platform (10);
another axial transmission mechanism (30) associated with and being of identical configuration as said second axial transmission mechanism (30) such that said two axial transmission mechanisms together form a pair of second axial transmission mechanisms (30); and
another abutting assembly associated with and being of identical configuration as said abutting assembly such that said two abutting assemblies together form a pair of abutting assemblies (40), which are respectively fixed to the second sliding seat (33) and able to independently make a 2-D movement in a vertical and horizontal directions relative to the machine platform (10) via the pair of first axial transmission mechanisms (20) and the pair of second transmission mechanisms (30).

Amended claims in accordance with Rule 137(2) EPC.

1. A spring manufacturing machine with an abutting apparatus , said spring manufacturing machine (1) having a machine platform (10), said abutting apparatus (2) comprising:

a first axial transmission mechanism (20), which comprises a first actuator (21) fixed to the machine platform (10), a first lead screw (22) driven by the first actuator (21) to rotate and a first sliding seat (23) coupled with the first lead screw (22) and capable of performing a linear movement relative to the machine platform (10);
a second axial transmission mechanism (30), which comprises a second actuator (31) fixed to the first sliding seat (23), a second lead screw (32) driven by the second actuator (31) to rotate and a second sliding seat (33) coupled with the second lead screw (32) and capable to be moved linearly relative to the first sliding seat (23); and
an abutting assembly (40 or 40'), which is fixed to the second sliding seat (33) and capable of performing a 2-D movement in vertical and/or horizontal directions relative to the machine platform (10) via the first axial transmission mechanism (20) and the second axial transmission mechanism (30);
characterized in that the abutting assembly (40') comprises a wire configuration knife seat (41'), a wire configuration knife (42') pivoted to the wire configuration knife seat (41') and a driving block (43'), wherein
the wire configuration knife seat (41') is fixed to the second sliding seat (33), while the driving block (43') is connected by abutting against one side of the wire configuration knife (42'),
the wire configuration knife seat (41') is configured to be moved to thereby cause the wire configuration knife (42') swing in a third axial direction relative to the wire configuration knife seat (41'),
one side of the wire configuration knife (42') is provided with a bearing (421'), and
the driving block (43') is provided with a lead slot (431') adapted for the bearing (421') to be connected by sliding therein, said driving block (43') being fixed onto the machine platform (10).

2. The abutting apparatus according to claim 1, wherein the first sliding plate (23) comprises a first

plate body (231) and a first nut (232) connected fixedly to the first plate body (231) and being in engagement with the first lead screw (22).

3. The abutting apparatus according to claim 1 or 2, wherein the second sliding seat (33) comprises a second plate body (331) and a second nut (332) connected fixedly to the second plate body (331) and being in engagement with the second lead screw (32).

4. The abutting apparatus according to any of the preceding claims, wherein the first sliding seat (23) is configured as a first sliding slot (2331) adapted for engaging with the machine platform (10) so that the first sliding seat (23) can be slidably moved relative to the machine platform (10).

5. The abutting apparatus according to claim 4, wherein the first sliding seat (23) further comprises a first slide (234) connected fixedly to the first plate body (231), and wherein the second sliding seat (33) is configured as a second sliding slot (3331) adapted for receiving and guiding a sliding movement of the first slide (234).

6. The abutting apparatus according to any of the preceding claims, wherein the abutting assembly (40) comprises a fixing seat (41) fixed to the second sliding seat (33) and an abutting telescopic rod (42) screwed with the fixing seat (41), and wherein the abutting telescopic rod (42) can make an oblique movement relative to the second sliding seat (33).

7. The abutting apparatus of any of the preceding claims, wherein the lead slot (431') has an oblique configuration.

8. The abutting apparatus of any of the preceding claims, further comprising:

another axial transmission mechanism (20) associated with and being of identical configuration as said first axial transmission mechanism (20) such that said two axial transmission mechanisms together form a pair of first axial transmission mechanisms (20), which are respectively formed at an upper and lower sides of a central line of the spring wire feeding axle (11) and each being capable of performing a linear movement relative to the machine platform (10);
another axial transmission mechanism (30) associated with and being of identical configuration as said second axial transmission mechanism (30) such that said two axial transmission mechanisms together form a pair of second axial transmission mechanisms (30); and
another abutting assembly associated with and being of identical configuration as said abutting assembly such that said two abutting assemblies together form a pair of abutting assemblies (40), which are respectively fixed to the second sliding seat (33) and able to independently make a 2-D movement in a vertical and horizontal directions relative to the machine platform (10) via the pair of first axial transmission mechanisms (20) and the pair of second transmission mechanisms (30).

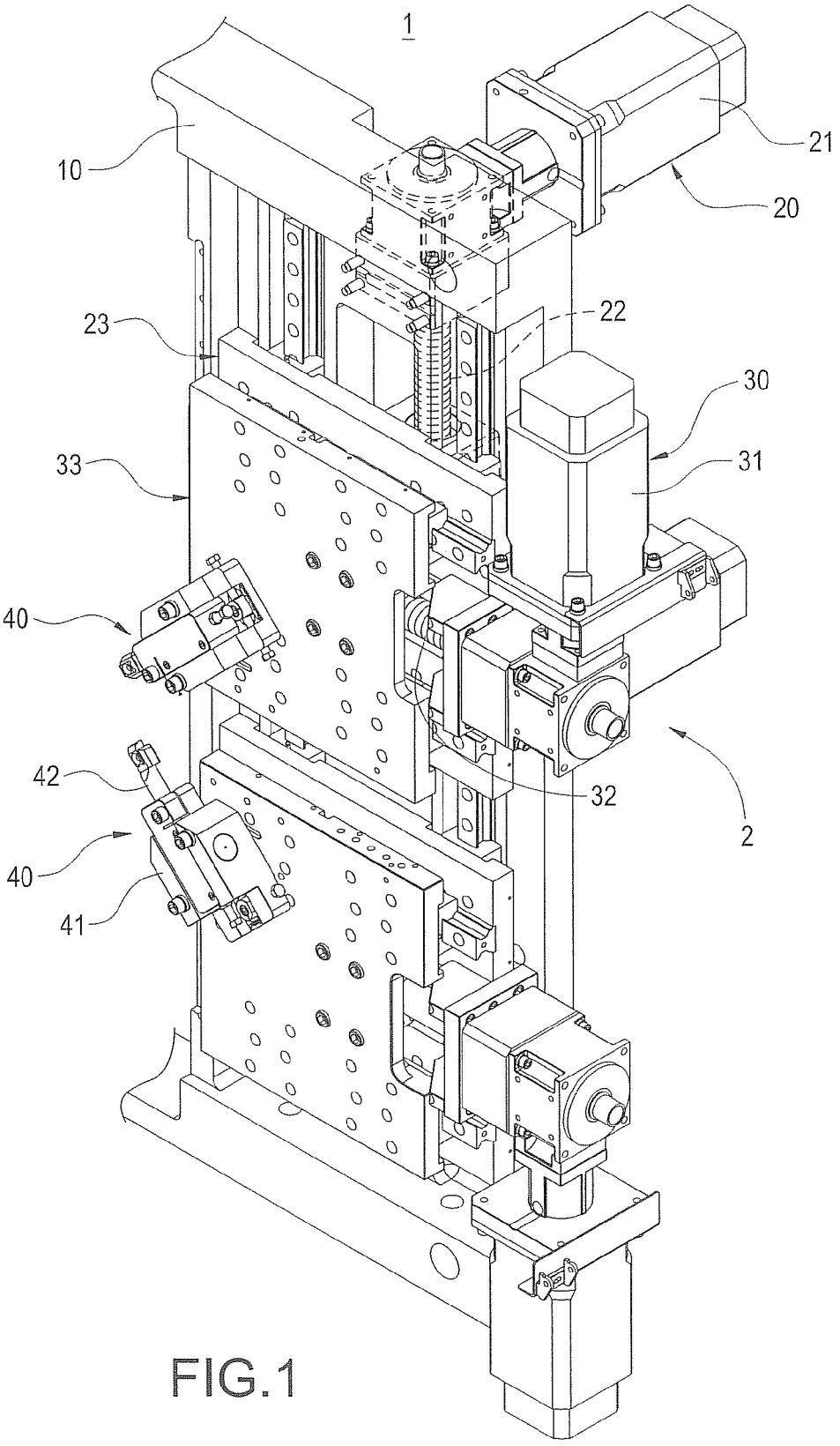

FIG.1

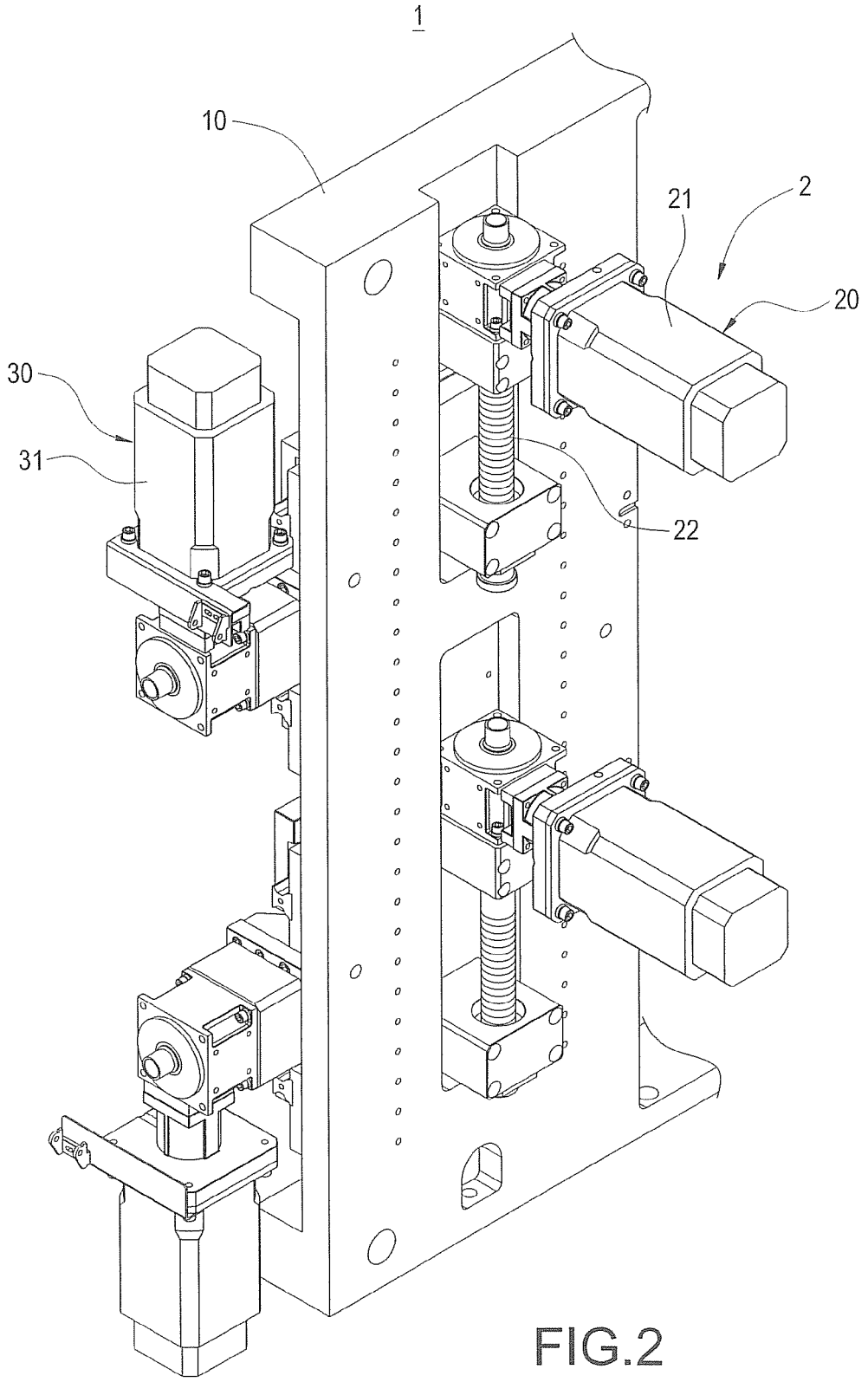

FIG.2

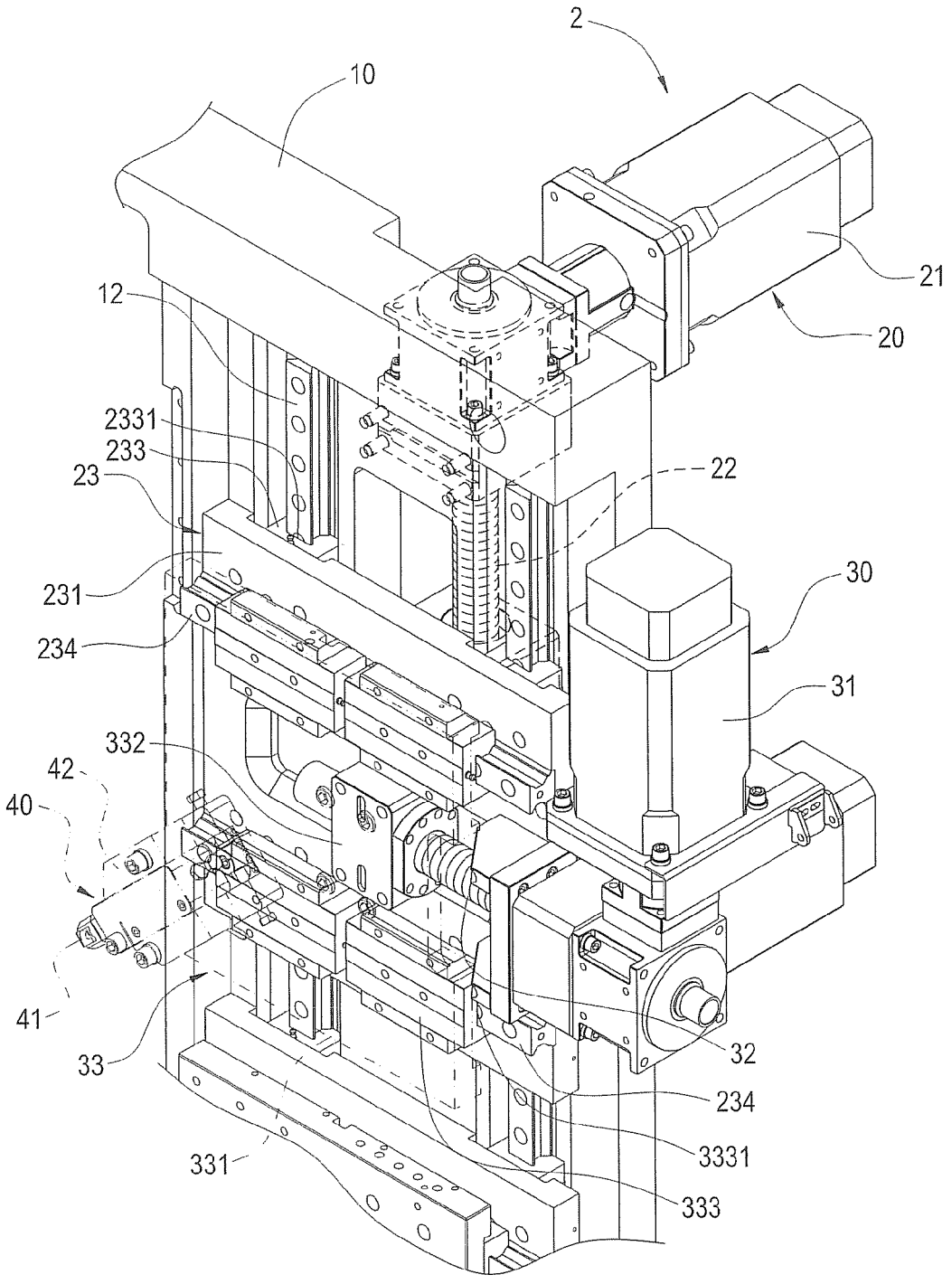
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FIG.3

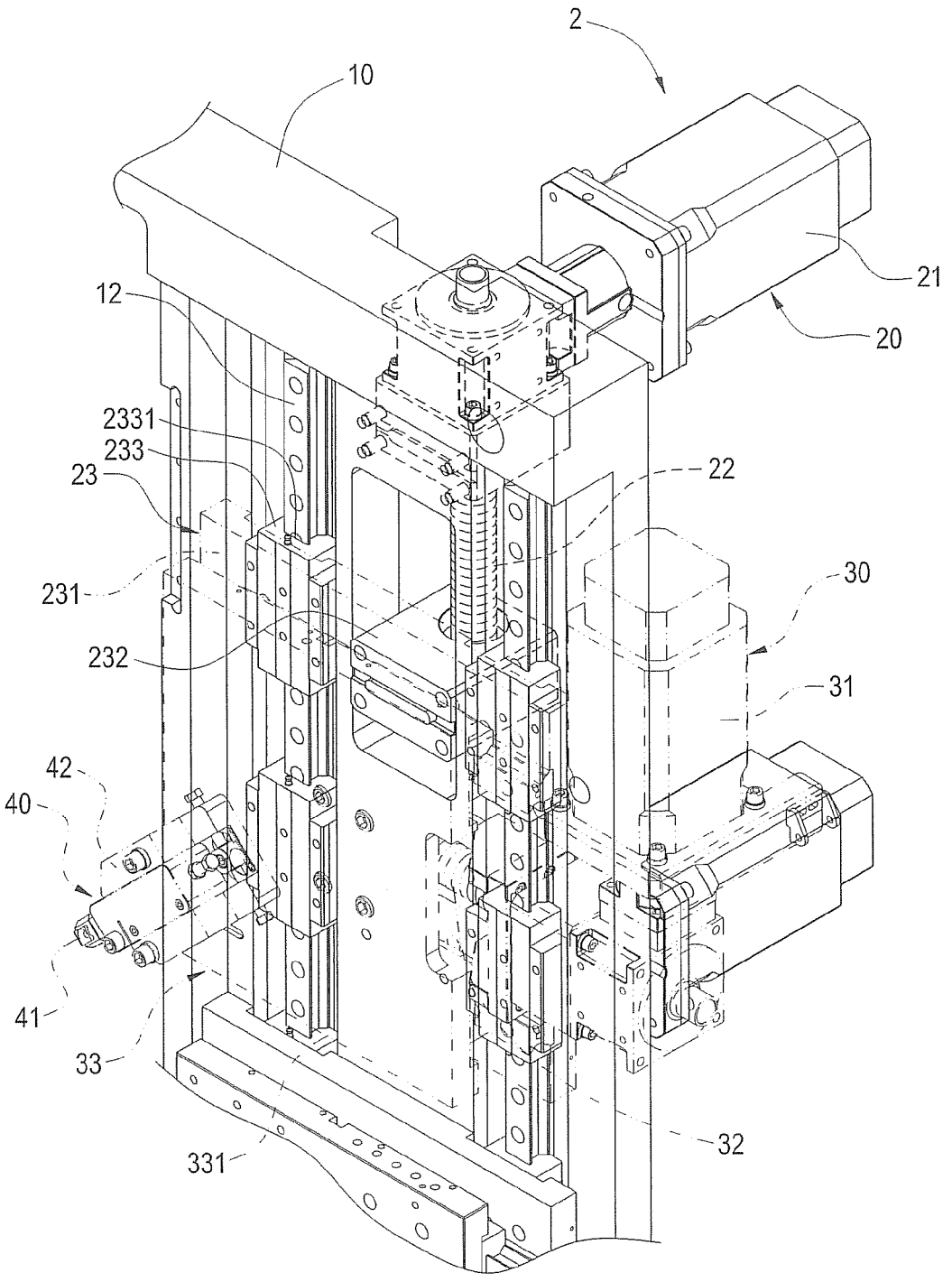

FIG.4

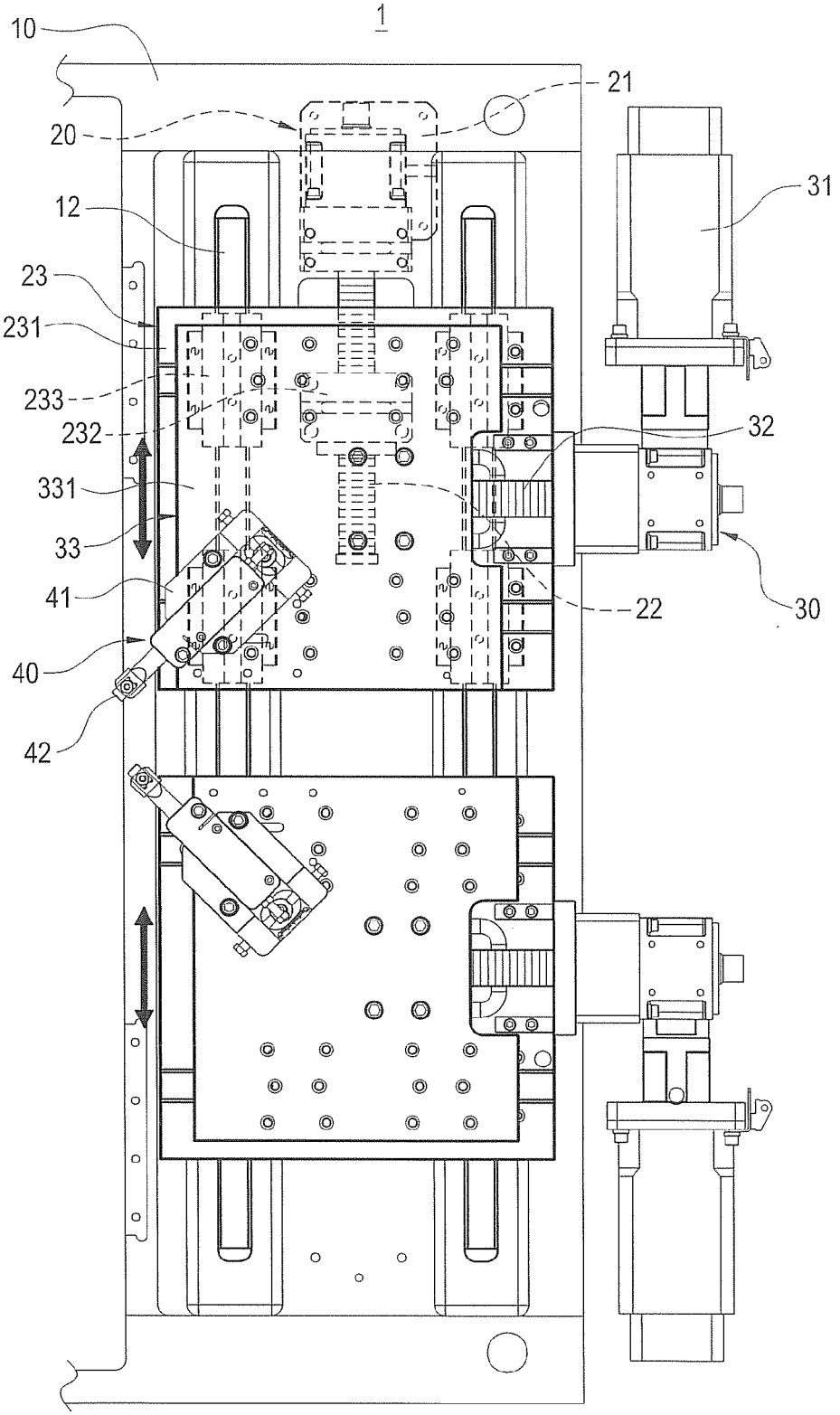

FIG.5

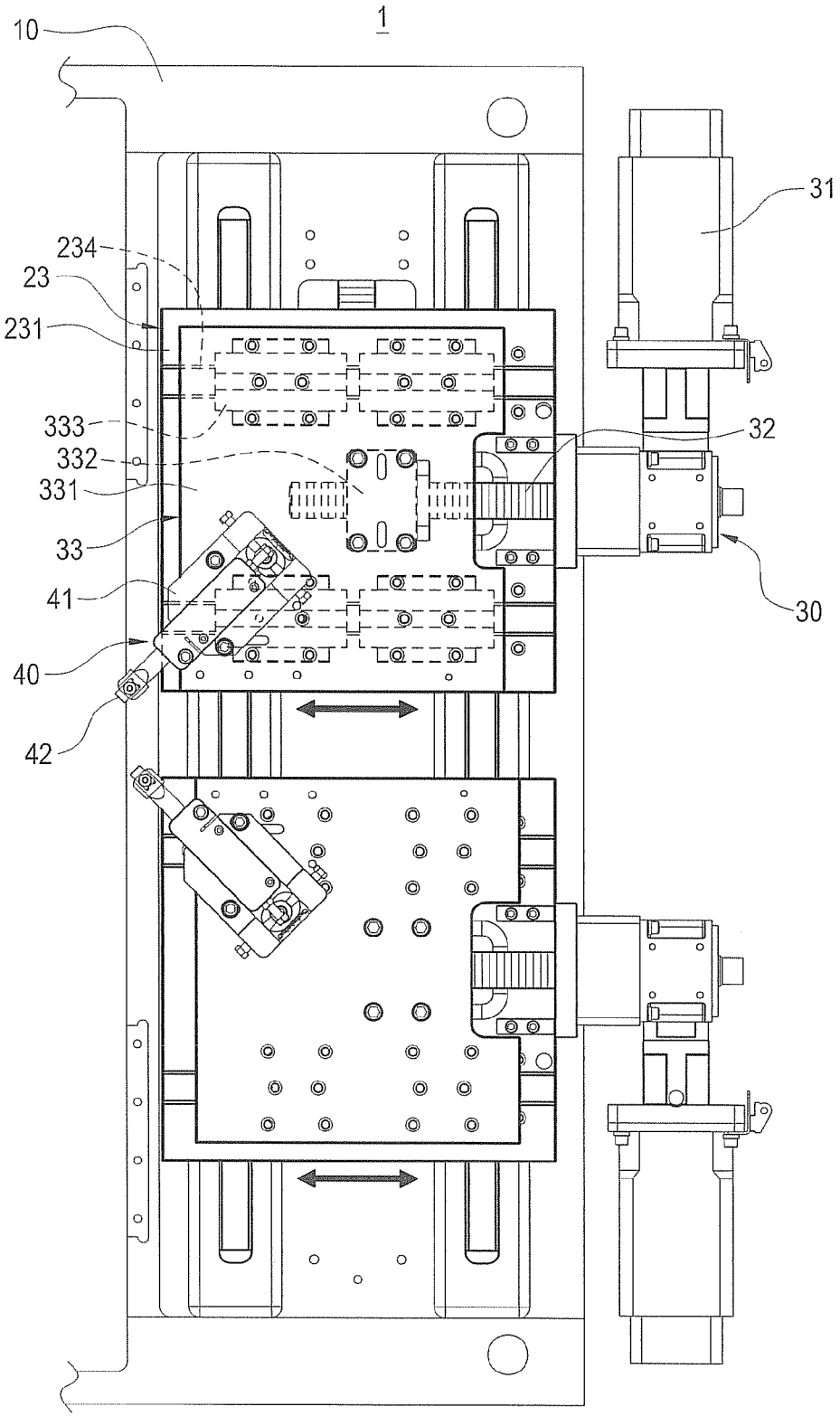

FIG.6

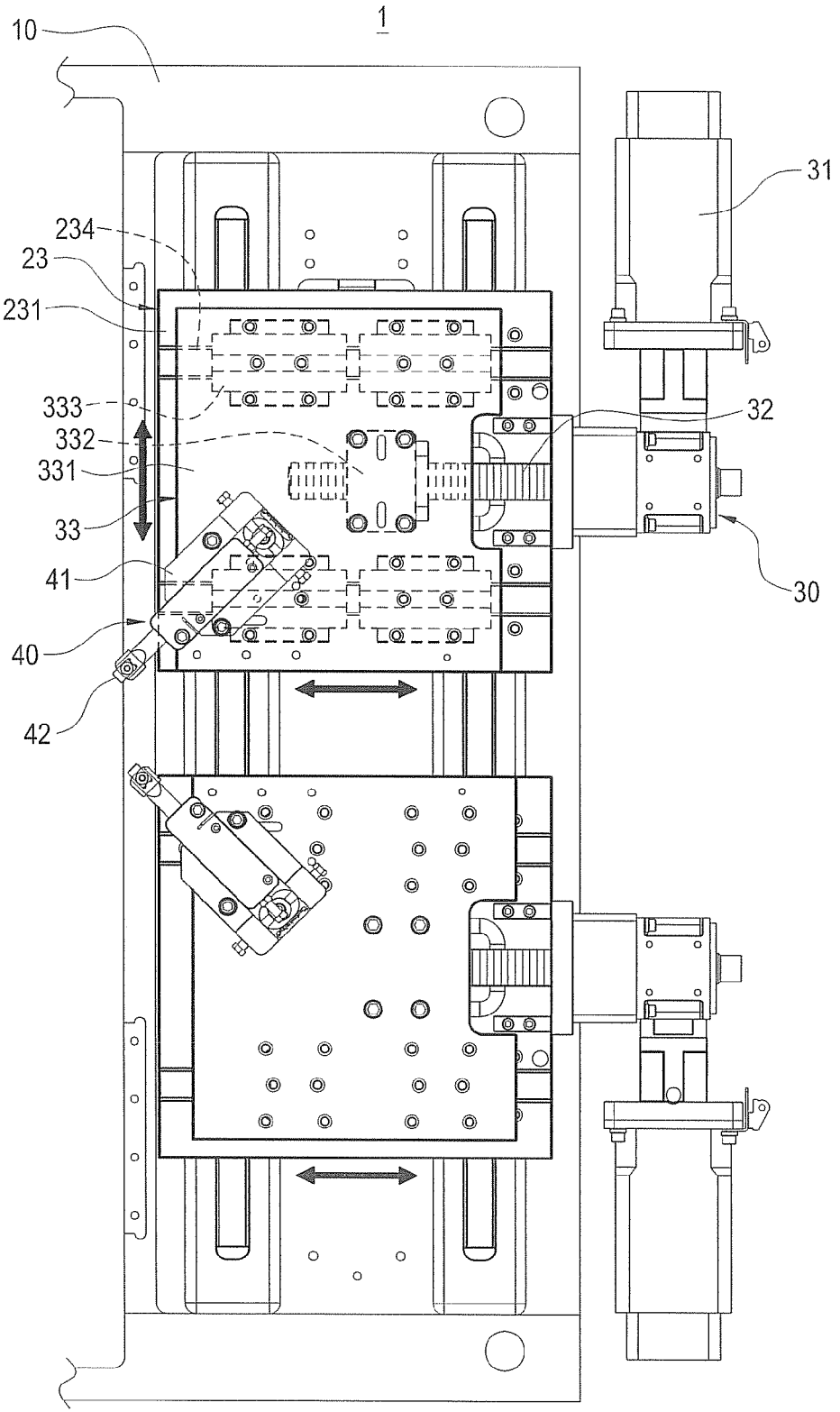

FIG.7

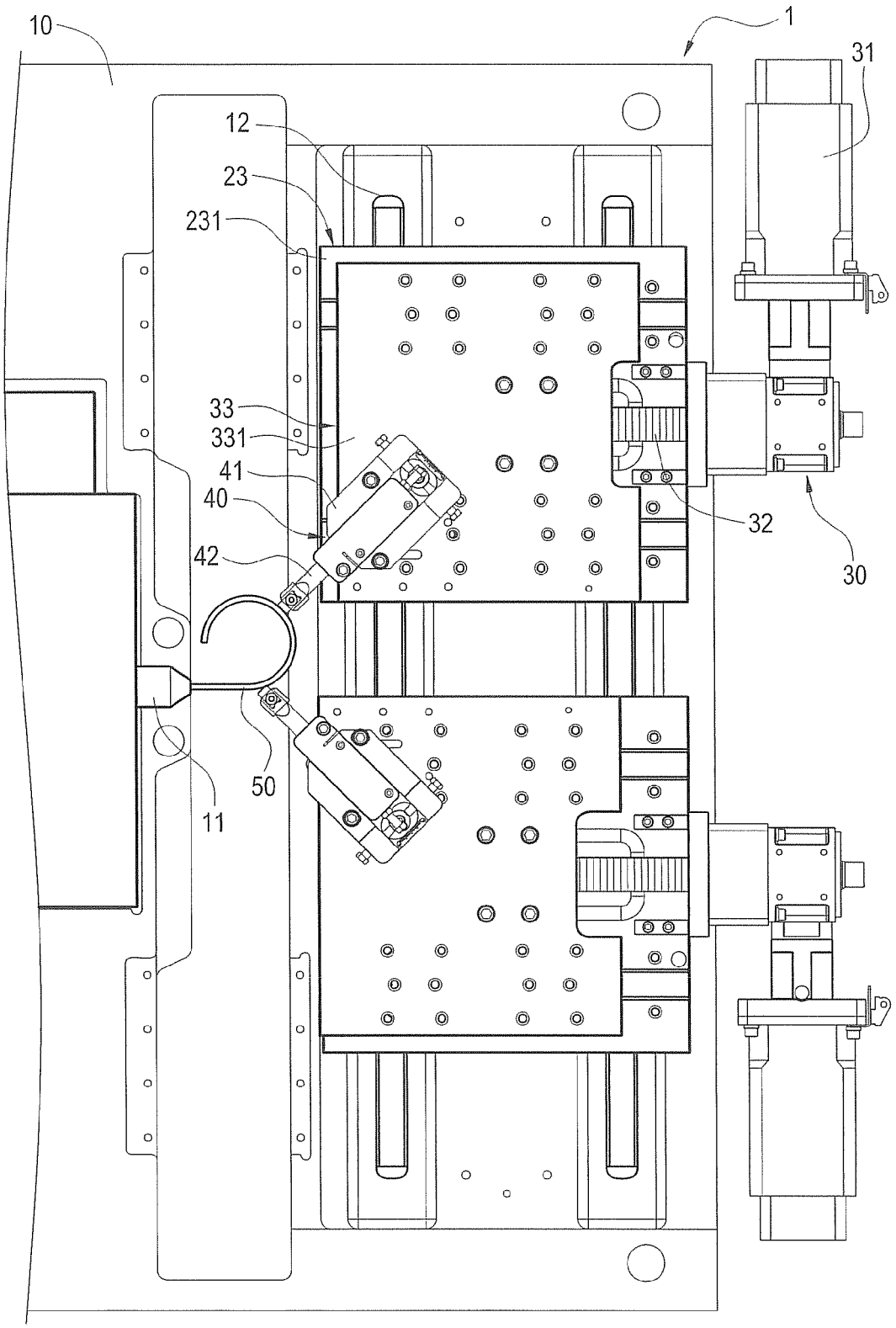

FIG.8

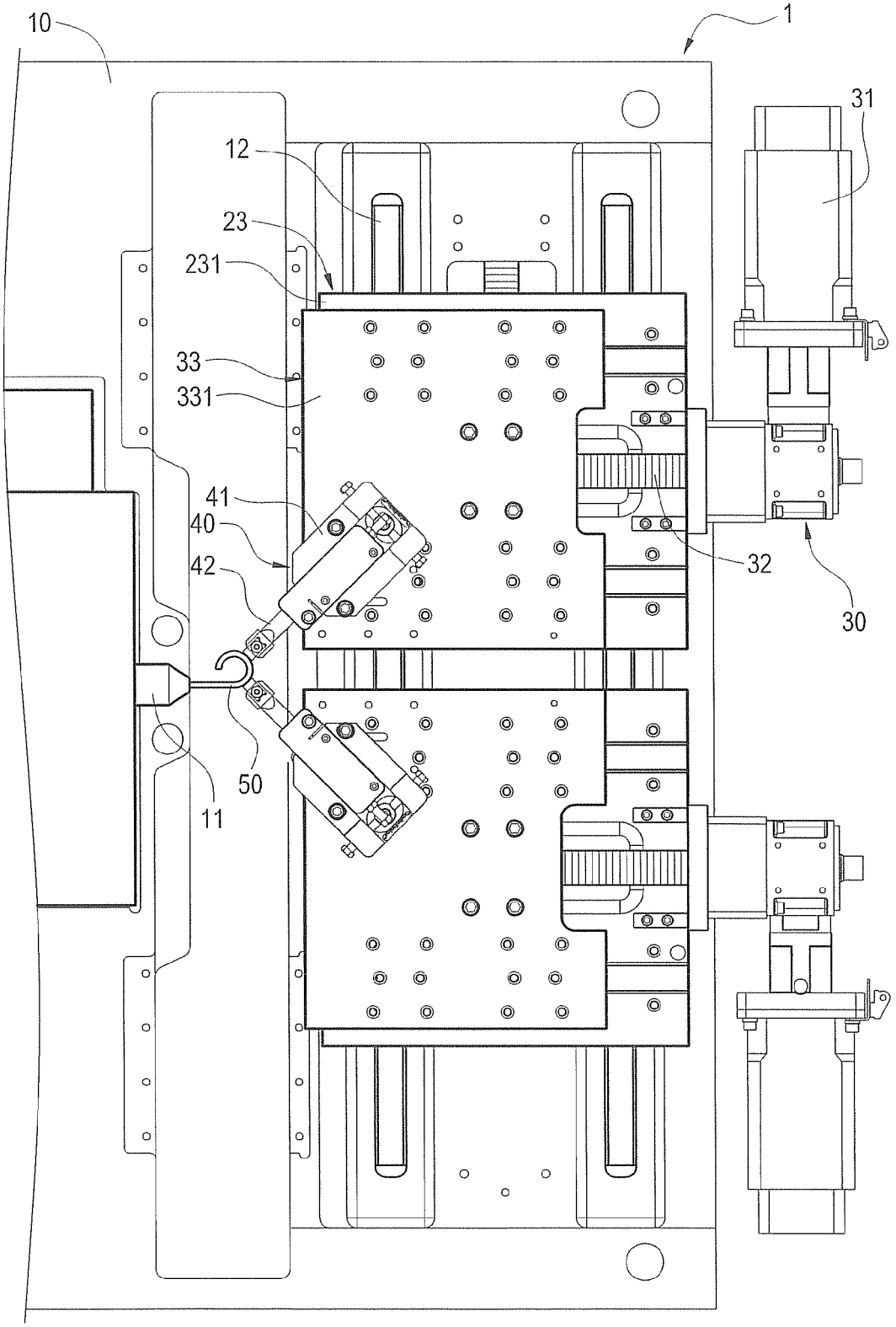

FIG.9

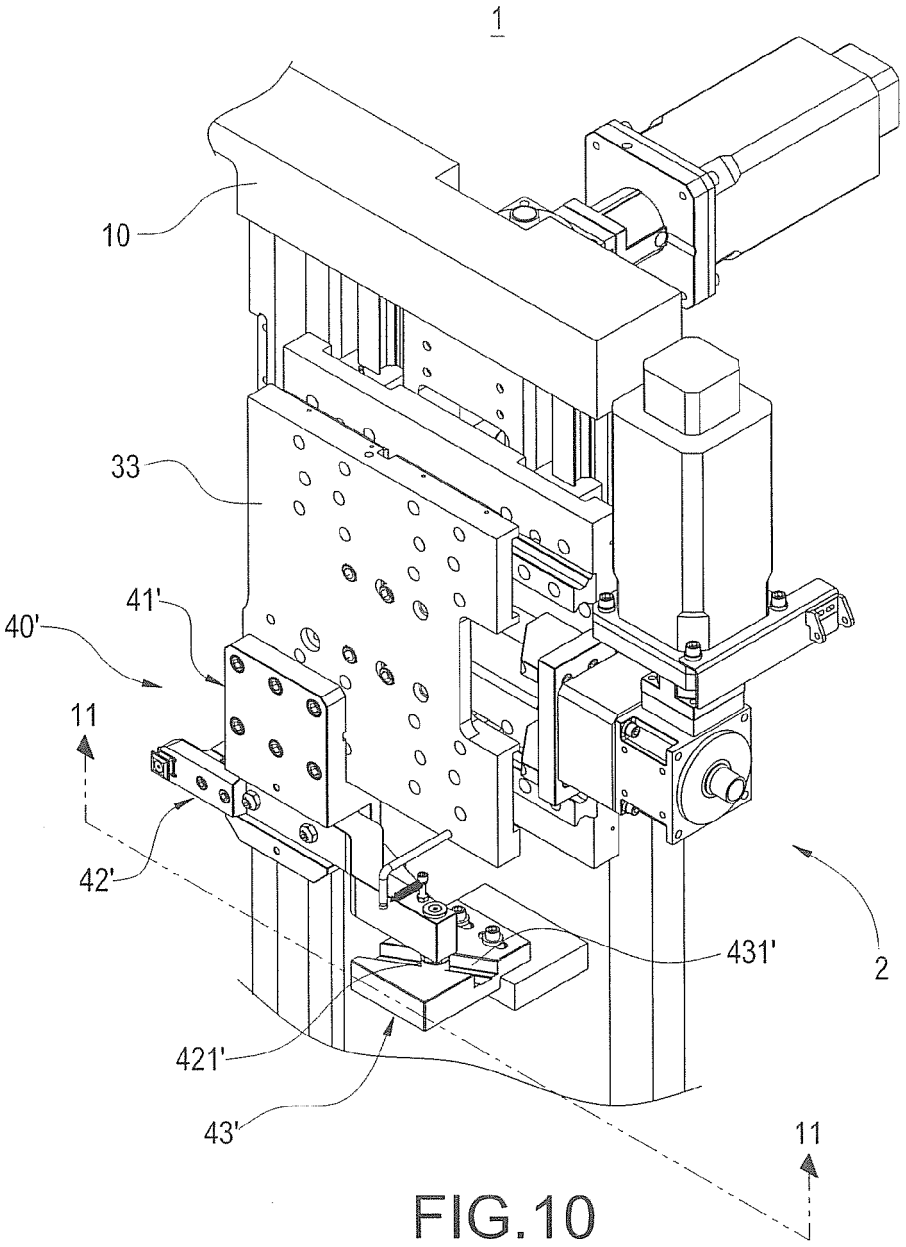

FIG.10

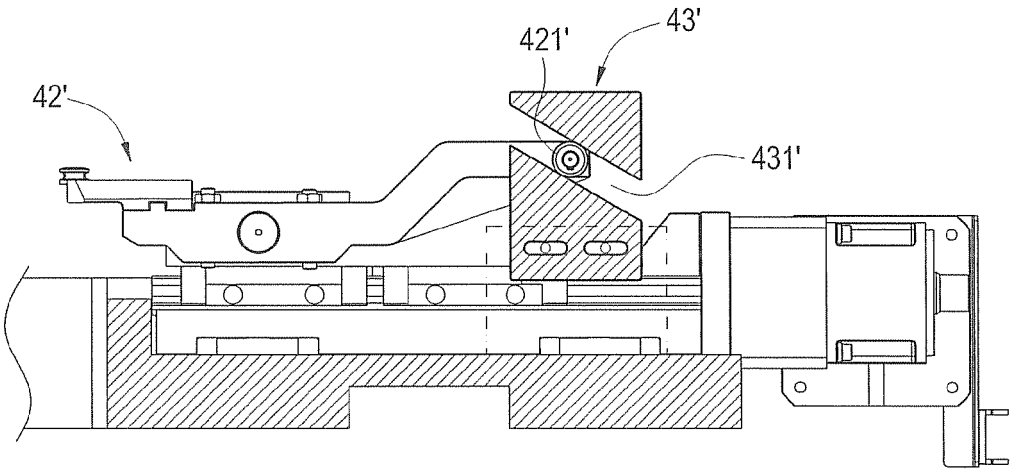

FIG.11

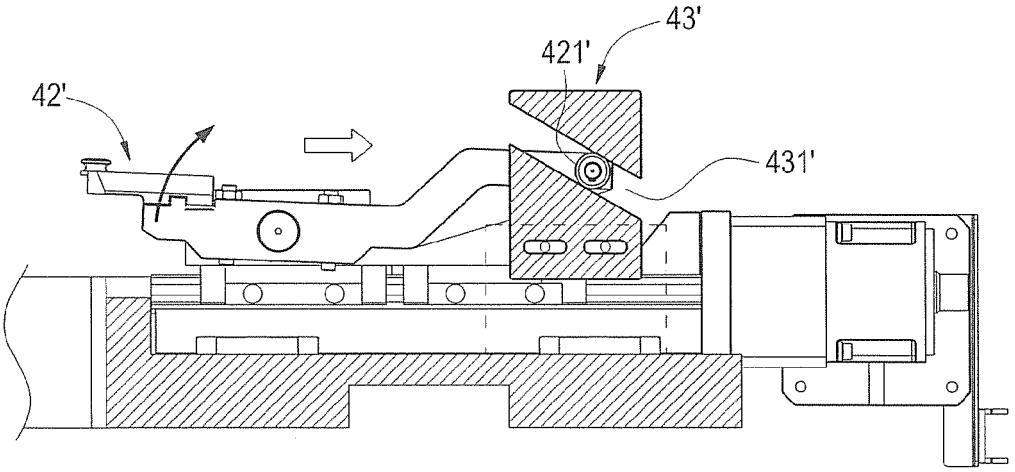

FIG.12

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EUROPEAN SEARCH REPORT

Application Number
EP 09 17 6966

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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B21F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	18 May 2010	Augé, Marc

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18-05-2010

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