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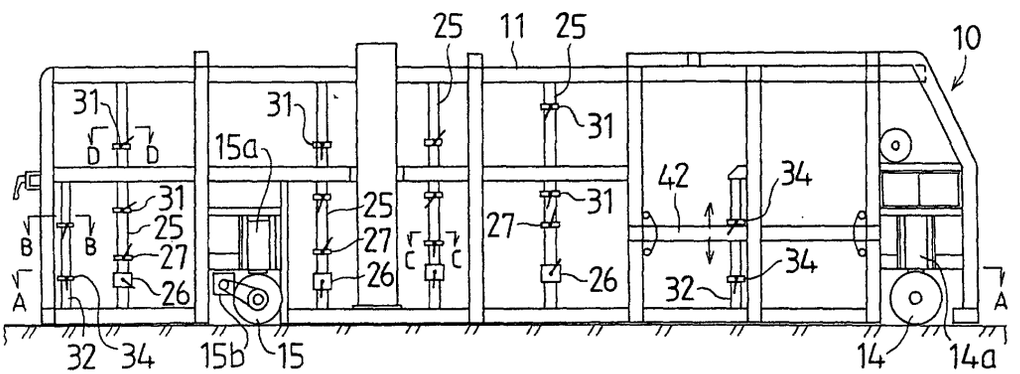
(54) AUTOMOBILE BODY CORRECTION DEVICE AND BODY CORRECTION METHOD

(57) An automobile body correction device (10) for correcting the body of an automobile deformed by a traffic accident or the like, comprising a frame body (11) capable of receiving the whole or part of the automobile body, lifting devices (12) disposed within the frame body (11), an automobile body holding device (13) for detachably fixing the lifted automobile body, wheels (14, 15) disposed at four positions, front/rear and right/left, of the frame body (11), and pressurizing devices which pressurize the automobile body fitted in the frame body (11) and which consist of a plurality of ceiling cylinders (16) and suspending cylinders (17) mounted to a ceiling unit, a plurality of side cylinders (18) mounted to both right and left side units, and a plurality of floor cylinders (19) mounted to a floor surface. An automobile body correction method, in which portions to be corrected of the automobile body inserted into the frame body are corrected while being pressurized by a plurality of pressurizing devices, eliminates the conventional need of fixing or pulling the automobile body by dedicated support members and chains and ensures a short-time, safe correction work. Directly pressurized and corrected deformed portions cause a very slight spring back and allow even unskilled workers to accurately correct the automobile body without requiring a high degree of technique. In addition, a correction work permitted only inside the frame body can make efficient use of space.

FIG.1



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Description

FIELD OF THE INVENTION

[0001] The present invention relates to a device and a method for correcting a body of an automobile deformed by a traffic accident or the like.

BACKGROUND OF THE INVENTION

[0002] Automobile body correction devices for restoring a body or a frame deformed by a traffic accident or the like to the original form are disclosed in Japanese Unexamined Patent Publications Nos. Sho 47-14850, Sho 50-37143, Sho 51-118235 and Sho 55-55221, for example.

[0003] The above automobile body correction devices are the devices in which a deformed body or a frame is fixed onto rails laid on a floor or dedicated support members, chains are hung on deformed portions of the body or frame, and then the chains are pulled by hydraulic cylinders or the like, thereby restoring the deformed portions to their original forms.

[0004] In the conventional body correction devices, a body or a frame is fixed using chains or dedicated support members. Therefore, considerable work and time are required for fixing the members and for detaching the body and frame from the correction device after the correction work. In addition, a large space is needed for the operation.

[0005] Moreover, in executing correction of a body or a frame, a spring back should be taken into account when pressurizing deformed portions, which requires advanced skill for accurate correction. Furthermore, excessive tension would sometimes damage a body or a frame, or deform the portions that do not need any correction.

[0006] In addition, chains loaded with tension may come out of a body or a frame, or break due to an excessive load, leading to high risk of causing a serious accident.

[0007] An object of the present invention is to provide an automobile body correction device and a body correction method capable of accurate and safe correction work of the deformed automobile body in a shorter time with efficient use of a working space.

DISCLOSURE OF THE INVENTION

[0008] An automobile body correction device of the present invention comprises a frame body capable of receiving whole or a part of the automobile body and a plurality of pressurizing devices mounted to the frame body for pressurizing the automobile body. By this structure, an automobile body or a part of the automobile body deformed by a traffic accident or the like is inserted into the frame body and corrected by pressurizing with a plurality of pressurizing devices.

[0009] According to the present invention, an automobile body or a part of the automobile body is corrected while being pressurized with a plurality of pressurizing devices. Thus, unlike the conventional devices, it is not necessary to fix an automobile body with dedicated support members or to pull the automobile body with chains, which enables the correction work to be safely finished in a shorter time. Furthermore, directly pressurized and corrected deformed portions cause a very slight spring back and allow even unskilled workers to accurately correct the body without requiring a high degree of technique. In addition, the correction work permitted only inside the frame body can make efficient use of space.

[0010] It is preferable that the above-described frame body has a box-like structure enclosed with a floor surface, both side units and a ceiling unit. The frame body may also have a structure comprising a plurality of frame bodies which are connected to each other. The frame body can be formed by a three-dimensional combination of structural steel materials such as H sections, I sections and L sections.

[0011] As the above-described pressurizing devices, oil or air cylinders which expand and contract with oil or air pressure can be used as well as jacks which expand and contract with screw mechanism. In this case, a base end portion of the pressurizing device is mounted to the frame body, and a working portion of the pressurizing device can be fitted to a portion of an automobile body to be corrected. By this structure, a reaction force generated when the pressurizing device works can be supported by the frame body, thereby pressurizing and correcting the automobile body. It is also preferable that three or more pressurizing devices are provided in order to simultaneously pressurize and correct three different portions of a deformed automobile body. Additionally, the working portion of the pressurizing device may be provided with a mechanism to which a fitting attachment having a form capable of closely contacting or fitting with a part of the automobile body can be attached. By attaching such fitting attachment to the pressurizing device when needed, the fitting attachment is securely fixed to an automobile body to pressurize and correct the body, which makes the operation easier, safer and more accurate. Furthermore, the working portion of the pressurizing body may be provided with a mechanism to which an extensible attachment can be attached. By attaching such extensible attachment to the pressurizing device when needed, an automobile body can be pressured and corrected even when the deformed portion of the automobile body is distant from the working portion of the pressurizing device.

[0012] Preferably, the above pressurizing devices are mounted to a floor surface, both side units and ceiling unit of the frame body, thereby enabling the device to pressurize the automobile body from three different directions. Accordingly, an automobile body which has been complicatedly deformed in various directions such as horizontal and vertical directions can be easily and

accurately corrected.

[0013] Preferably, the above pressurizing devices are movable in horizontal and vertical directions inside the frame body. Thus, an automobile body can be pressurized and corrected in a method applicable to various sizes and deformed conditions of the body. Also, the automobile body can be accurately pressurized and corrected irrespective of the position of the portion to be corrected inside the frame body.

[0014] Preferably, on a floor surface of the above frame body, a body supporting member is provided upon which an automobile body inserted into the frame body can be laid. By this structure, the automobile body can be easily set and securely held during the correction work, which leads to safer and more accurate correction.

[0015] Preferably, the body supporting member can descend and ascend, thereby securely holding an automobile body in a way depending on the size and deformed condition of the body. Thus, the automobile body can be held at a optimum height applicable to various pressurizing and correcting work.

[0016] Preferably, the body supporting member is movable along with a floor surface of the frame body. By this structure, an automobile body can be held in a way depending on the size and deforming condition of the body. Also, as the correction work progresses, the position of the automobile body and the held portions thereof can be changed, which enhances the workability.

[0017] In addition, the body supporting member is preferably detachable from a floor surface of the frame body. Thus, the unused supporting member can be detached from the frame body and, therefore, the member does not hinder the correction work, making efficient use of space within the frame body.

[0018] Preferably, inside the above frame body, provided are a lifting device which can lift up an inserted automobile body and a body holding device to hold the lifted body so that the deformed automobile body inserted into the frame body is lifted with the lifting device up to an optimum height depending on the size of the body and fixed with the body holding device, and a plurality of pressurizing devices pressurize plural portions of the automobile body to elastically transform the deformed portions, thereby restoring the original form. Accordingly, the correction work can be accurately and safely finished in a shorter time irrespective of the size of the automobile body.

[0019] Preferably, the body holding device is provided with an auxiliary connector to fix an automobile body, which is detachably mounted. The auxiliary connector applicable to various sizes and forms of automobiles is used for securely fixing the automobile body, which enables further safer, easier and more accurate correction work.

[0020] The body holding device may descend and ascend so as to hold an automobile body at an optimum height depending on the size, form and deformed condition of the automobile body, which leads to higher workability.

[0021] Moreover, the body holding device may be movable along with a floor surface of the frame body. By this structure, an automobile body can be held at a suitable position depending on the size and form of the body, which enhances workability. The deformed portion of the automobile body can be easily corrected wherever the portion is.

[0022] In addition, the body holding device may be detachable from a floor surface of the frame body. Thus, the unused body holding device can be detached from the frame body and, therefore, the device does not hinder the correction work, making efficient use of space in the frame body.

[0023] Preferably, the above-described pressurizing devices provided on the ceiling unit of the frame body are mounted to suspending members which are extensibly, swingably and rotabably suspended from the ceiling unit of the frame body. Thus, the deformed portion of the automobile body which is distant from the ceiling unit of the flame body can be pressurized and corrected, and the position to be pressurized and the direction to which the body is pressurized can be optionally determined. Accordingly, an appropriate position depending on the size and the deformed condition of the automobile body is pressurized to a suitable direction, making the correction work accurate.

[0024] Preferably, the pressurizing devices provided on the ceiling unit of the frame body are mounted to the suspending members via universal joints. By this structure, a movable range of the direction to which an automobile body is pressurized is widened, making accurate pressurizing and correction depending on the size and deforming condition of the automobile body.

[0025] Furthermore, on both side units of the frame body, reaction force supporting members may be provided to support any reaction force of the pressurizing devices mounted to the ceiling unit of the frame body. Thus, the body can also be strongly pressurized at a position distant from the both side units of the frame body, making the correction work of a relatively largely deformed automobile body easier.

[0026] Preferably, the above reaction force supporting members are movable forward and backward of the frame body. By this structure, the reaction force of the pressurizing devices can be supported at an optional position of the both side units depending on the position where the pressurizing devices are disposed, which enhances workability.

[0027] Preferably, a mounting member to detachably receive a holding member for an automobile body is provided on at least one portion in the floor portion, the ceiling unit or the both side units. By this structure, the automobile body inserted into the frame body can be immovably mounted with the holding member so that the automobile body can be more securely fixed, making the

correction work of complicatedly deformed portions easier. As the holding member, preferably a chain or the like can be used. However, unlike the conventional methods, the chain or the like only used inside the frame body would not cause any serious accidents if the chain or the like were broken.

[0028] The mounting member may be detachable from the frame body so that the unused mounting member does not hinder the correction work. Thus, the limited working space inside the frame body can be efficiently used, making the correction work easier.

[0029] The mounting member may be movable to horizontal and vertical directions so as to mount an automobile body at a suitable position depending on the size and the deformed condition of the automobile body. Furthermore, wherever the deformed position of the automobile body is inside the frame body, the automobile body can be easily mounted. The mounting member may be movable along with a ceiling unit of the frame body so that a part of the automobile body, being hung on the mounting member via the fixing member, can be inserted into the frame body or removed from the frame body, which leads to easier insertion and removal operations.

[0030] Preferably, in the above mounting member, the mounting member which is disposed on the front side or the rear side of the frame body is provided via a bar member which is detachable from a plurality of engaging members formed at different heights on a part of the front side or the rear side of the frame body, respectively. By this structure, the mounting member can be attached to the front side or the rear side of the frame body only when needed and does not hinder the inserting operation of an automobile body into the frame body as well as the removal operation.

[0031] Preferably, the pressurizing devices provided on the both side units of the frame body are storable in the both side units of the frame body. Thus, the unused pressurizing devices do not hinder the correction work, and the limited space inside the frame body can be efficiently used, enhancing workability.

[0032] Preferably, the mounting members disposed on the both side units in the frame body are provided with engaging members to detachably fix the pressurizing devices stored in the both side units in order to prevent the stored pressurizing devices from projecting by accident, thereby making the correction work safer.

[0033] The pressurizing devices provided on the floor surface of the frame body may be detachable from the floor surface of the frame body. Thus, the unused pressurizing devices can be detached and do not hinder the correction work, which leads to efficient use of the limited space inside the frame body and higher workability.

[0034] Preferably, the pressurizing devices mounted to the floor surface of the frame body are mounted to the floor surface via a transfer mechanism, which is fixed to the floor surface by the load charged on the pressurizing devices. By this structure, once the pressurizing and correction work starts, the pressurizing devices are automatically fixed on the floor surface, which enhances workability and makes the correction work safer and more accurate. When the load charged on the pressurizing devices is released, the pressurizing devices become movable again. Thus, the positions to be pressurized can be easily changed, and also the automobile body can be easily transferred.

[0035] Preferably, each of the above pressurizing devices is provided with a detachable correction jig to detachably engage with a part of an automobile body for transmitting pressure from the pressurizing devices to the automobile body. By this structure, portions where the operating portion of the pressurizing devices does not easily fit directly and portions which do not fit in stable conditions can also be safely and securely pressurized.

[0036] As each of the above pressurizing devices, an oil cylinder which extends and contracts with hydraulic power may be used. Thus, the pressurizing devices can be operated only with oil pumps without any large-scaled construction work for facilities. It is also possible to simultaneously operate a plurality of the pressurizing devices to uniformly pressurize deformed portions of an automobile body and areas around them for correction, making the correction work accurate. Furthermore, the number of the pressurizing devices installed can be easily changed compared to conventional devices.

[0037] Preferably, a hydraulic power generator to operate the above oil cylinder is detachable from the frame body. By this structure, the hydraulic power generator can be detached from the frame body and used in combination with other pressurizing devices having oil cylinder systems, which leads to higher applicability.

[0038] Preferably, the above frame body is provided with wheels to transfer the frame body, wheel lifting devices to land and store the wheels, and a steering device to change the moving direction of the frame body. Thus, the whole body of the automobile body correction device can be moved by landing the stored wheels and rotating them. Accordingly, it becomes easier to transfer the automobile body correction device to a working place, to insert an automobile body into the frame body, and to transfer the unused device to a storehouse. As a bottom surface of the frame body lands on the ground when the wheels are stored, there is no problem in strength and durability of the frame body during the correction work.

[0039] Preferably, inside the frame body, wheel holding members to receive wheels of an automobile body inserted into the frame body are provided. By this structure, the automobile body can be stably held even when deformed portions adjacent to the wheels of the automobile body are corrected. When the automobile body correction device is not used, an automobile can be inserted into the frame body, thereby using the device as a garage, which leads to efficient use of space.

[0040] The above wheel holding members may be detachable from the frame body. Thus, the unused wheel

holding members can be detached from the frame body and do not hinder the correction work, contributing to efficient use of space inside the frame body.

[0041] The automobile body correction method of the present invention is a correction method using the above-described automobile correction device, wherein whole or a part of an automobile body is inserted into a frame body provided with a plurality of pressurizing devices to pressurize the automobile body, and said pressurizing devices pressurize three different portions of the inserted automobile body or the part of the inserted automobile body to elastically transform the automobile body or the part of the automobile body.

[0042] According to the above automobile body correction method, it is possible to pressurize the automobile body in a constantly stable condition without causing any wobbling or shaking by pressurizing the three different portions of the deformed automobile body. Therefore, the correction work can be accurately finished in a shorter time irrespective of the size of the automobile body, and also space can be efficiently used.

BRIEF DESCRIPTION OF THE DRAWINGS

[0043]

Figs. 1 to 22 show the first embodiment of the present invention, wherein Fig. 1 is a side view of a automobile body correction device; Fig. 2 is a partially omitted plan view of the automobile body correction device; Fig. 3 is a sectional view taken along the line A-A of Fig. 1; Fig. 4 is a front view of the automobile body correction device; Fig. 5 is a rear elevated view of the automobile body correction device; Fig. 6 is a front view showing a suspending cylinder of the automobile body correction device; Fig. 7 is a perspective view showing a side cylinder of the automobile body correction device; Fig. 8 is a perspective view showing a floor cylinder of the automobile body correction device; Fig. 9 is a sectional view taken along the line B-B of Fig. 1; Fig. 10(a) is a sectional view taken along the line C-C of Fig. 1; Fig. 10(b) is a sectional view taken along the line D-D of Fig. 1; Fig. 11 is a sectional view taken along the line E-E of Fig. 3; Fig. 12 shows a mechanism for mounting a horizontal bar to a rear side of a frame body constituting the automobile body correction device; Fig. 13 shows an oil cylinder and engaging attachments installed in the automobile body correction device; Fig. 14 is a perspective view showing correction work using the automobile body correction device; Fig. 15 is a top plan diagram showing the correction work using the automobile body correction device; Fig. 16 is a sectional view taken along the line F-F of Fig. 15; Fig. 17 is a top plan diagram showing another correction work using the automobile body correction device; Fig. 18 is a sectional view taken along the line G-G of Fig. 17; Fig. 19 is a perspective view showing a correction jig used in the correction work using the automobile body correction device; Fig. 20 is a side view showing another correction work using the automobile body correction device; Fig. 21 is a perspective view showing yet another correction work using the automobile body correction device; and Fig. 22 is a perspective view showing a body holding device used in the correction work shown in Fig. 21.

Figs. 23 to 31 show the second embodiment of the present invention, wherein Fig. 23 is a perspective view of an automobile body correction device viewed from a diagonally front direction; Fig. 24 is a perspective view of the automobile body correction device viewed from a diagonally right direction; Fig. 25 is a perspective view of the automobile body correction device viewed from a diagonally rear right direction; Fig. 26 is a perspective view showing a ceiling unit of the automobile body correction device; Fig. 27 is a perspective view showing an area around a floor cylinder and a side cylinder; Fig. 28 is perspective view showing correction work using the automobile body correction device; Fig. 29 is a vertical sectional view showing an automobile body held by body holding members of the automobile body correction device; Fig. 30 is a perspective view showing wheel holding members fitted inside a frame body of the automobile body correction device; and Fig. 31 is a perspective view showing a passenger car inserted into the frame body of the automobile body correction device.

BEST MODE FOR CARRYING OUT THE INVENTION

[0044] Figs. 1 to 22 show the first embodiment of the present invention.

[0045] As shown in Figs. 1 to 5, an automobile body correction device of this embodiment comprises a frame body 11 formed by combining steel materials, lifting devices 12 which can lift an automobile body inserted into the frame body 11, a control box 12a of the lifting devices 12, a body holding device 13 (see Fig. 21) to fix the lifted automobile body, wheels 14, 15 disposed at four positions, front/rear and right/left, of the frame body 11, wheel lifting cylinders 14a, 15a, a steering cylinder 14b for the wheels 14, a driving motor 15b for the wheels 15, a plurality of ceiling cylinders 16 and suspending cylinders 17 mounted to a ceiling unit, functioning as pressurizing devices to pressurize and correct the automobile body inserted into the frame body, a plurality of side cylinders 18 mounted to both right and left side units, and a plurality of floor cylinders 19 mounted to a floor surface.

[0046] To both the right and left sides on the front side of the frame body 11, mounted are reaction force supporting members 42 which can ascend and descend with lifting cylinders 41. The frame body 11 is provided with a detachable hydraulic power generator 43 to op-

erate the lifting devices 12, the wheel lifting cylinders 14a, 15a, the steering cylinder 14b, the ceiling cylinders 16, the suspending cylinders 17, the side cylinders 18, the floor cylinders 19, the lifting cylinders 41 or the like.

[0047] The ceiling cylinders 16 and the suspending cylinders 17 are mounted to three ceiling rails 20 which are movable along the front and rear directions of the ceiling unit via sliding members 22, respectively, and can be moved in front/rear and right/left directions throughout the ceiling unit. As shown in Fig. 6, the suspending cylinders 17 are suspended from the sliding members 22 via lifting cylinders 21 having universal joints 23 on upper and lower ends thereof, and can descend/ascend, rotate, swing and slant in any direction, thereby optionally defining positions and directions to be pressurized by the suspending cylinders 17. Therefore, as described below, when correcting a deformed automobile body, optimal positions for correction are pressurized from optimal directions depending on the size, form and deformed condition of the automobile body, making the correction work accurate.

[0048] Each of the suspending cylinders 17 comprises a cylinder body 17a inserted into a cylindrical body 24 and is fixed with a fixing screw 24a by engaging an external thread portion (not shown) formed on a circumference of the cylinder body 17a with an internal screw thread portion (not shown) formed inside the cylindrical body 24. By this structure, only the cylinder body 17a can be replaced, and the cylinder body 17a does not come off the cylindrical body 24 during the correction work.

[0049] The ceiling rails 20 and the sliding members 22 can be freely moved when the ceiling cylinders 16 and the suspending cylinders 17 are not in use. However, provided with a locking mechanism to automatically stop the ceiling rails 20 and the sliding members 22 at their present positions when the ceiling cylinders 16 extend and load an upward reaction force, the ceiling rails 20 and the sliding members 22 do not freely move during the correction work and, after the upward reaction force is released, become movable again.

[0050] As shown in Fig. 3, the side cylinders 18 are mounted to pillars 25 comprising H sections which stand at four positions each on the right and left side portions of the frame body. As shown in Fig. 7, lower ends of the side cylinders 18 are rotatably mounted to sliding members 26 which can ascend and descend along the pillars 25. Above each of the sliding members 26, disposed is a mounting member 27 which can ascend and descend along the pillar 25 and, as shown in Fig. 10(a), has a mounting hole 27a to receive a chain 35, described below, and a locking hole 27b through which an upper end of the side cylinder 18 can pass.

[0051] The sliding members 26 and the mounting members 27 are fixed to the pillars 25 with fixing screws 28 and, when the fixing screws 28 are loosened, can freely ascend and descend along the pillars 25. Therefore, the side cylinders 18 can be stored when not in use as shown in Fig. 7(a), and project toward the inside of the frame body 11 when in use as shown in Fig. 7(b). Furthermore, vertical positions of the side cylinders 18 can be optionally determined. As the pillars 25 are movable in the front and rear directions in the frame body 11, the positions of the side cylinders 18 in front and rear directions can also be optionally determined.

[0052] As shown in Fig. 3, the floor cylinders 19, which are disposed on a floor surface of the frame body 11, are mounted, via sliding members 30 (see Fig. 8), to six floor rails 29 movable in right and left directions along the floor surface, and thus are movable front/rear and right/left directions on the floor surface. Each of the floor cylinders 19 is fixed to the sliding member 30 by engaging an internal thread portion (not shown) formed in a lower end of the floor cylinder 19 with an external thread portion 30a formed on the sliding member 30. As the floor cylinders 19 are detachable from the sliding members 30, only the floor members can be replaced. The floor rails 29 and the sliding members 30 can be freely moved when the floor cylinders 19 are not in use. However, provided with a locking mechanism to automatically stop the floor rails 29 and the sliding members 30 at their present positions when the floor cylinders 19 extend and load an downward reaction force, the floor rails 29 and the sliding members 30 do not freely move during the correction work and, after the downward reaction force is released, become movable again.

[0053] As shown in Figs. 1 and 3, each of the pillars 25 is provided with a plurality of mounting members 31, and each of columns 32 standing on the both sides of the frame body 11 is provided with a plurality of mounting members 33, which function as auxiliary members to receive the chains 35 described below. As shown in Fig. 9, each of the mounting members 33 has a mounting hole 33a to receive the chain 35 and is fixed to the column 32 with the fixing screw 28. Thus, when loosening the fixing screw 28, the mounting member 33 ascends and descends along and rotates around the column 32 and can be fixed at an optional position with the mounting hole 33a directed to an optional direction. As shown in Fig. 10(b), each of the mounting members 31 has a mounting hole 31a to receive a chain and is fixed to the pillar 25 with the fixing screw 28. Accordingly, when loosening the fixing screw 28, the mounting member 31 ascend and descend along the pillar 25 and can be fixed in an optional position.

[0054] Furthermore, as shown in Fig. 3, on the floor surface of the frame body 11, six slits 36 to which mounting members 34 to receive the chains 35 can be attached are formed in front and rear directions throughout the frame body 11. As shown in Fig. 11, each of the mounting members 34 has a mounting hole 34a to receive the chain 35, an engaging portion 34b to be engaged with the slit 36, and supporting portion 34c to connect these portions. Putting a longitudinal direction of the engaging portion 34b along a longitudinal direction of the slit 36, the engaging portion 34b is inserted into

the slit 36 and then rotated around the supporting portion 34c in 90 degrees. Thus, the mounting member 34 is fixed in the slit 36 and, by the operation vice versa, is detached from the slit 36, which is a simple attaching/detaching operation. The mounting member 34 can be fixed at an optional position in the slit 36.

[0055] As shown in Figs. 5 and 12, a horizontal bar 38 made of an H-section steel material is detachably mounted to a plurality of engaging holes 37a which are formed at different heights on pillars 37 standing both right and left sides of the rear surface of the frame body 11. A plurality of mounting members 39 to receive the chains 35 are mounted to the horizontal bar 38, being freely movable along the horizontal bar 38. Inserting portions 38a extending from both ends of the horizontal bar 38 are inserted into a pair of the engaging holes 37a, and lock pins 40 are attached to the mounting holes 38b of the inserting portions 38a protruding to a front side of the horizontal bar 38, thereby fixing the horizontal bar 38. The structures of the mounting members 39 and the horizontal bar 38 are the same as the ones shown in Fig. 10(b). Thus, a plurality of the mounting members 39 can be disposed at any optional position within a range where the engaging holes 37a are arranged and within a length of the horizontal bar 38.

[0056] As shown in Figs. 2 and 5, a sliding member 48 is mounted to a ceiling rail 47 which is movable in front and rear directions of the ceiling unit of the frame body 11, and a mounting member 49 to receive the chain 35 is mounted to the sliding member 48. Therefore, the mounting member 49 is movable throughout the ceiling portion of the frame body. The ceiling rail 47 and the sliding member 48 can be freely moved when the mounting member 49 is not in use. However, provided with a locking mechanism to automatically stop the ceiling rail 47 and the sliding member 48 at their present positions when stress is loaded with the chain 35 or the like, the ceiling rail 47 and the sliding member 48 do not freely move during the correction work and, after the stress is released, become movable again. While the mounting member 49 is used as a mounting means for receiving a chain of the like to hold an automobile body during the correction work, it is also possible, when inserting an automobile body, to suspend a front portion of the automobile body with a chain or the like hanging from the mounting member 49.

[0057] As shown in Fig. 13, each of the ceiling cylinders 16, the suspending cylinders 17, the side cylinders 18, the floor cylinders 19 or the like houses an oil cylinder 44 operated by the hydraulic power generator 43. Engaging attachments 46a to 46f having various forms to engage parts of an automobile body to be corrected can be attached to a screw portion of a tip end of a ram 45. For example, a tip end of the engaging attachment 46a is flat to fit a flat portion of an automobile body, and tip ends of the engaging attachments 46b and 46c have an L-form and a V-form, respectively, to fit a corner of an automobile body. Any other form variations can be employed depending on a portion to be corrected.

[0058] The oil cylinders 44 have open/close valves 44v for oil. By opening and closing the open/close valves 44v, the oil cylinders 44 are set to be either in use or not. Therefore, each of the oil cylinders 44 can be operated only with the hydraulic power generator 43 without any large-scaled construction work for facilities. It is also possible to simultaneously operate a plurality of the oil cylinders 44 to uniformly pressurize deformed portions of an automobile body for correction, making the correction work accurate. Furthermore, the number of the oil cylinders 44 installed can be relatively easily changed.

[0059] The lifting cylinders 21 to lift the suspending cylinders 17 and the lifting cylinders 41 to lift the reaction force supporting members 42 are also oil cylinders operated by the hydraulic power generator 43, which have larger operating strokes compared to the oil cylinders 44 and, therefore, can lift and lower the suspending cylinders 17 and the reaction force supporting members 42 over a wider range. The automobile correction device 10 is operated by an operating box 43a of the hydraulic power generator 43.

[0060] Referring to Figs. 14 to 18, the correction work using the automobile body correction device 10 will be explained below. When correcting an automobile body frame 50 deformed by a car accident or the like, as shown in Fig. 14, the automobile body frame 50 is inserted from a front side or a rear side of the frame body 11. A front portion of the automobile body frame 50 is laid on the floor cylinders 19, and right and left of a rear portion are held with the chains 35 mounted to the mounting members 27 and 31. The tip ends of the engaging attachments 46b attached to three of the side cylinders 18 which extend from the both side portions fit the deformed portions of the automobile body frame 50. Thus, the automobile body frame 50, the floor cylinders 19, the side cylinders 18 and the chains 35 are in the state as shown in Figs. 15 and 16.

[0061] In the above-described state, three side cylinders 18 are operated to gradually pressurize the three deformed portions of the automobile body frame 50, thereby elastically deforming the portions. Thus, the deformed automobile body frame 50 can restore the original form. After finishing the correction of the automobile body frame 50, the side cylinders 18, the chains 35 and the like are removed so that the automobile body frame 50 can be carried out from the frame body 11.

[0062] According to the correcting work using the automobile body correction device 10, by simultaneously pressurizing the three different portions of the automobile body frame 50, it is possible to pressurize the automobile body in a constantly stable condition without causing any wobbling or shaking. Therefore, the correction work can be accurately and safely finished in a shorter time. Furthermore, directly pressurized and corrected deformed portions of the automobile body frame 50 and area adjacent thereto cause a very slight spring back and allow even unskilled workers to accurately cor-

rect the automobile body without requiring a high degree of technique. In addition, the correction work permitted only inside the frame body 11 can make efficient use of space.

[0063] Each of the floor cylinders 19, the side cylinders 18, the mounting members 27, 31 for the chains 35 or the like is movable and, therefore, can be set at an optimal position depending on the size and the deformed condition of the automobile body frame 50, which leads to accurate correction work. While the above embodiment refers to the correction work for the automobile body frame 50 which constitutes a body of a truck, the present invention should not be limited to this embodiment, and it is possible to insert whole or a part of various kinds of automobile bodies into the frame body 11 to correct them.

[0064] Referring to Figs. 17 to 19, another correction work using the automobile body frame 10 will be explained. When correcting an automobile body frame 51 which has been deformed ranging relatively large area, not only the side cylinders 18 but also the suspending cylinders 17 are used for the correction work. As shown in Fig. 17, the side cylinders 18 and the suspending cylinders 17 are moved to appropriate positions depending on the deformed condition of the automobile body frame 51, respectively. Then, the engaging attachments 46b, extension attachments 52 and the like are attached, and distal ends of the engaging attachments 46b are fit to the deformed portions and areas adjacent thereto of the automobile body frame 51. Simultaneously, distal ends of the extension attachments 52 are fit to the reaction force supporting members 42 in order to support reaction force of the suspending cylinders 17.

[0065] In the above-described state, the side cylinders 18 and the suspending cylinders 17 are operated to gradually pressurize the deformed portions or the like, thereby restoring the original form of the automobile body frame 51. In this case, it is also preferable that all of the side cylinders 18 and the suspending cylinders 17 are not simultaneously operated, but the three different portions of the automobile body frame 51 are pressurized one by one in one process. If the automobile body frame 51 is likely to dent inwardly by pressure, one of the suspending cylinders 17 is disposed inside the automobile body frame 51 to support the automobile body frame 51 outwardly with the extension attachment 53 having appropriate length, thereby preventing the deformation.

[0066] Depending on the deformed condition of the automobile body frame 51, as shown in Fig. 19, the correction work can be operated while loading pressurizing force of the suspending cylinders 17 or the like to the automobile body frame 51 via correction jigs 55 having engaging grooves 55a which can be engaged with a rim 51a of the automobile body frame 51. Employing the correction jigs 55 enables the rim 51a to be safely and securely pressured.

[0067] Next, referring Fig. 20, yet another embodiment of the correction work using the automobile correction body 10 will be explained below. When correcting an automobile body frame 54 which has been deformed in a vertical direction, the automobile body frame 54 inserted into the frame body 11 is laid on the floor cylinders 19 with its deformed portions placed between the two floor cylinders 19, and the deformed portions are pressurized with the ceiling cylinder 16 to restore the original form. In this case, by simultaneously pressurizing the three different portions of the deformed automobile body frame, it is also possible to pressurize the automobile body in a constantly stable condition without causing any wobbling or shaking. Therefore, the correction work can be accurately and safely finished in a shorter time.

[0068] Referring to Figs. 21 and 22, yet another embodiment using the automobile body correction device 10 will be explained below. When correcting a relatively small automobile body 56 such as a low displacement car, as shown in Fig. 21, the automobile body 56 inserted into the frame device 11 is lifted with the lifting devices 12 up to an appropriate height. After a frame of the automobile body 56 is fixed with a plurality of the body holding devices 13 arranged in a front/rear direction at predetermined intervals, the lifting devices 12 are released.

[0069] By the above steps, the automobile body 56 is fixed while being laid on the body holding devices 13 and, using moving wheels 13a thereof, is moved to an appropriate position inside the frame body 11 and fixed on the floor surface by locking the moving wheels 13a. Then, as described above, the automobile body 56 is corrected by using the ceiling cylinders 16, the suspending cylinders 17, the side cylinders 18 and the floor cylinders 19 as well as the mounting members 27, 31, 33, 34 and 39 depending on the deformed condition. Thus, the automobile body 56 inserted into the frame body is lifted with the lifting members 12 up to an appropriate height depending on the size of the automobile frame and fixed with the body holding devices 13, and then a plurality of portions of the automobile body are pressurized with a plurality of the pressurizing devices to restore the original form. Accordingly, the correction work can be accurately and safely finished in a shorter time irrespective of the size of the automobile body.

[0070] As shown in Fig. 22, in each of the body holding devices 13, two moving members 13d are mounted to a body rail 13c having the moving wheels 13a, and a frame fixing members 13b which can ascend/descend and rotate are mounted to the moving members 13d. Therefore, a height and interval of the frame fixing members 13b can be adjusted depending on the frame size of the automobile body 56. As the frame of the automobile body 56 is fixed to the frame fixing members 13b via auxiliary connectors 57, providing several kinds of the auxiliary connectors 57 applicable to various frame sizes and forms of automobiles on the market, a variety of frames can be securely fixed, improving convenience

and workability of the correction work as well as making the operation safer and more accurate.

[0071] In the automobile body correction device 10 of this embodiment, the hydraulic power generator 43 is detachable from the frame body 11 and can be used in combination with other pressurizing devices having oil cylinder systems, which leads to higher applicability.

[0072] After the wheels 14, 15 are lowered and landed with the wheel lifting cylinders 14a, 15a while lifting up the frame body 11 from the ground, the wheels 14 are steered by the steering cylinder 14b while rotating the wheels 15 with the driving motor 15b, thereby moving the automobile body correction device 10 as a whole. Accordingly, it becomes easier to transfer the automobile correction device 10 to a working place, to move the device into a workshop, to insert an automobile body into the device, and to move the unused device to a storehouse. After stopping the automobile correction device 10 at a working place, by lifting up the wheels 14, 15 with the wheel lifting cylinders 14a, 15a, the frame body is landed on the ground, and the wheels 14, 15 are stored.

[0073] Figs. 23 to 31 show the second embodiment of the present invention.

[0074] According to this embodiment, an automobile body correction device 110 comprises a front frame body 111 and a rear frame body 112, wherein the front frame body 111 has a floor surface, both right and left side units and a ceiling unit structured by steel materials, and the rear frame body 112 has a floor surface and both right and left side units structured by steel materials. To comer portions of the front frame body 111 and the rear frame body 112, wheels 142, 143 are mounted. The wheels 142 mounted to the front side are driven by a motor (not shown) to be self-propelled, and the automobile body correction device 110 can be transferred to an optional place when needed.

[0075] Six ceiling cylinders 113 and nine suspending cylinders 114 are disposed on the ceiling unit of the front frame body 111, and six floor cylinders 115 are disposed on the floor surface. As shown in Fig. 26, the ceiling cylinders 113 are movable along longitudinal directions of two rails 116. The suspending cylinders 114 are suspended from three rails 118 via lifting cylinders 117, and the lifting cylinders 117 are movable along longitudinal directions of the rails 118.

[0076] Upper ends of the lifting cylinders 117 are mounted to sliding members 160 via universal joints 158, and the suspending cylinders 114 are mounted to lower ends of the lifting cylinders 117. Thus, the suspending cylinders 114 can ascend/descend, rotate, swing and slant in any direction, thereby optionally defining positions and directions to be pressurized. Therefore, as described below, when correcting a deformed automobile body 151, optimal positions for correction are pressurized from optimal directions depending on the size, form and deforming condition of the automobile body 151, making the correction work accurate.

[0077] The floor cylinders 115, as shown in Fig. 27, are movable along longitudinal directions of two moving members 119, and the moving members 119 are movable along longitudinal directions of rails 120. As each of the floor cylinders 115 and the moving members 119 has stoppers 121 on both end portions, the floor cylinders 115 are stopped at optional positions on the moving members 119 by pushing pressing portions 122, and the moving members 119 are stopped at optional positions on the rails 120. By pushing the pressing portions 122 again, the floor cylinders 115 and the moving members 119 are released to become movable again.

[0078] Inside both right and left side units of the front frame body 111, disposed are horizontal reaction force members 130, respectively. The reaction force members 130 can be lifted by lifting cylinders 131 and stopped at optional height. The reaction force members 130 are provided to support reaction force generated when pressurizing and correcting an automobile body with the suspending cylinders 114.

[0079] Two side cylinders 123 are disposed on each of both right and left side portions of the rear frame body 112, and two moving members 125 which are movable along longitudinal directions of rails 124 are disposed on the floor surface. At optional positions of the moving members 125, body supporting members 126 can be mounted. Supporting units 134 can be lifted and lowered by rotating handles 133 of the body supporting members 126.

[0080] The side cylinders 123 can be lifted along pillars 127, and the pillars 127 are movable along longitudinal directions of rails 128. The side cylinders 123 are lifted and lowered by winding and unwinding wires 129 with hand-operated winches 135, and fixed/released at optional positions with the stoppers 121. The hand-operated winches 135 are also movable with the pillars 127 along the longitudinal directions of the rails 128.

[0081] The ceiling cylinders 113, the suspending cylinders 114, the floor cylinders 115 and the side cylinders 123 have oil cylinders which extend and contract by hydraulic power generated by oil pumps 144. To distal ends of the oil cylinders, depending on the conditions of the correction work, attached are extending attachments 139 having various lengths or, as described referring to Fig. 13, a variety of the engaging attachments to engage with various parts of an automobile body. Engaging attachments 141 have L-forms which fit with corners of an automobile body frame.

[0082] The lifting cylinders 117 from which the suspending cylinders 114 hang and the lifting cylinders 131 to lift the reaction force members 130 are also oil cylinders which extend and contract by hydraulic power generated by oil pumps 144. As these oil cylinders have larger operating strokes compared to the oil cylinders 137, the suspending cylinders 114 and the reaction force members 130 can ascend and descend over a wider range.

[0083] Each member of the automobile body correct-

ing device 110 is operated with operating devices 145 to 148 provided in the front surface of the automobile body correcting device 110. The operating devices 145 to 148 are connected to extension cords 149 wound on reels 150, and an operator can move to his/her intended positions with the operating devices 145 to 148 in hands and operate them while visually checking the operations.

[0084] Next, referring to the Figs. 28 and 29, the correction work using the automobile body correction device 110 will be explained below. As shown in Fig. 28, the deformed automobile body frame 151 is inserted into the front frame body 111 through the rear frame body 112, and the engaging attachments 141 which are connected to three of the side cylinders 123 via the extension attachments 139 are fitted to deformed portions of the automobile body frame 151. In this case, the heights of the side cylinders 123 are adjusted with the hand-operated winches 135, and the positioning in front/rear directions are adjusted by moving the pillars 127. The lengths of the extension attachments 139 are determined in accordance with distances from the side cylinders 123 to the deformed portions of the automobile body frame 151.

[0085] By the above process, the automobile body frame 151 and the side cylinders 123 are in the state shown in Fig. 15 of the above-described first embodiment. If necessary, a bottom portion of the automobile body frame 151 may be supported by the body supporting members 126.

[0086] In the state shown in Figs. 28, the three side cylinders 123 are operated to gradually pressurize the three deformed portions of the automobile body frame 151, thereby restoring the original form of the deformed automobile body frame 151. When the automobile body frame 151 reverts to the original straight form, the correction work is finished.

[0087] In the correction work using the automobile body correction device 110, as the automobile body frame 151 are pressurized and corrected with the three side cylinders 123, it is not necessary to fix or pull the automobile body frame 151 with chains or the like. Therefore, the automobile body frame 151 can be easily inserted into the automobile body correction device 110 and can also be easily carried out after the correction work, making the time required for the operation shorter. Furthermore, no fears that chains or the like may break make the correction work highly safer. In addition, directly pressurized and corrected deformed portions of the automobile body frame 151 cause a very slight spring back and allow even unskilled workers to accurately correct the body without requiring a high-level technique.

[0088] The ceiling cylinders 113, the suspending cylinders 114, the floor cylinders 115, the frame supporting members 126, the reaction force members 130, or the like, each of which is movable, are disposed at optional positions depending on the size and deformed condition of the automobile body frame 151 so that the correction work is accurate. In the automobile body correction device 110, the correction work described in Figs. 17 to 20 above is also possible.

[0089] The approximate size of the automobile body correction device 110 is 3 meters in width and 5 meters in length, which requires a smaller space to install compared to the conventional automobile body correction devices. Moreover, the correction work permitted only inside the front frame body 111 and the rear frame body 112 can make efficient use of space. The automobile body correction device 110 can applicable to a relatively wide range of automobiles, correcting the automobiles from 2-ton trucks to 25-ton trucks. While the above embodiment refers to the correction work for the automobile body frame 151, the present invention should not be limited to this embodiment, and it is possible to correct any kind of automobile body as long as the whole body or a part of the body can be inserted into the front frame body 111 and the rear frame body 112.

[0090] Here, referring to Figs. 30 and 31, another use of the automobile body correction device 110 will be explained. When the automobile body correction device 110 is not in use, providing wheel holding members 154 on the floor surfaces of the front frame body 111 and the rear frame body 112 as shown in Fig. 30, the automobile body correction device 110 may be used as a garage for a passenger car 155 or the like as shown in Fig. 31. Furthermore, the automobile body correction device 110 has wheels 142, 143 and are movable carrying the passenger car 155 inside, which makes the device more convenient.

[0091] The wheel holding members 154 can be detachably mounted to mounting portions 157 provided on sides of the rails 120, 124. When using the automobile body correction device 110 as a garage, by arranging slant members 156 adjacent to the rails 124, it is possible to safely and smoothly drive the automobile 115 into and out of the automobile body correction device 110.

[0092] When wheels of a deformed automobile body need to be supported during the correction work using the automobile body correction device 110, the wheels can be laid on the wheel holding members 154 mounted to the floor surface in advance during the operation.

INDUSTRIAL APPLICABILITY

[0093] As described above, an automobile body correction device of the present invention comprises a frame body capable of receiving whole or a part of the automobile body and a plurality of pressurizing devices mounted to the frame body for pressurizing the automobile body. By this structure, an automobile body or a part of the automobile body deformed by a traffic accident or the like is inserted into the frame body, and the portions to be corrected are pressurized by a plurality of the pressurizing devices to correct the deformed portions. The automobile body correction device can be used for cor-

recting not only standard-sized passenger cars but also various kinds of automobiles such as large-sized passenger cars, buses, trucks, trailers, and specially-equipped vehicles.

Claims

1. An automobile body correction device comprising a frame body capable of receiving whole or a part of an automobile body and a plurality of pressurizing devices mounted to the frame body for pressurizing the automobile body.

2. The automobile body correction device according to claim 1, wherein said pressurizing devices are mounted to a floor surface, both side units and a ceiling unit of the frame body.

3. The automobile body correction device according to claim 1 or 2, wherein said pressurizing devices are movable in horizontal and vertical directions inside the frame body.

4. The automobile body correction device according to claim 1 further comprising a body supporting member on a floor surface of the frame body upon which the automobile body inserted into the frame body can be laid.

5. The automobile body correction device according to claim 1 further comprising, inside the frame body, a lifting device to lift the automobile body inserted into the frame body and a body holding device to hold the lifted automobile body.

6. The automobile body correction device according to claim 2, said pressurizing devices mounted to the ceiling unit of the frame body are mounted to suspending members which are extensibly, swingably and rotabably suspended from the ceiling unit of the frame body.

7. The automobile body correction device according to claim 6 further comprising reaction force supporting members provided on the both side units of the frame body to support the reaction force of the pressurizing devices mounted to the ceiling unit.

8. The automobile body correction device according to claim 2, said pressurizing devices mounted to the both side units of the frame body are storable in the both side units of the frame body.

9. The automobile body correction device according to claim 2, said pressurizing devices mounted to the floor surface of the frame body is detachable from the floor surface of the frame body.

10. The automobile body correction device according to claim 1, wherein said frame body is provided with wheels to transfer the frame body, wheel lifting devices to land and store the wheels, and a steering device to change a moving direction of the frame body.

11. The automobile body correction device according to claim 1 further comprising, on a floor surface of the frame body, wheel holding members to receive wheels of the automobile body inserted into the frame body.

12. An automobile body correction method using the automobile body correction device according to any one of claims 1 to 12, wherein whole or a part of an automobile body is inserted into a frame body provided with a plurality of pressurizing devices for pressurizing the automobile body, and three different portions of the inserted automobile body or the part of the automobile body are pressurized with a plurality of the pressurizing devices to elastically transform the automobile body or the part of the automobile body.

FIG. 1

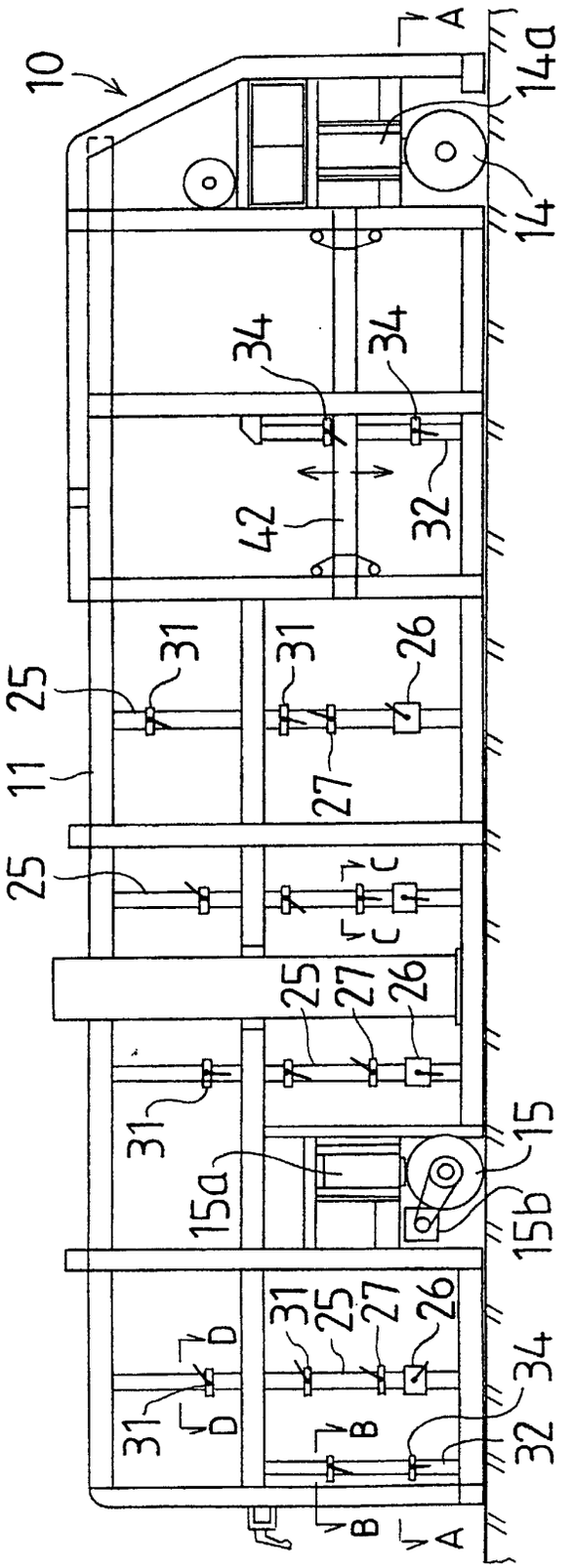
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FIG.2

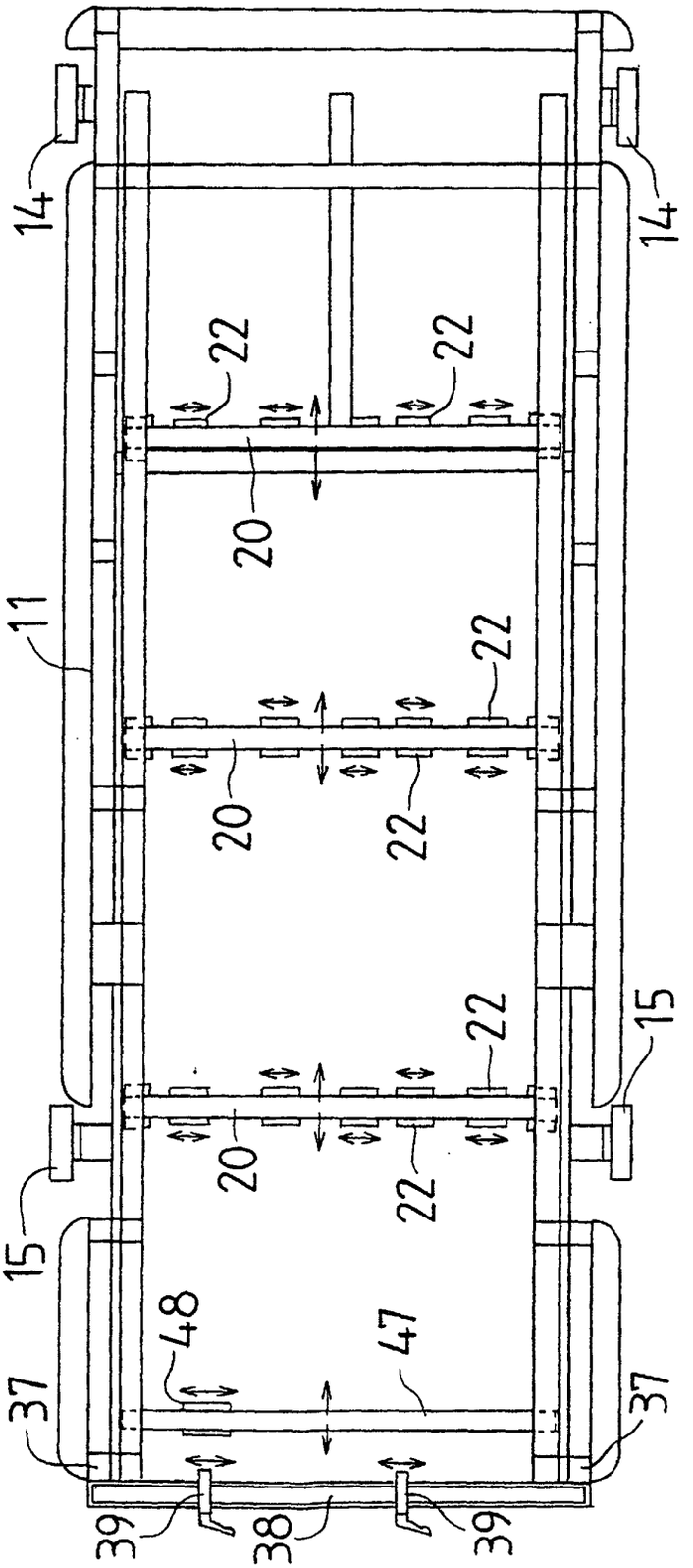


FIG.3

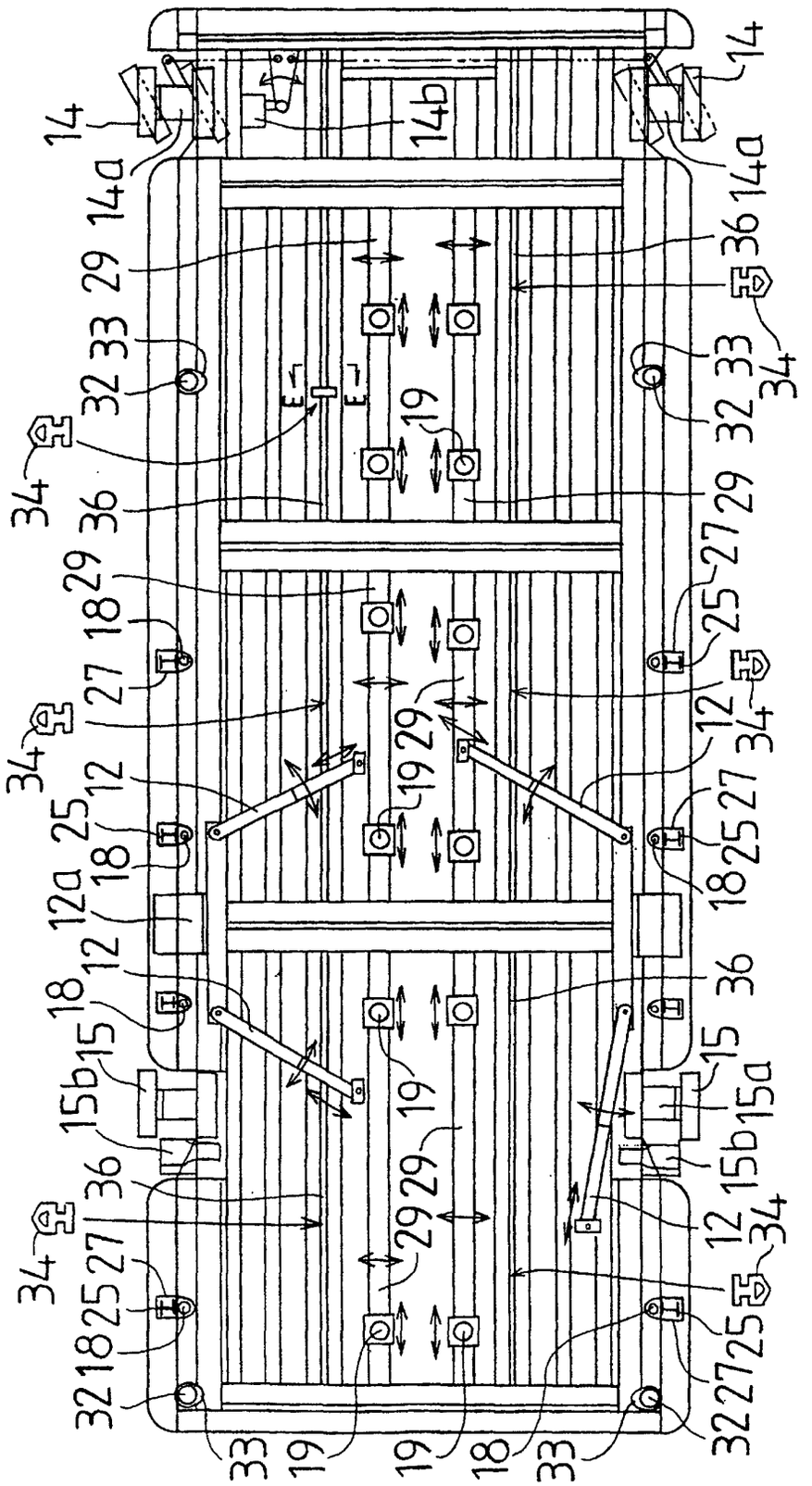


FIG. 4

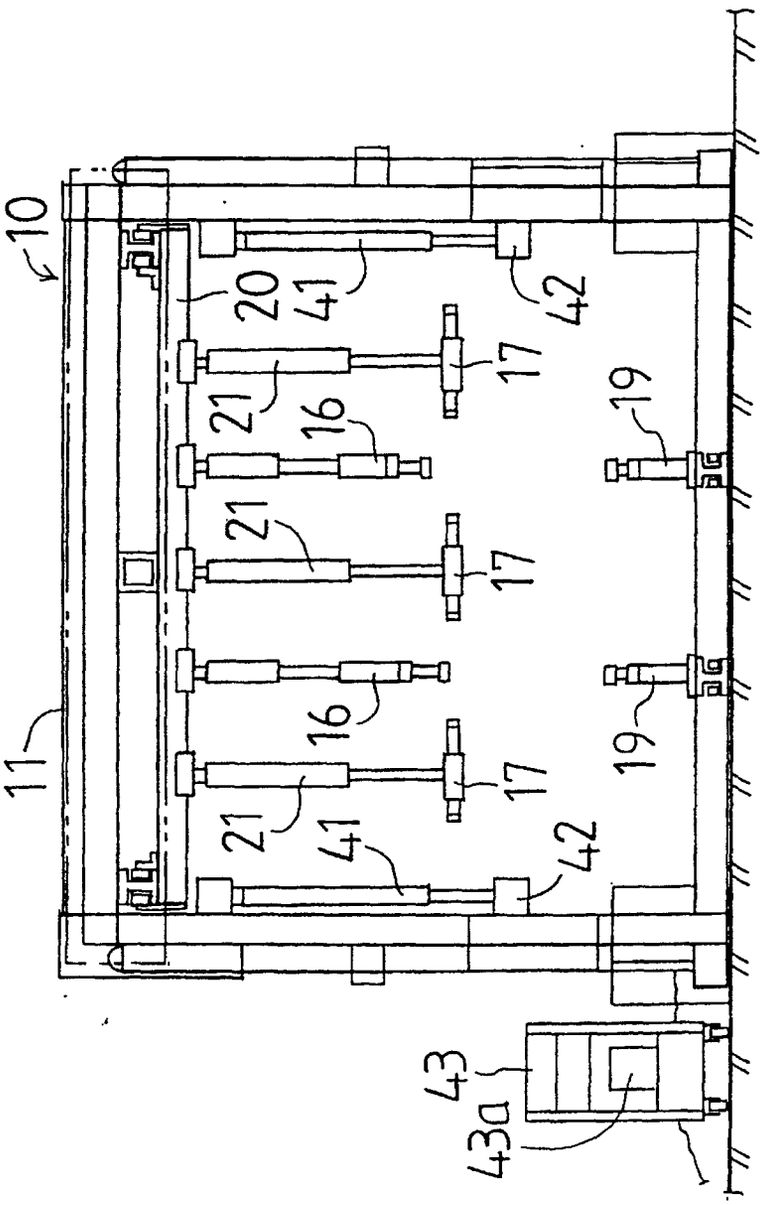
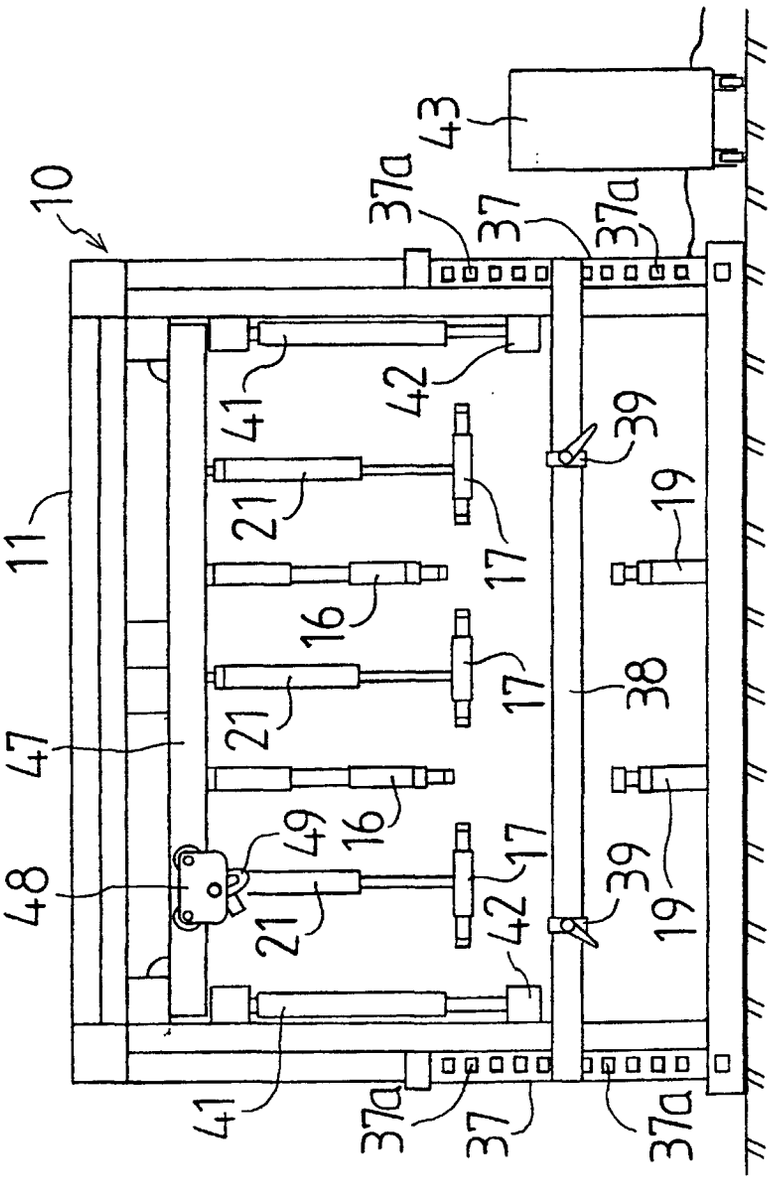


FIG.5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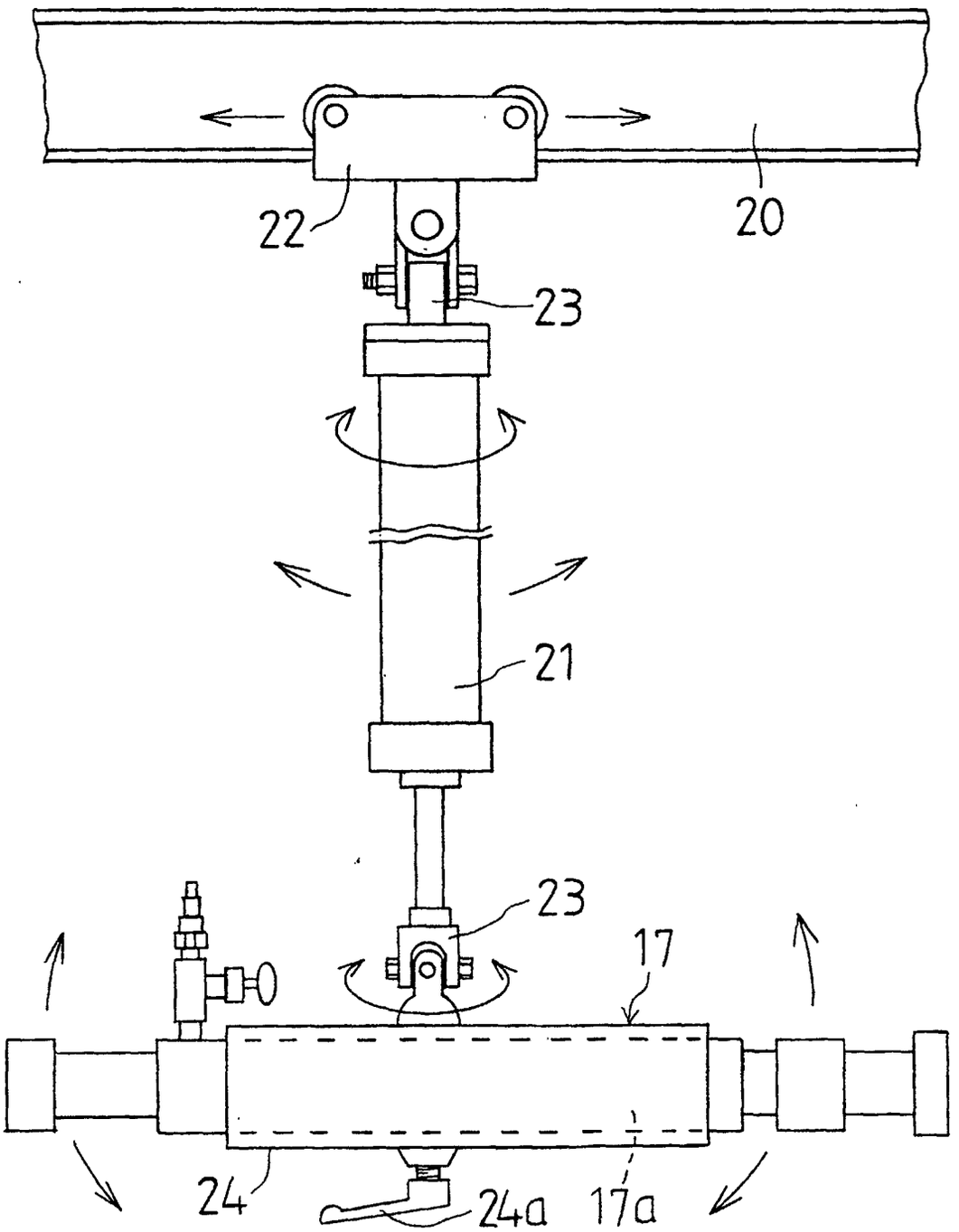
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FIG. 7

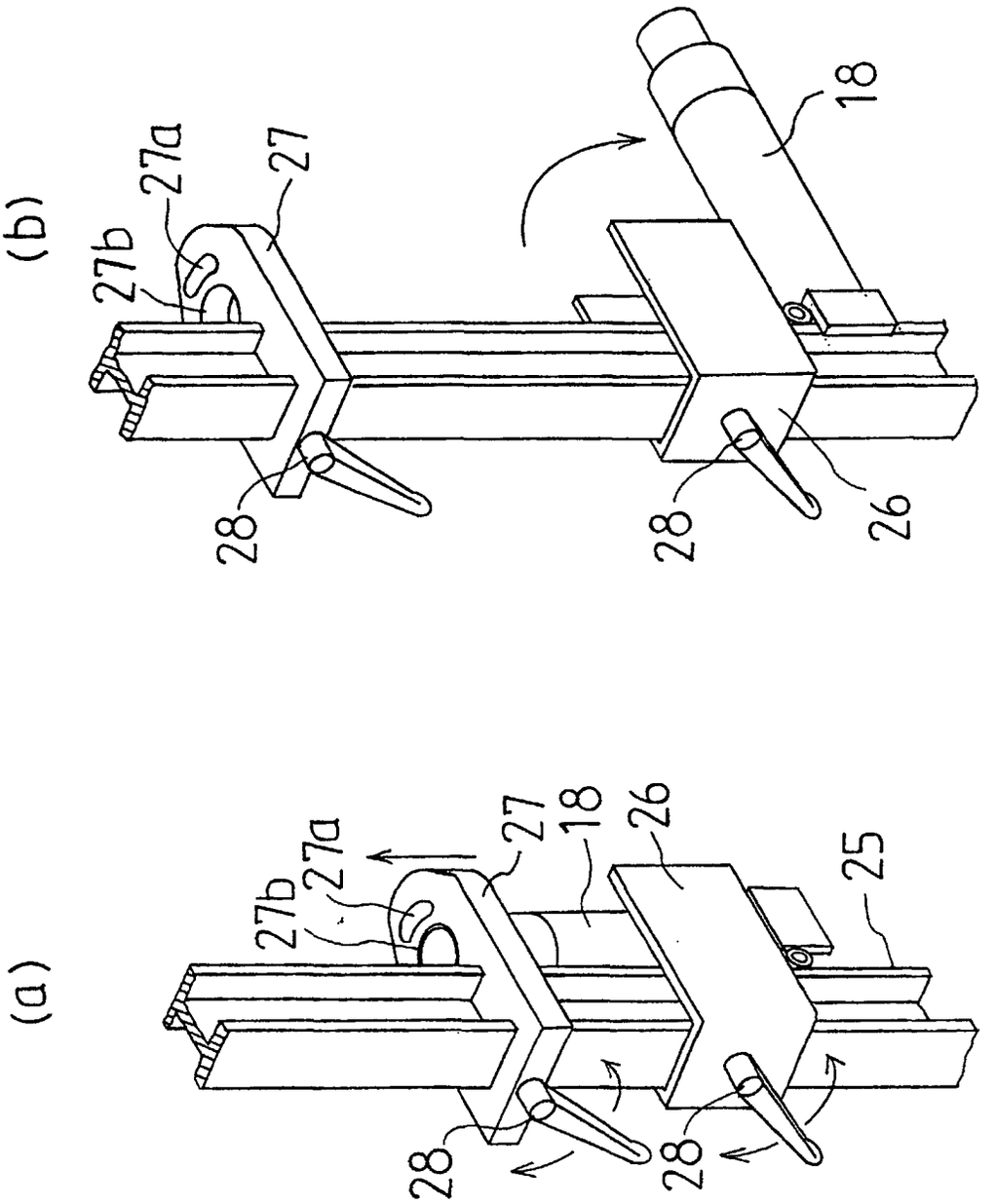

FIG.8

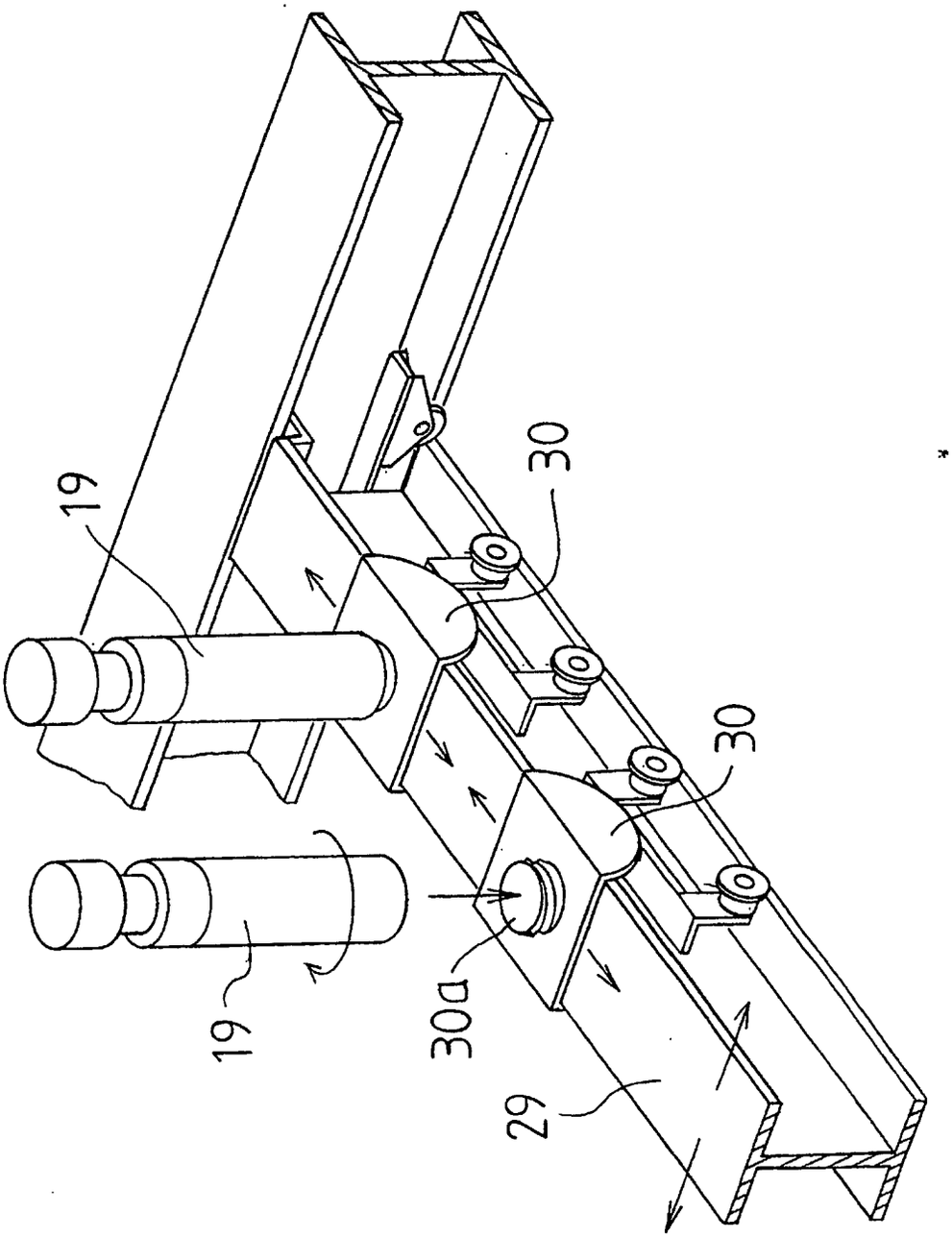

FIG.9

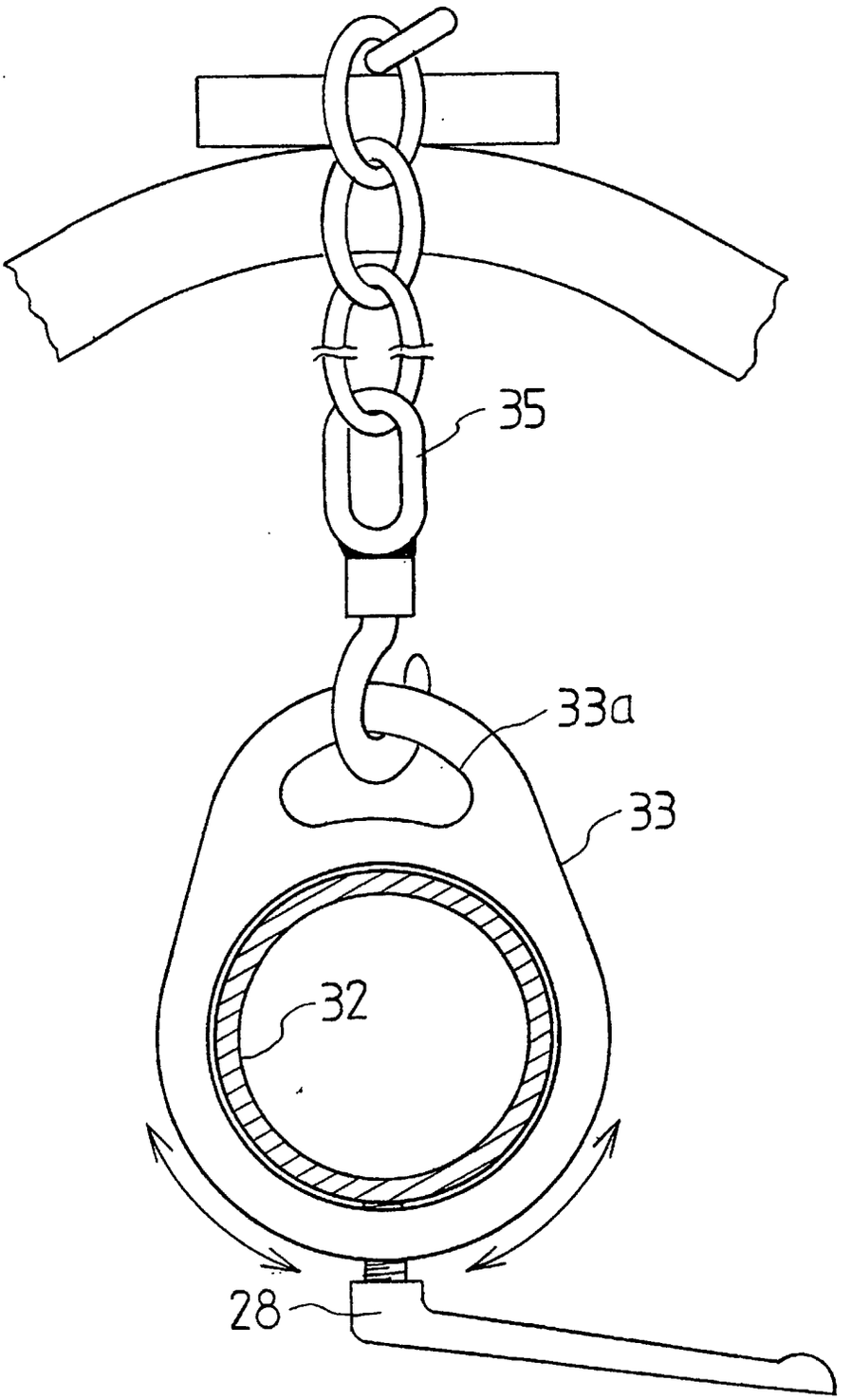

FIG.10

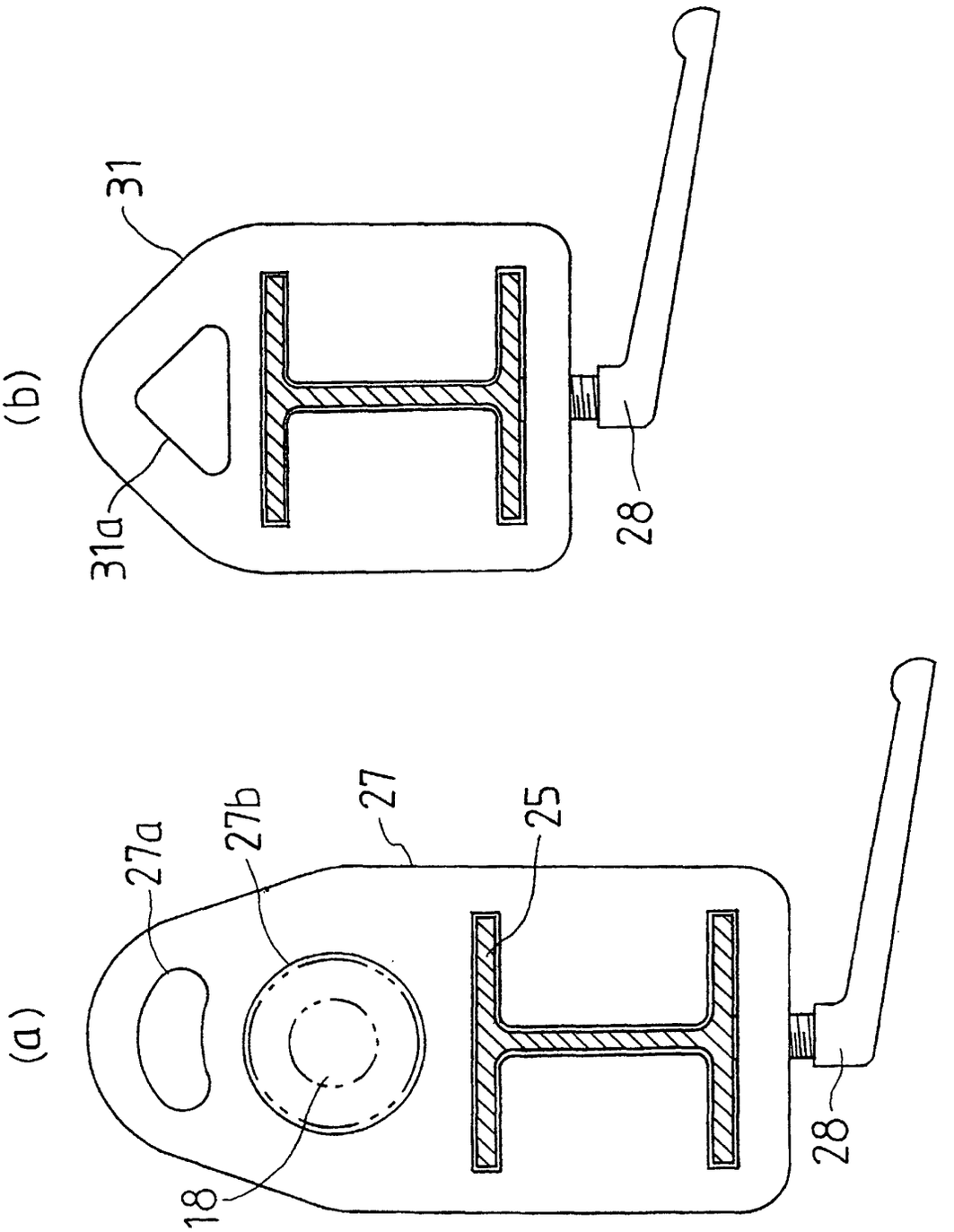

FIG. 11

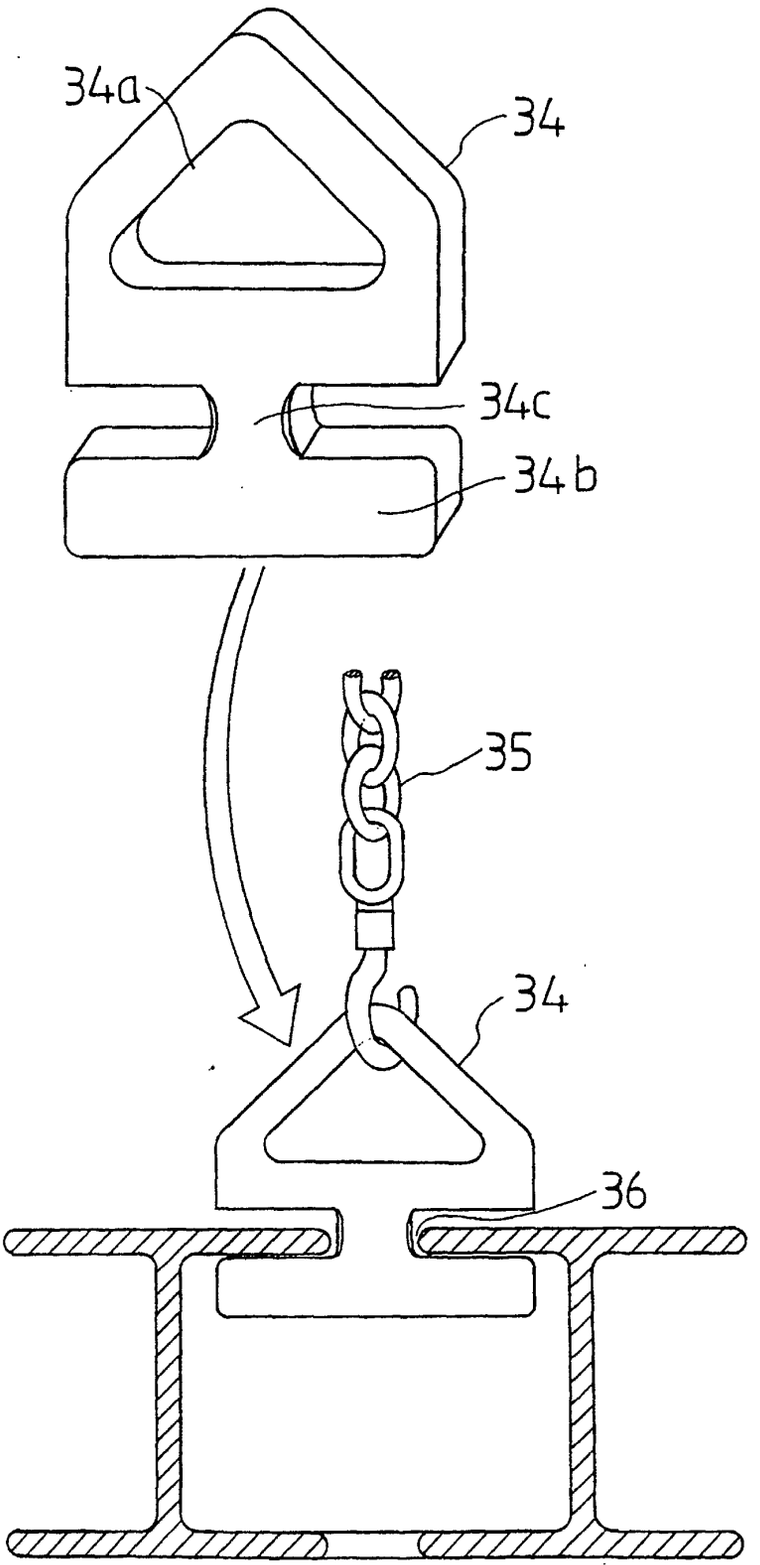

FIG.12

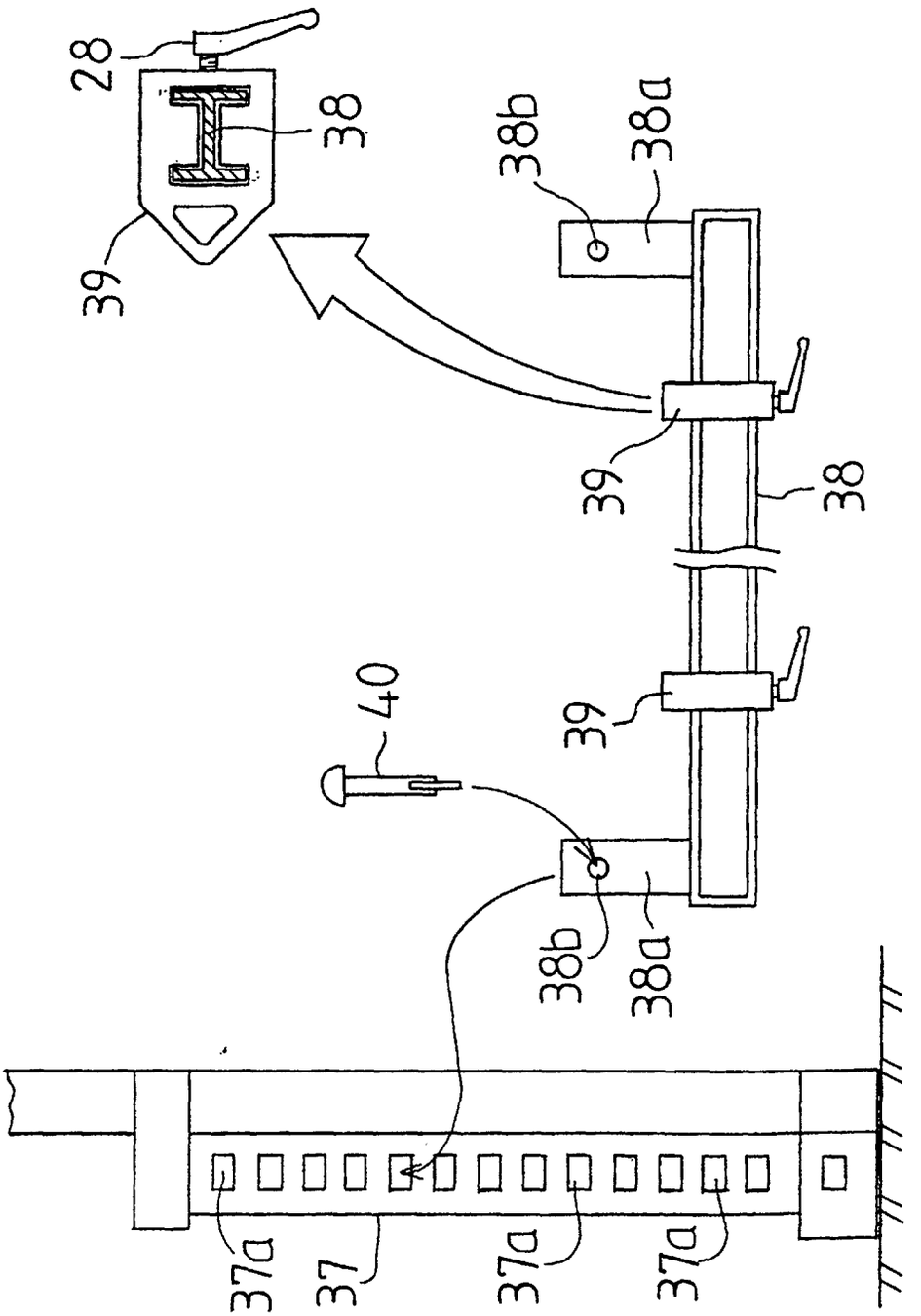

FIG.13

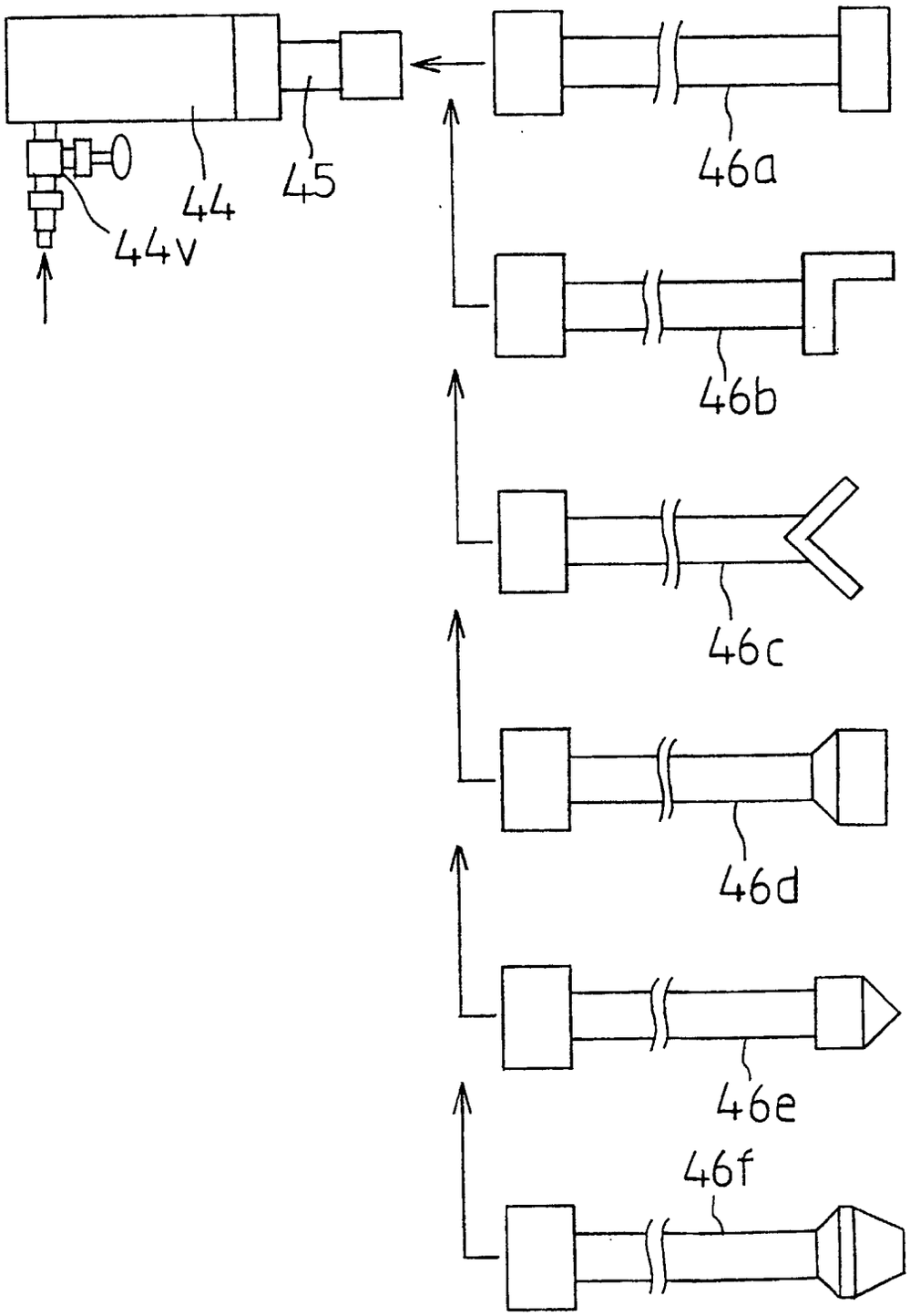

FIG. 14

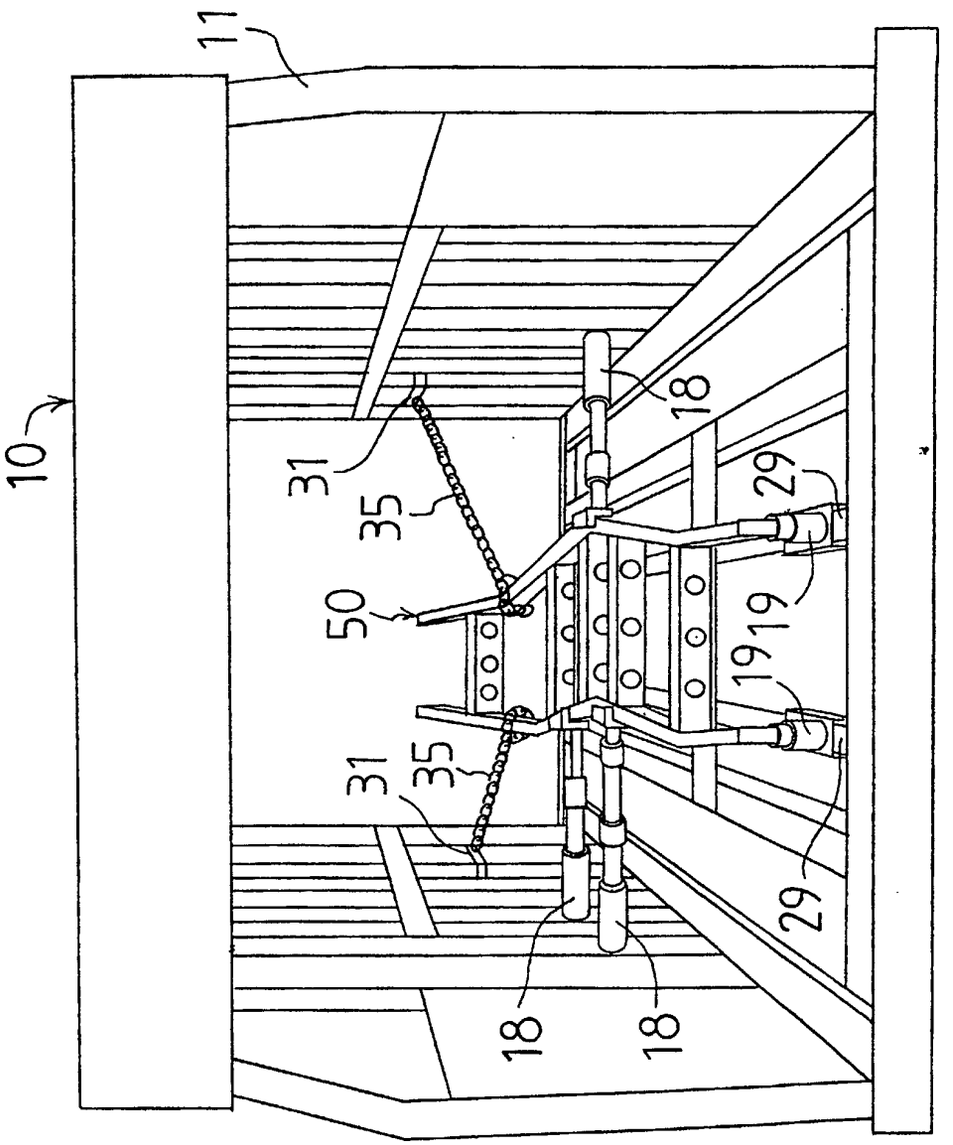

FIG. 15

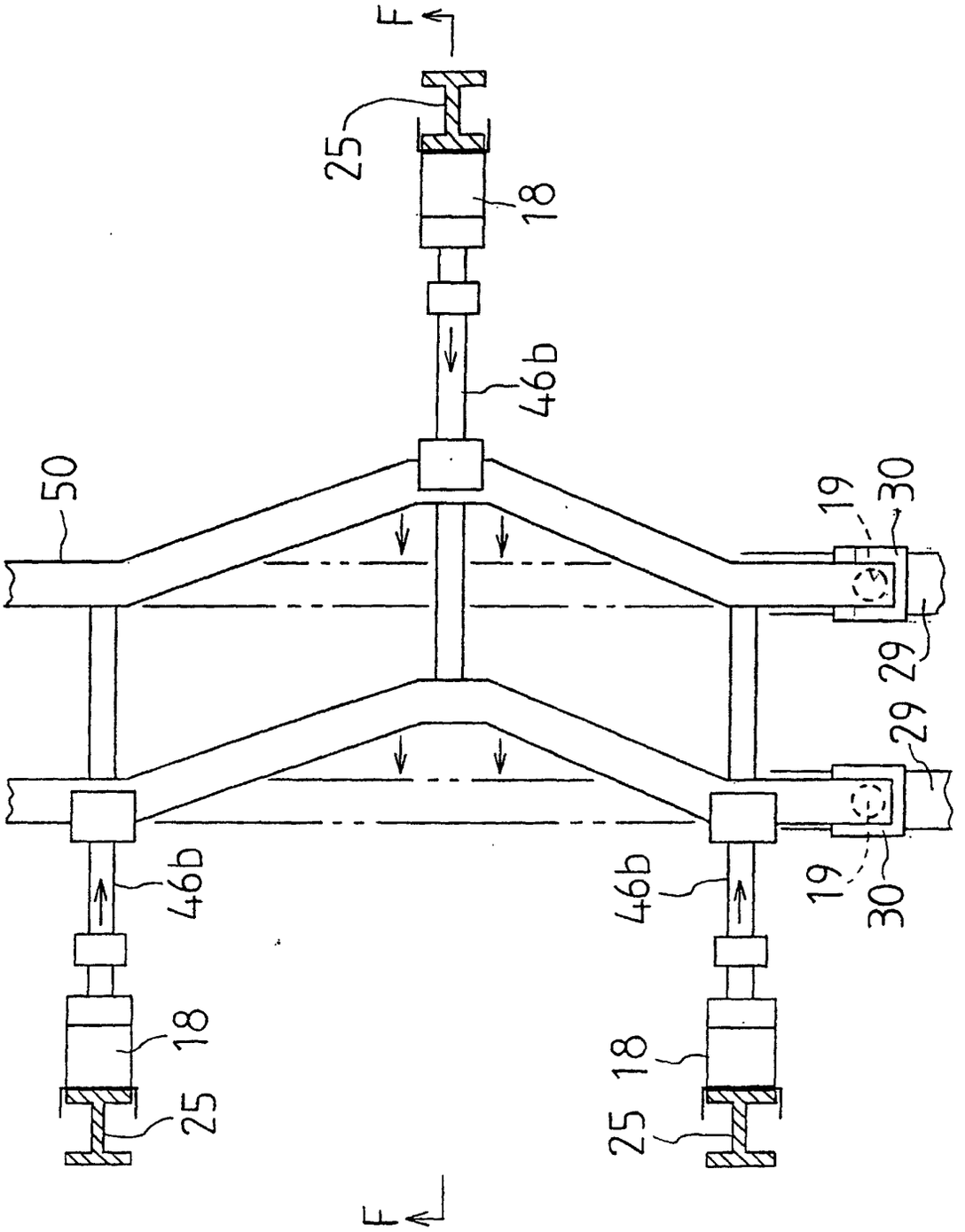

FIG.16

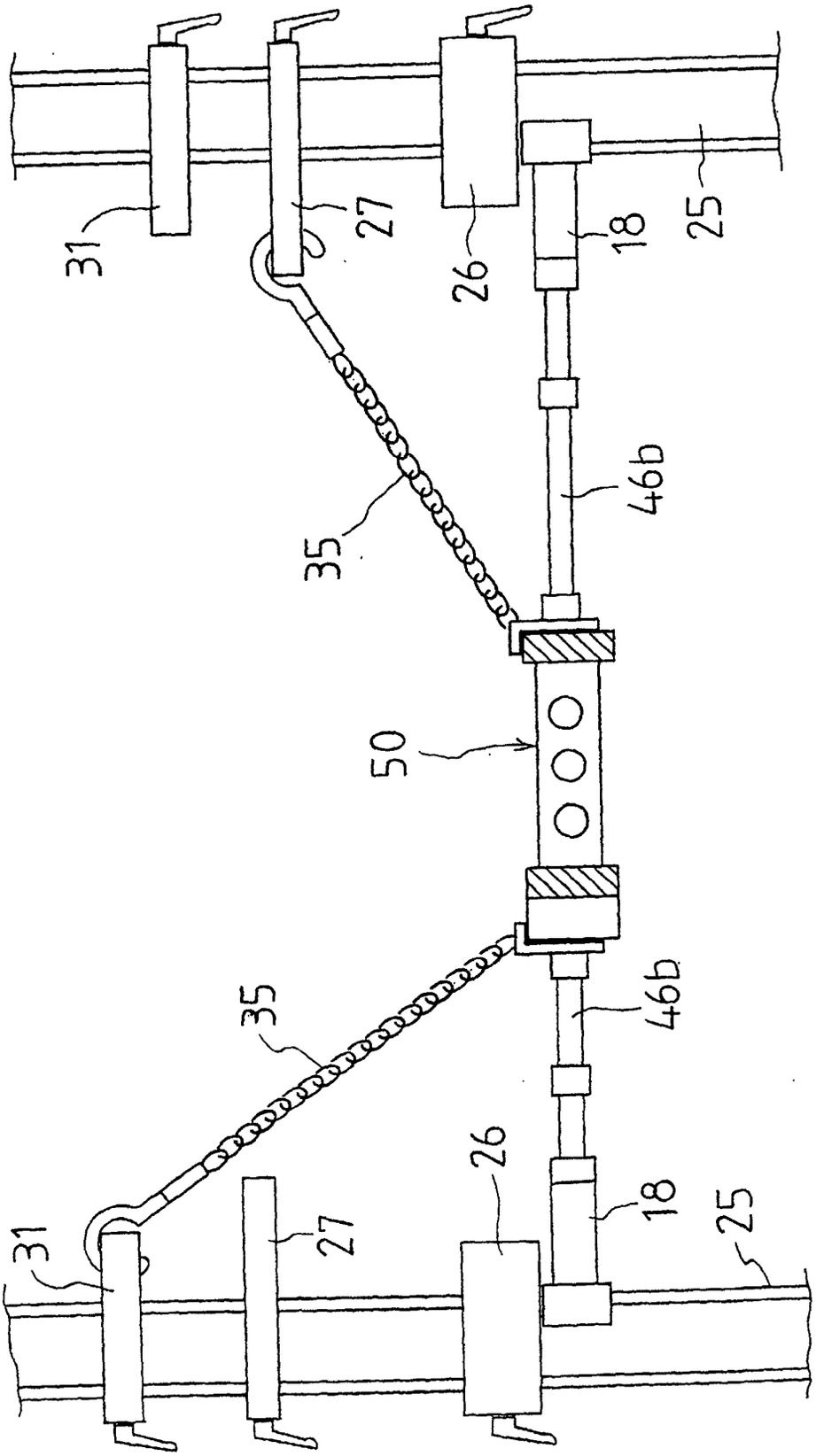

FIG.17

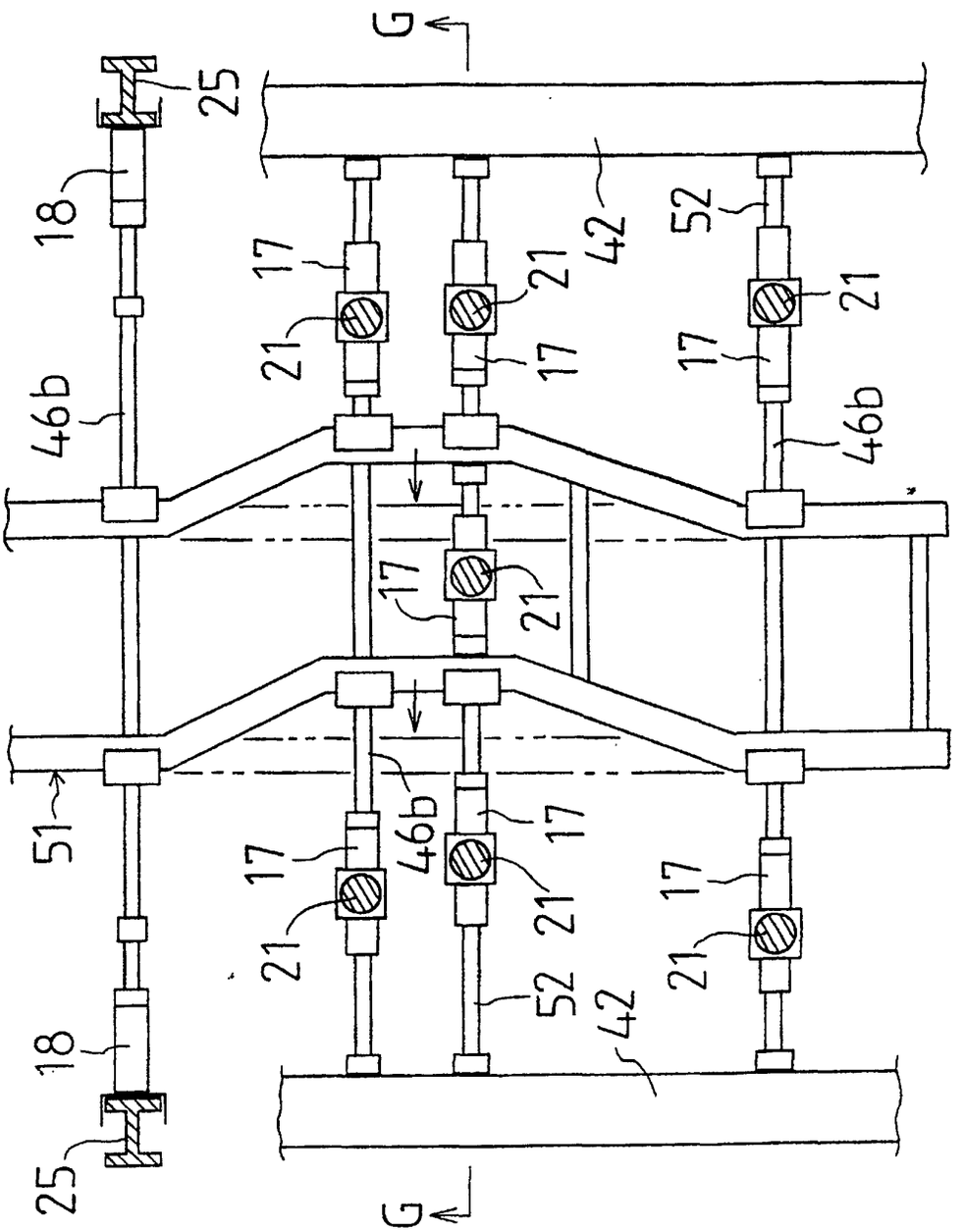

FIG.18

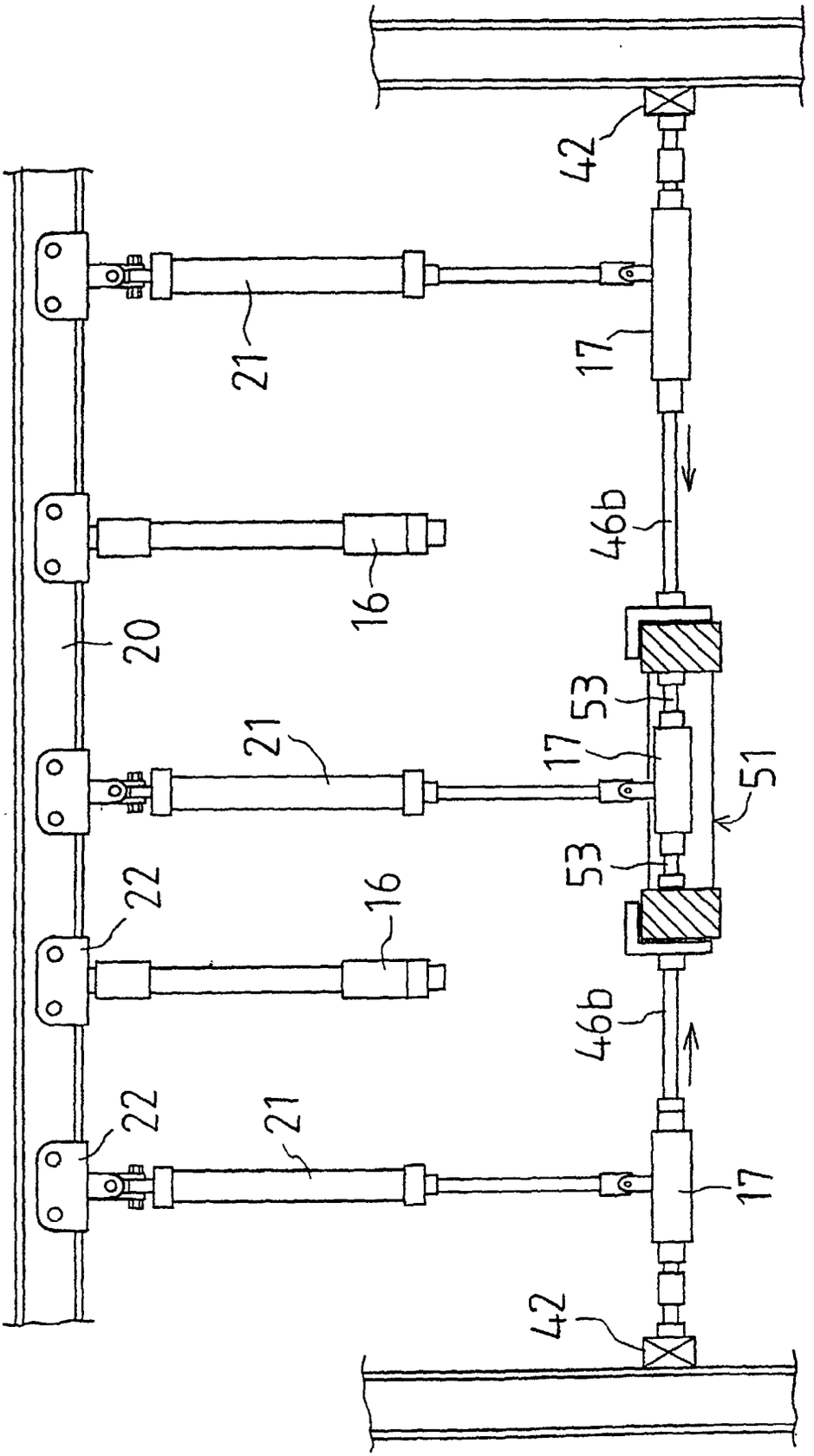

FIG.19

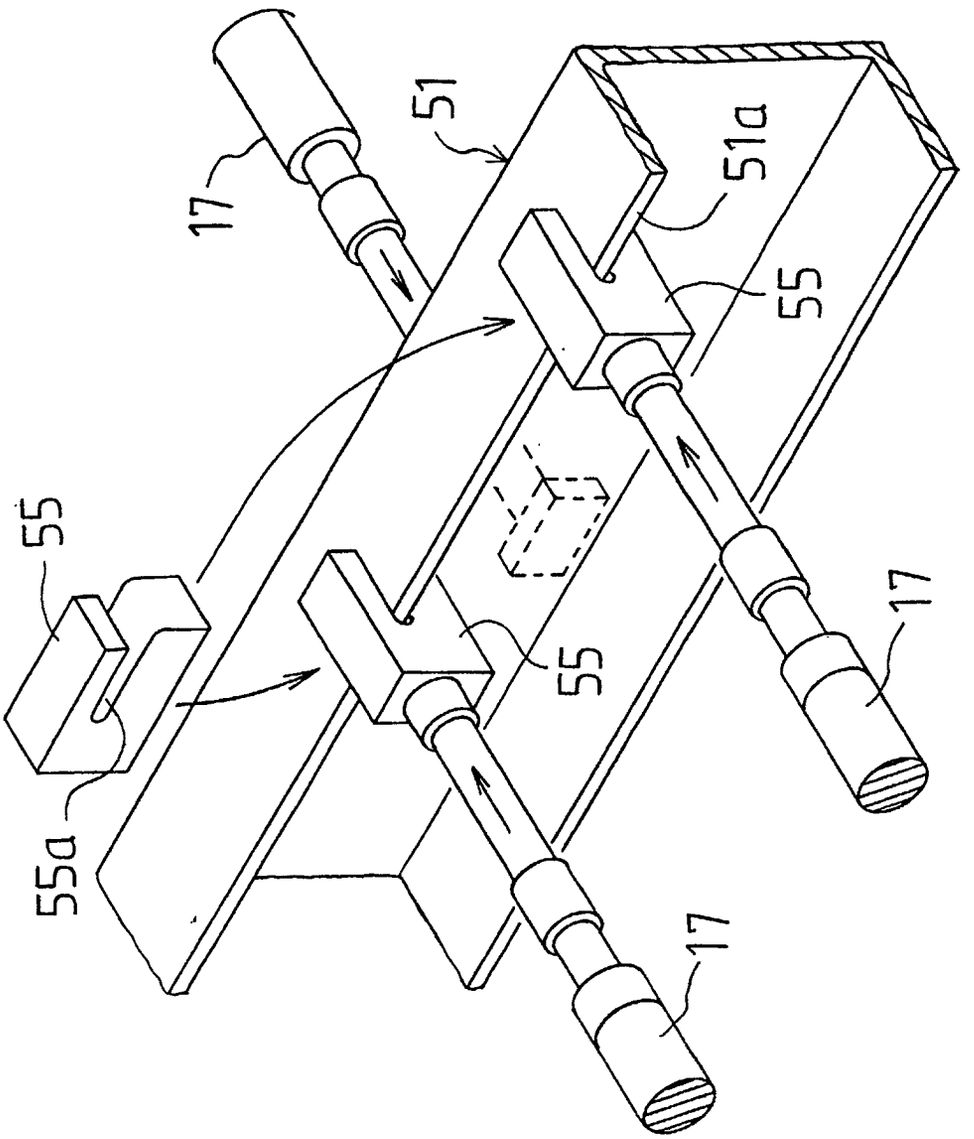

FIG. 20

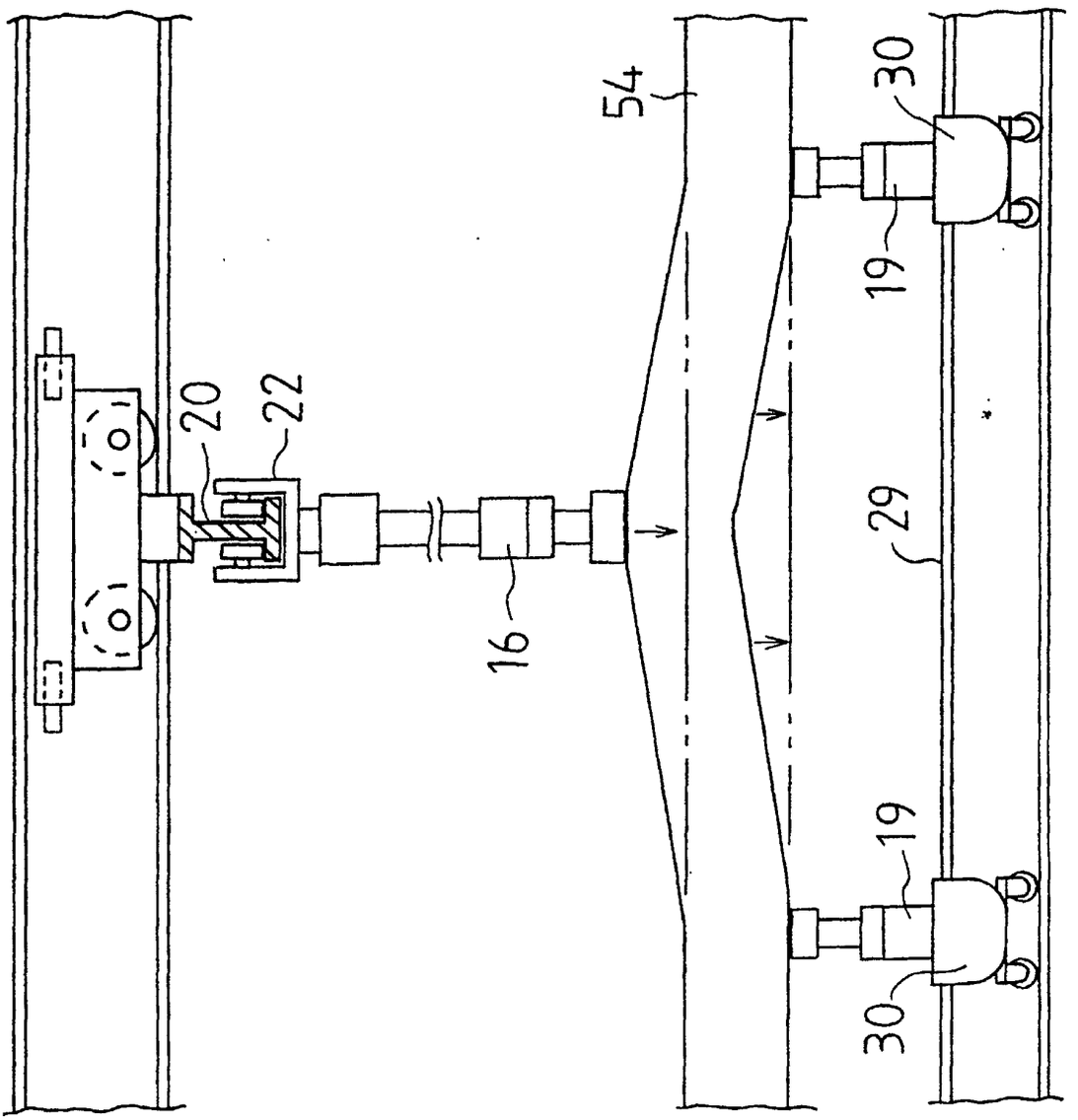

FIG.21

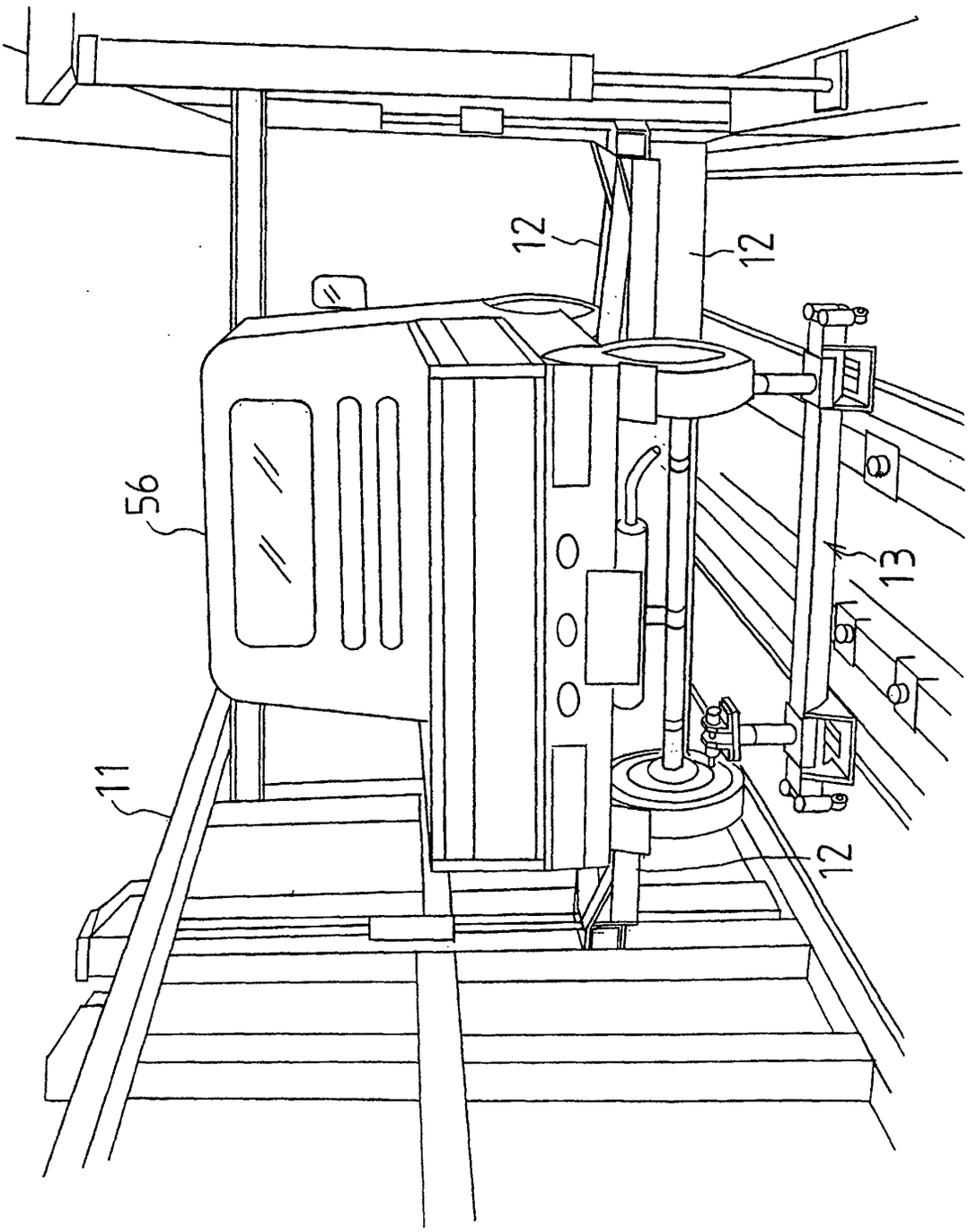

FIG. 22

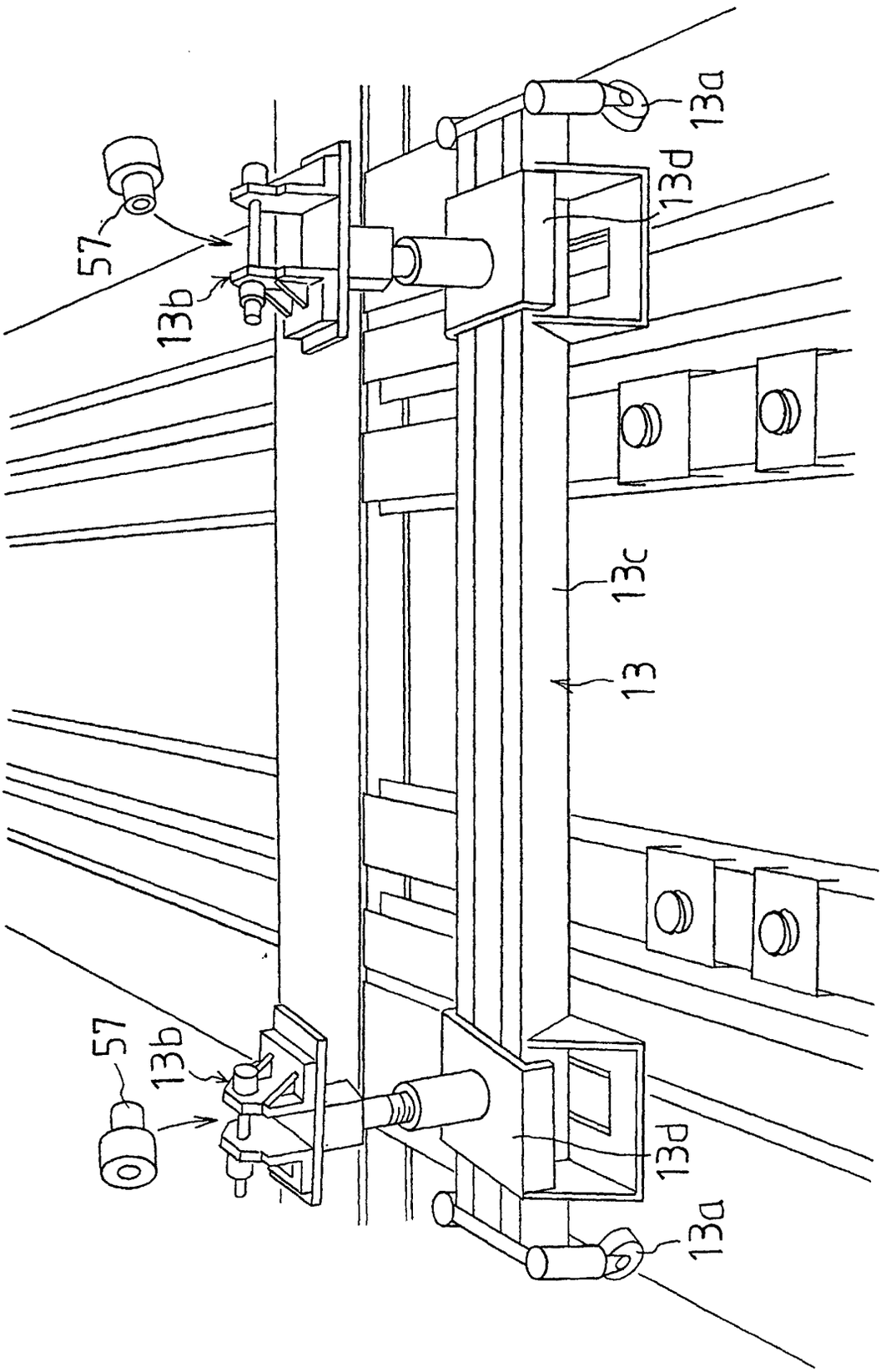

FIG.23

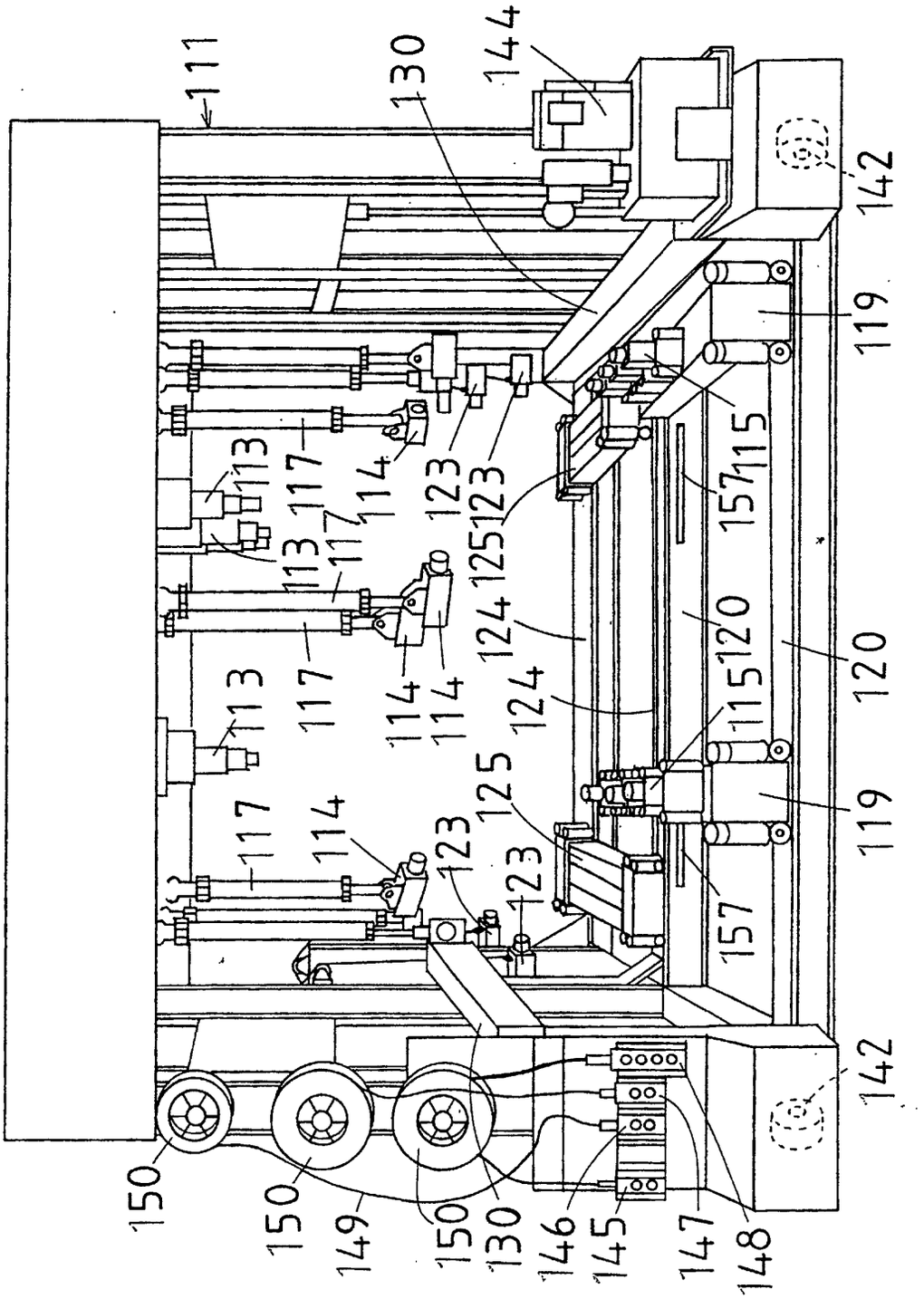
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FIG.24

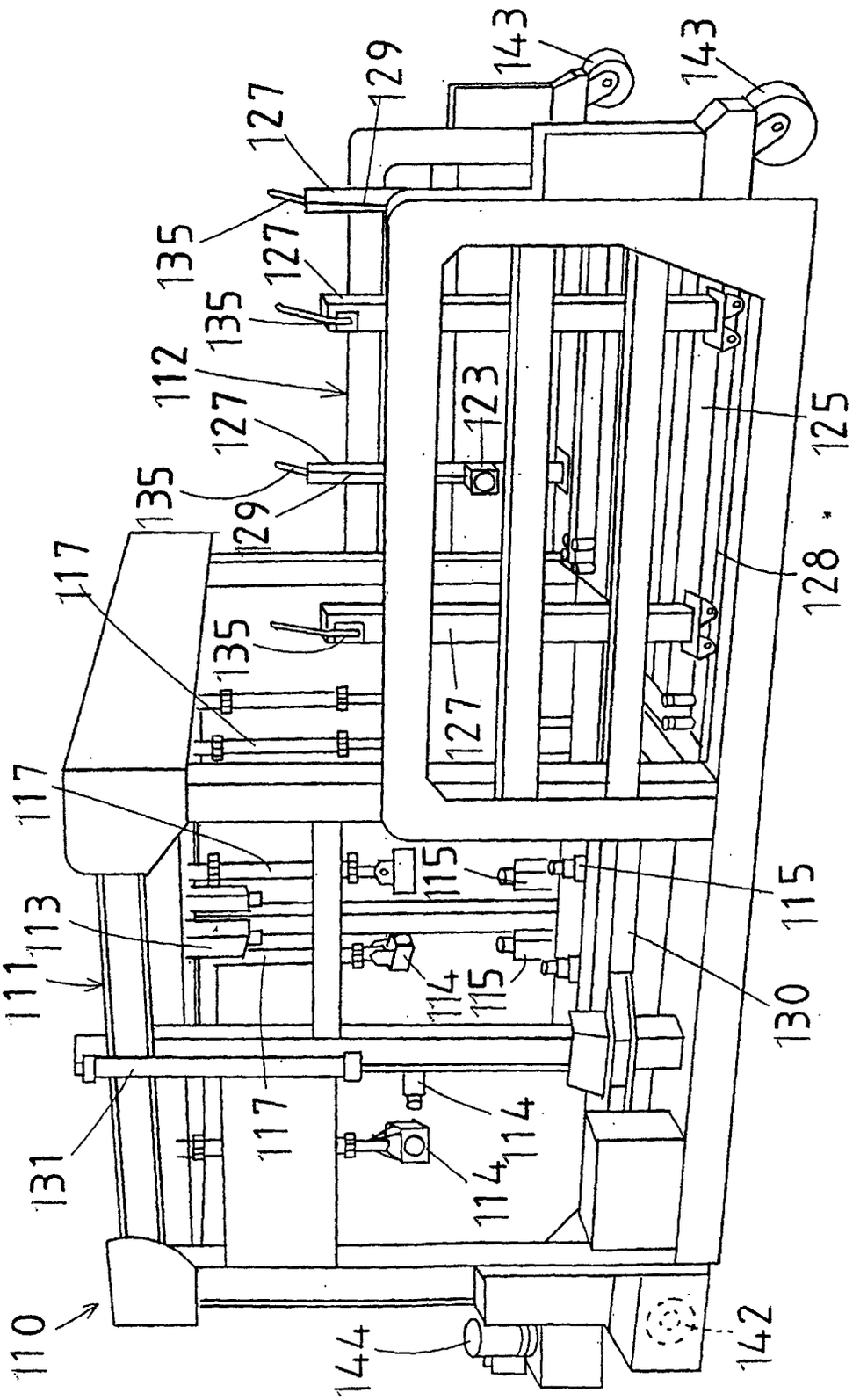
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FIG.25

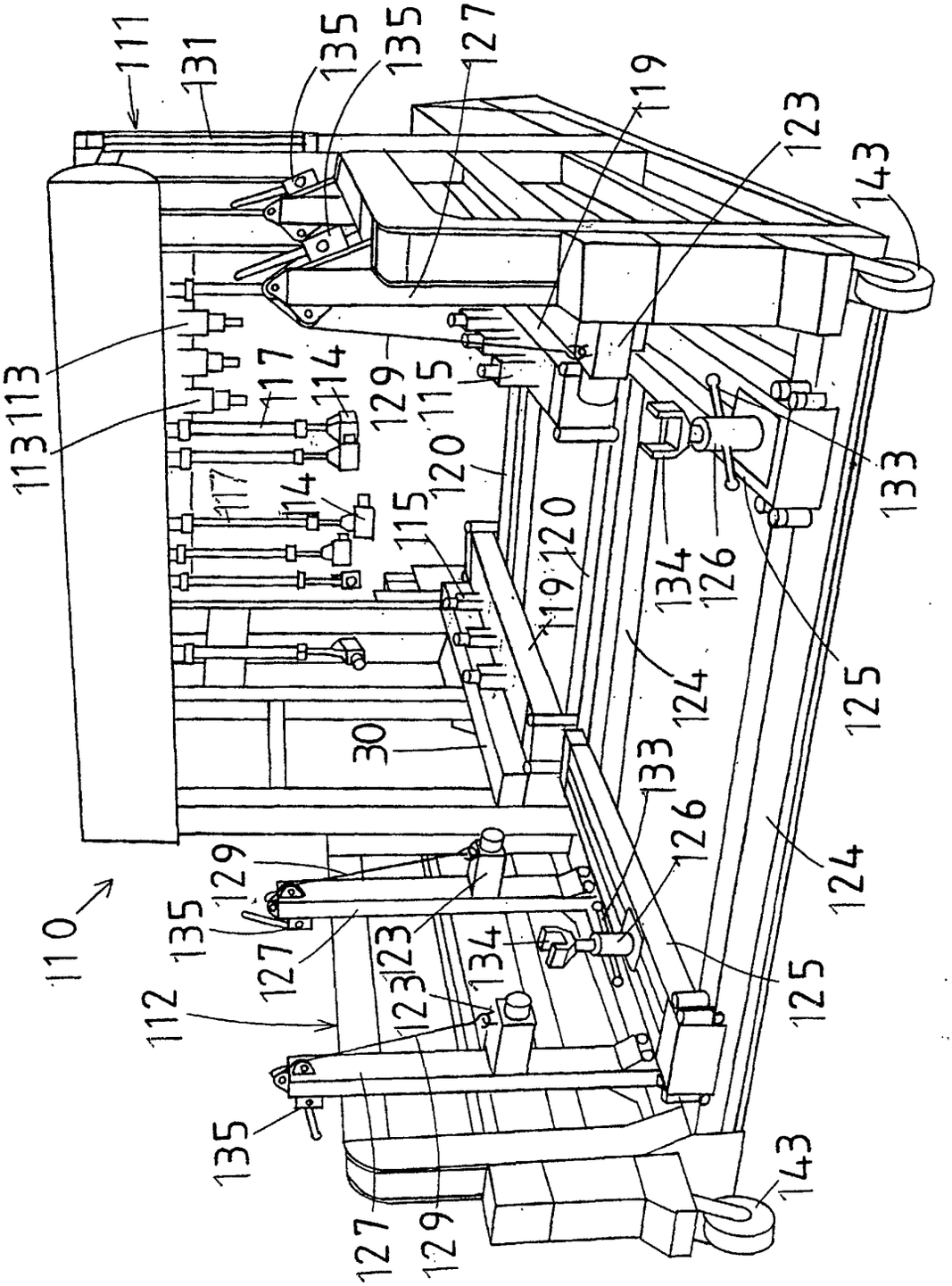
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FIG.26

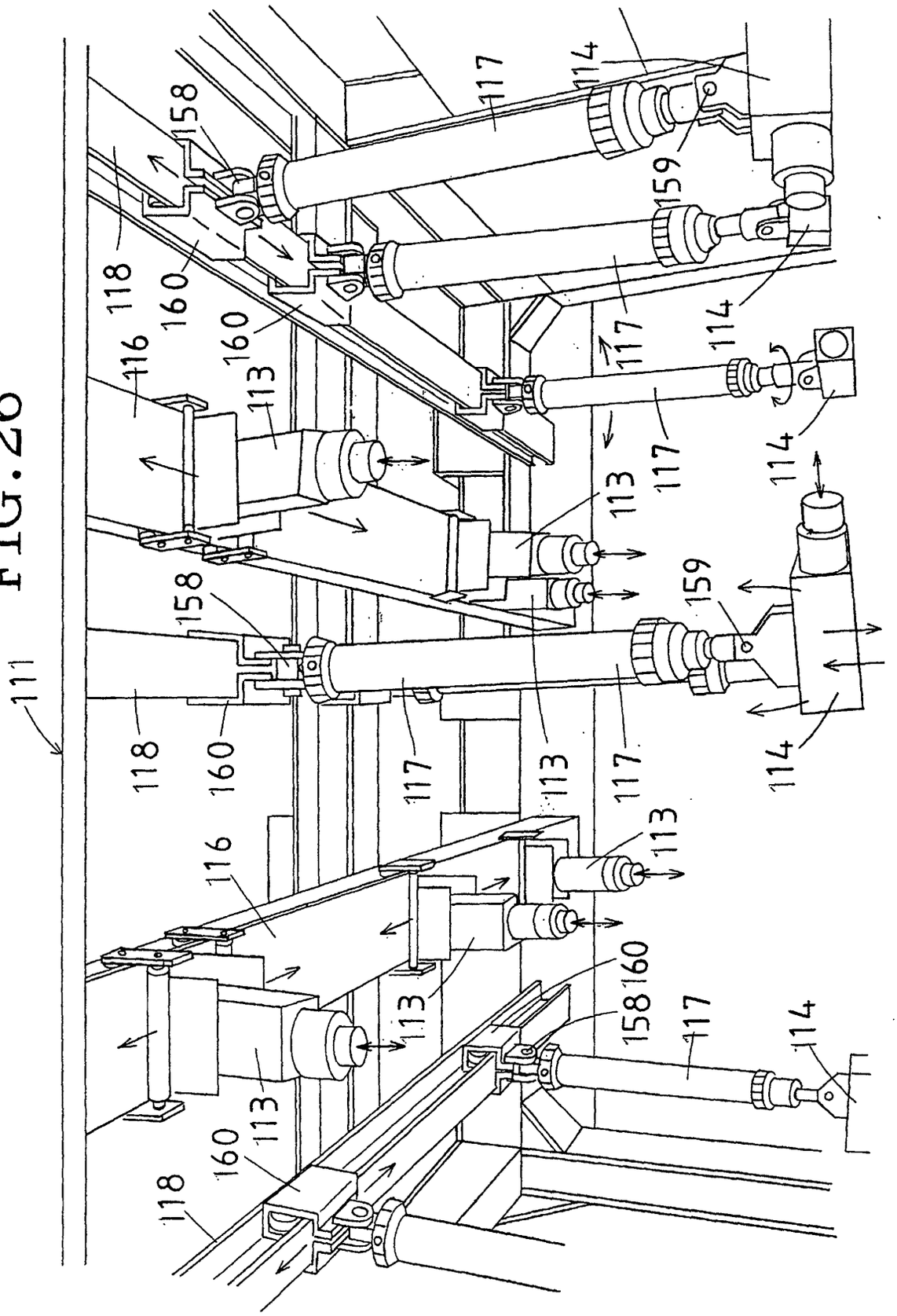

FIG.27

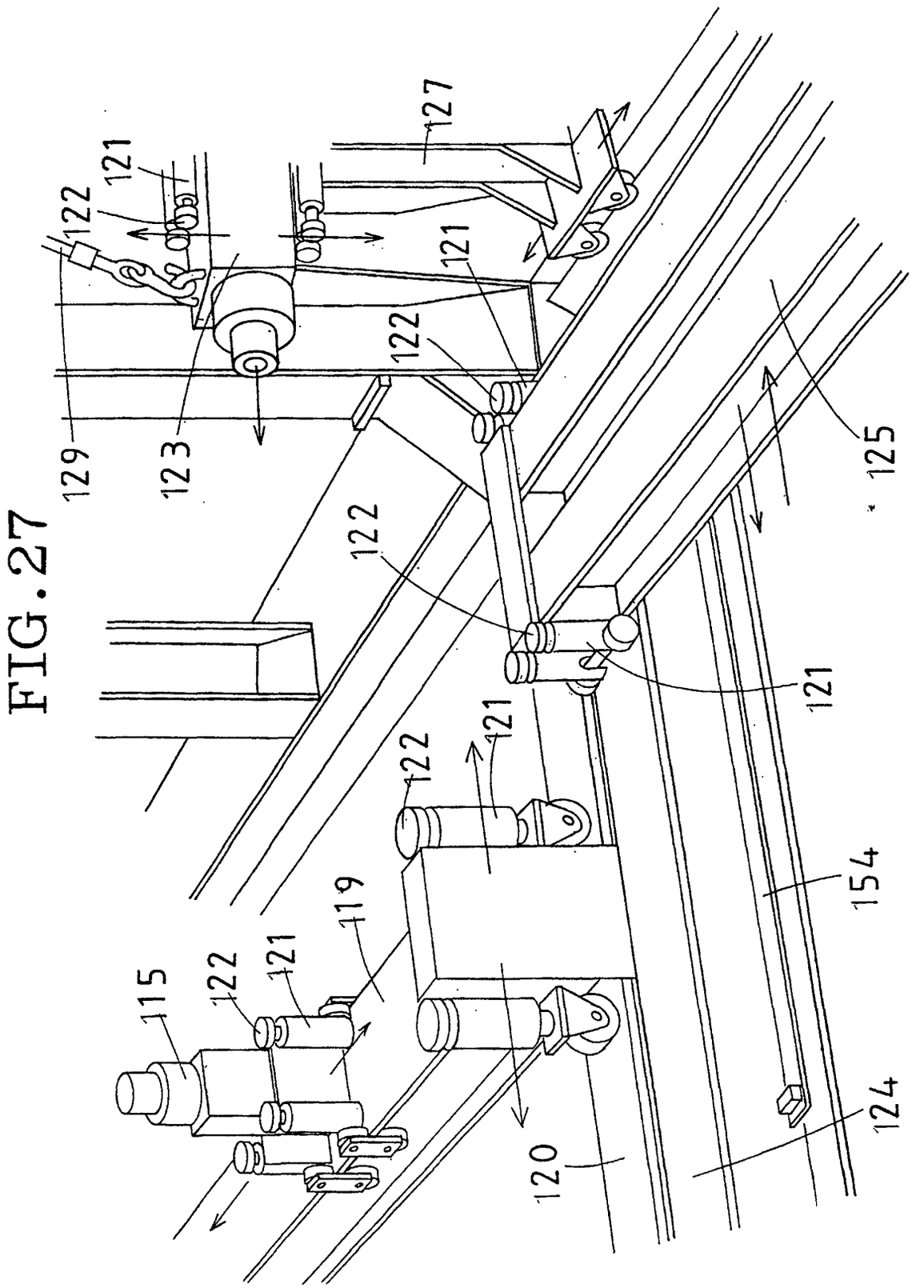
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FIG.28

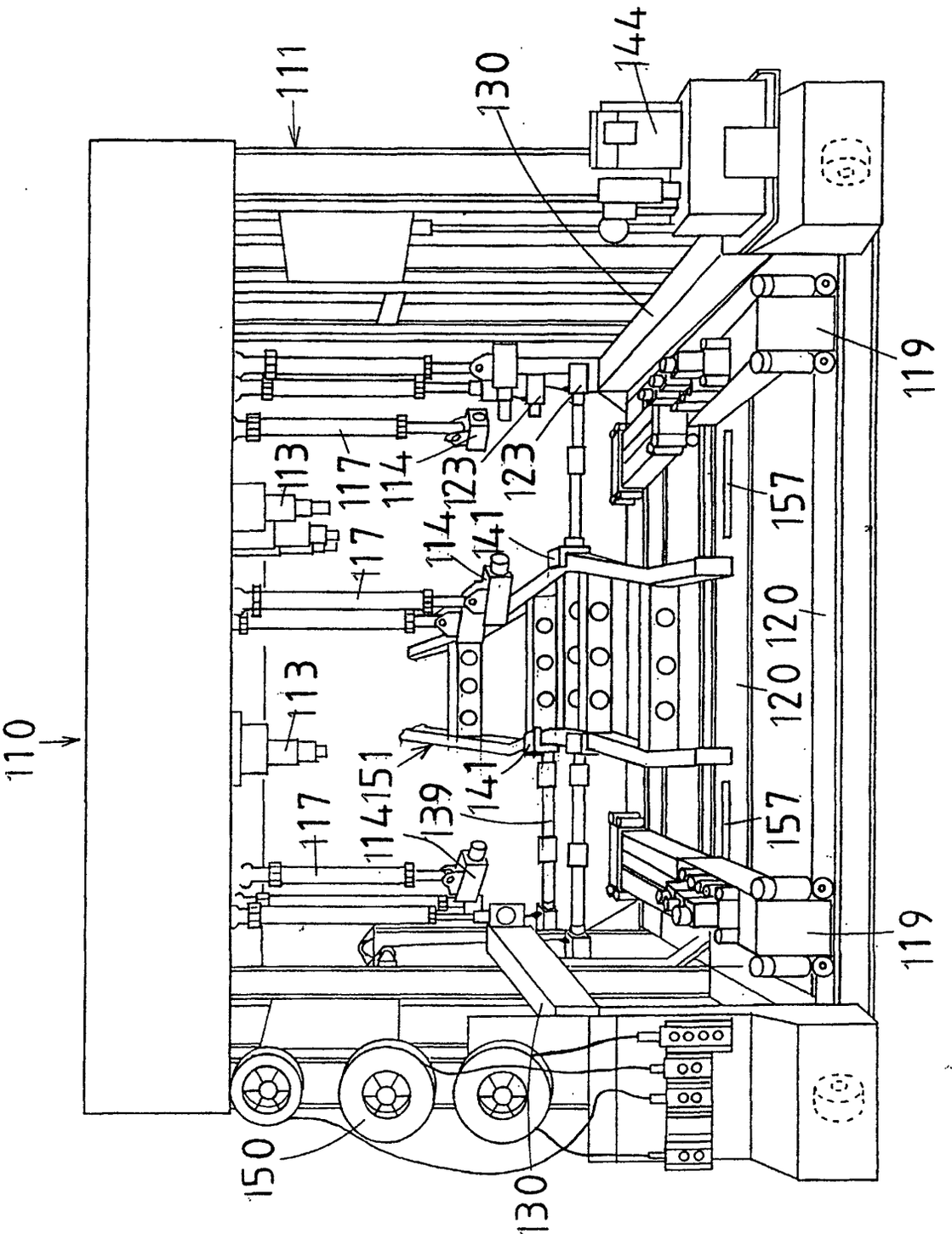
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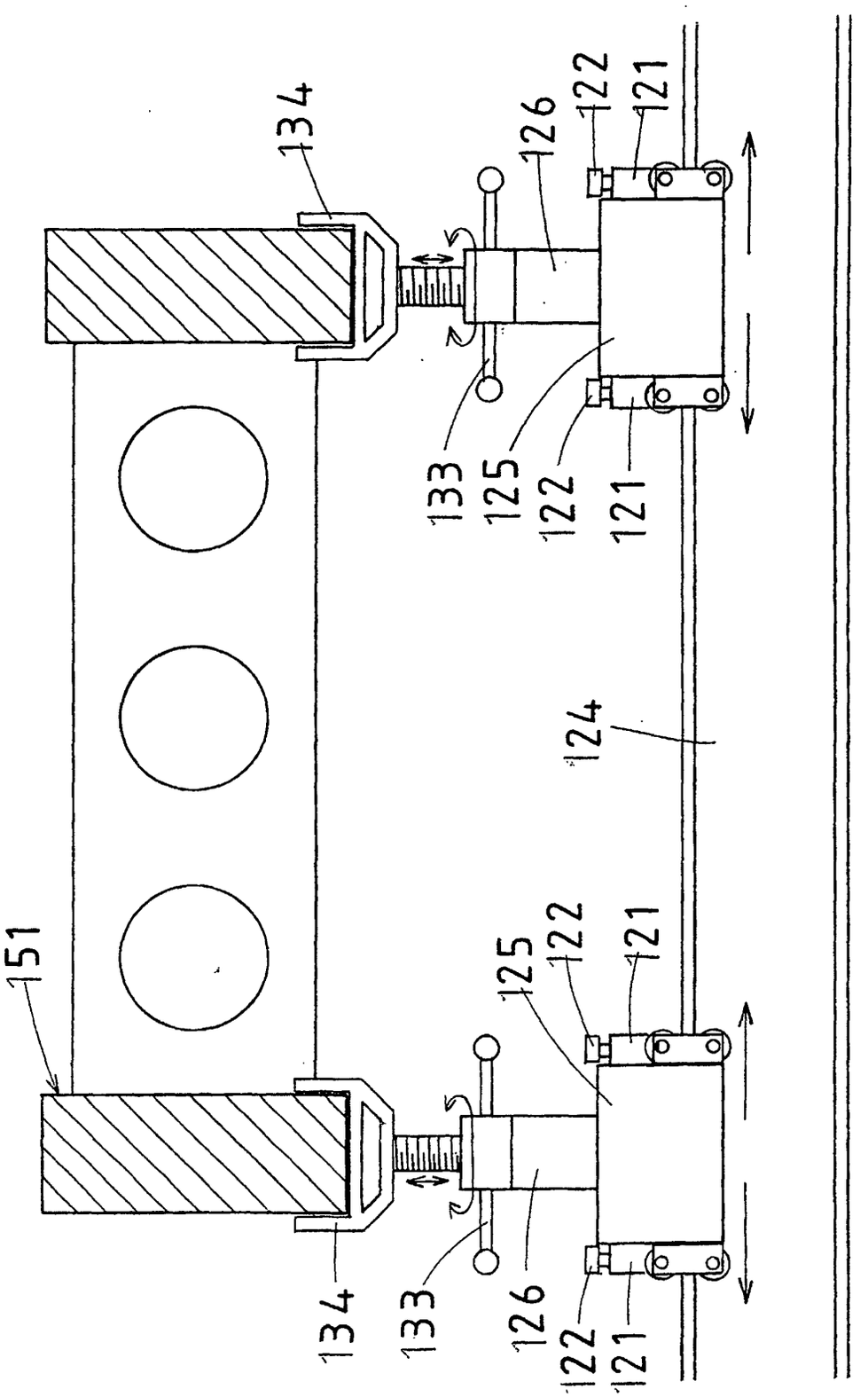
FIG.29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121

FIG.30

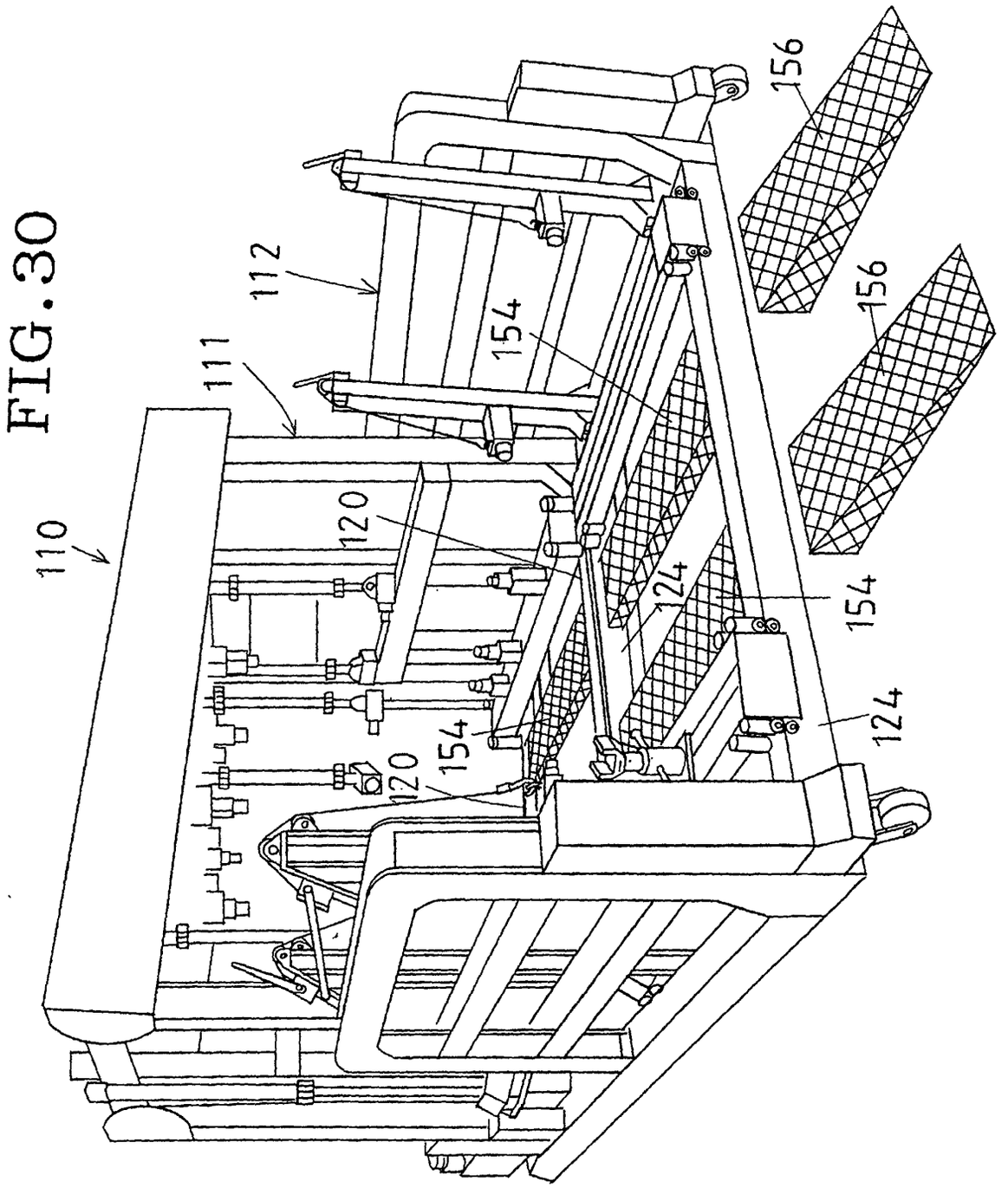
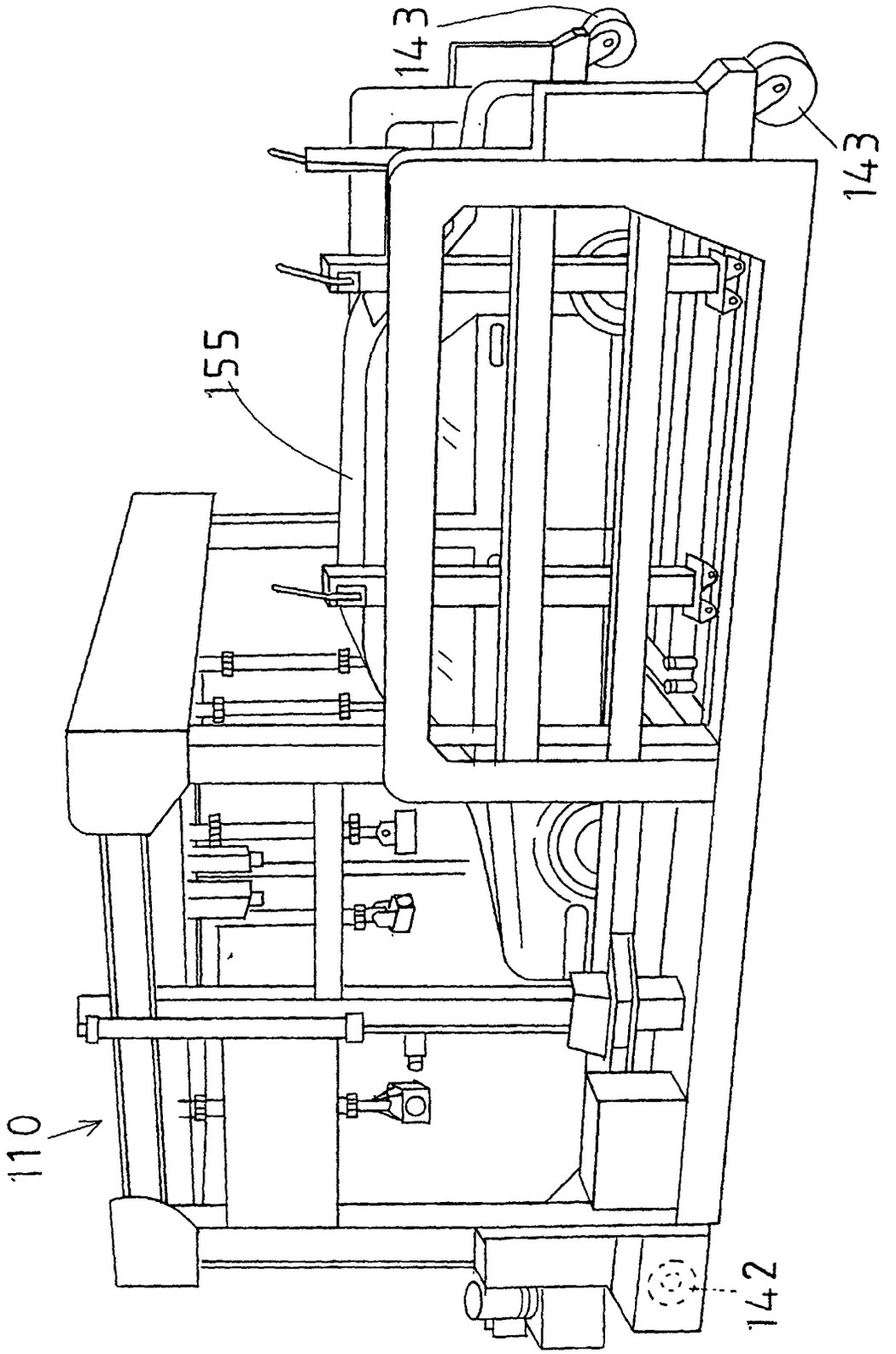


FIG.31



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP00/02949

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl[7] B60S5/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int.Cl[7] B60S5/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1941-1996 Jitsuyo Shinan Toroku Koho 1996-2000
Kokai Jitsuyo Shinan Koho 1971-1996 Toroku Jitsuyo Shinan Koho 1994-2000

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 48-62746 U (Press Kogyo K.K.), 09 August, 1973 (09.08.73) (Family: none)	1-12
Y	JP 46-39605 B (Aripio Runarudini), 22 November, 1971 (22.11.71) (Family: none)	1-12
Y	JP 7-88783 A (Toyota Motor Corporation), 04 April, 1995 (04.04.95) (Family: none)	1-12
Y	JP 48-16352 A (Anasutasio V Sanchezu), 01 March, 1973 (01.03.73) (Family: none)	1-12

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
01 August, 2000 (01.08.00)	08 August, 2000 (08.08.00)
Name and mailing address of the ISA/ Japanese Patent Office	Authorized officer
Facsimile No.	Telephone No.

Form PCT/ISA/210 (second sheet) (July 1992)