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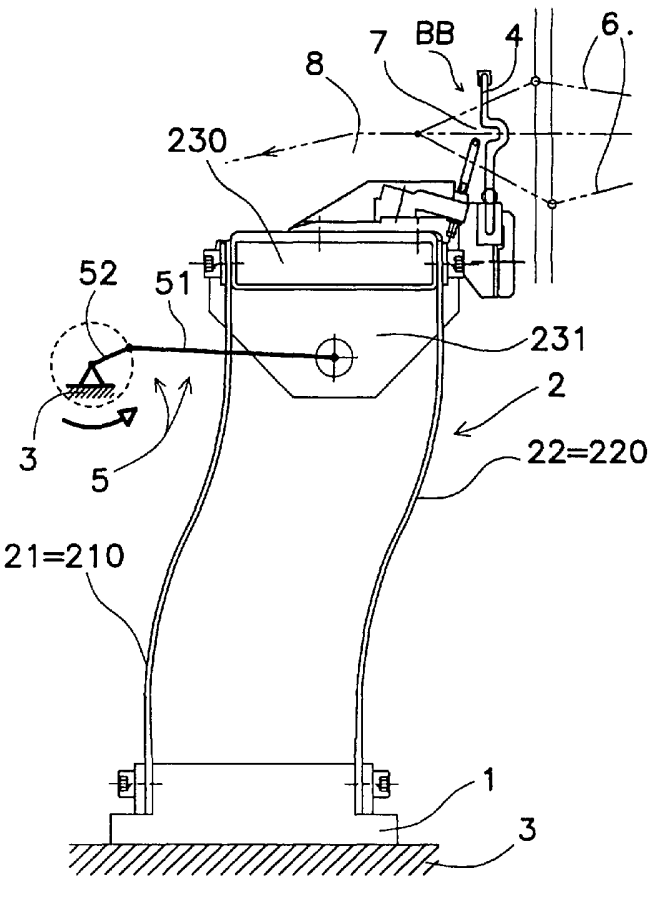
(54) Title: A WEAVING MACHINE AND A BATTEN OF THE WEAVING MACHINE



(57) Abstract: A weaving machine consisting of a reed (4) reversibly adjustable between a shed position and a beat up position and mounted on a stringer (230) of a batten (2), which is a member of a multimember mechanism, while the stringer (230) of the batten represents an inner member of the multimember mechanism. The batten (2) of the weaving machine for positioning the reed (4) and for transmission of a reversible motion of a drive on the reed (4), consisting of at least two leaf springs (210, 220) serving to its mounting on the frame (3) of the weaving machine.

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A weaving machine and a batten of the weaving machine

Technical field

The invention relates to a weaving machine consisting of a reed reversibly adjustable between the shed position and the beat up position and positioned on a stringer of a batten, which is a member of a multimember mechanism.

The invention further relates to the batten of the weaving machine for positioning the reed and for transmission of a reverse motion of a drive on the reed.

Background art

A reverse motion of a reed is in known weaving machines realized by reversible rotation motion due to positioning of the reed on a swinging batten, which is a member of a multimember mechanism.

The batten of the weaving machine is composed of a swinging device, on which the reed is positioned, while there is a requirement for a rigid and firm connection of the reed with the batten and sufficient torsional and flexural rigidity of the batten and the reed.

According to known embodiments the batten is composed of a swinging tube pivoted in the frame of the weaving machine and coupled with a driving device, while the batten represents the outer member of the multimember mechanism. On the swinging tube are firmly fixed slay swords, on which is fixed a carrier of the reed.

The drawback of this solution is the mass distribution in the section of the batten because the carrier of the reed in particular distinctively increases the inertia moment of the whole batten or if you like the system of the batten and the reed, while the share of this carrier in increase of torsional and flexural rigidity of the system of the batten and the system of the reed is minimal.

The drawbacks of this solution were minimized by use of a batten of a weaving machine according to CS Patent 278388, according to which the batten is formed of a thin-walled hollow body comprising a swinging tube with two arms coming out of it, where between their ends is a longitudinal channel for the bottom part of the reed, while both arms with the bottom part of the reed form a solid dismountable assembly connected using bolts. Although in this embodiment a high portion of the batten section takes part in increasing the batten rigidity and relatively small portion of the batten section takes part in increasing the inertia moment of the batten, increasing the inertia moment is an obstacle for further increasing the weaving machines speed.

This basic drawback of swinging arrangement of the batten and the reed positioned on the batten was not eliminated nor in batten solution according to CZ 290910 B6 leading to production of indeed light batten with a high carrying capacity but the essential disadvantage of the swinging batten, i.e. relation of the batten inertia moment on swing radius was not eliminated, while reducing the swing radius limits the picking angle of the weaving machine because the picking channel in the reed is restricted by warp threads and in a low picking angle is the insertion of the weft into the shed problematic.

During rotation reverse motion of the batten are while clearance adjustment in particular in dead centers created beats which adversely affect weaving machine run and operating life.

The increasing efficiency and rotations of weaving machines bring demand on increasing the rigidity of the batten and means the increase of energy and efficiency for its drive.

The goal of the invention is to increase parameters of the weaving machine and the weaving machine and the batten enabling elimination of relation of the batten inertia moment on swing radius.

Principle of the invention

The goal of the invention is reached by a weaving machine consisting of a reed reversibly adjustable between the shed position and the beat up

position, whose principle consists in that a stringer of a batten is a member of a multimember mechanism. In consequence of this arrangement the reed positioned on the stringer of the batten performs a translation motion, whose considerable advantage consists in that the reed does not lean but in principle maintains the same position while moving between its shed and beat up position.

Nevertheless in the weaving machine is the stringer of the batten advantageously mounted on the frame of the weaving machine using at least two flexible members, which are advantageously formed according to Claim 3 by leaf springs. The advantage of this solution is a significant reduction of the batten weight and a change from a reverse rotary motion of the stringer of the batten to a reverse translation motion. That provides a significant reduction of a reduced inertia moment of the weaving machine, which allows an increase of frequency of the reverse translation motion of the reed over the limit of the frequency of reverse swinging motion of the reed of up-to-the-date known weaving machines, while reducing the noise and reducing the energy and the power output for the driving the batten.

The leaf springs as claimed in Claim 4 are with their ends opposite to the ends fixed on the frame of the weaving machine firmly fixed with the stringer of the batten, on which is positioned the reed with its accessory parts, while the stringer of the batten is coupled with a drive for eliciting a reverse motion.

The leaf springs form with the stringer of the batten a body, whose profile is of a shape of an open tetragon, which can be of a shape of a part of a parallelogram or a part of a rectangle. Nevertheless the leaf springs can be on the frame of the weaving machine firmly fixed or hinged.

In the alternative arrangement of the weaving machine the leaf springs form deformable walls of the batten, which are by the connecting wall and the closing wall connected into a profile of a closed tetragon, which can be of a shape of a parallelogram or a rectangle, while the connecting wall forms the stringer of the batten, on which is positioned the reed and its accessory parts

and the closing wall forms a fixing beam of the batten, which is firmly fixed with the frame of the weaving machine.

The principle of the batten of the weaving machine according to the invention consists in that it contains at least two leaf springs serving for its mounting on the frame of the weaving machine. Thus the batten is represented by a body, which can be easily inserted into the weaving machine, while the stringer of the batten represents an inner member of the multimember mechanism.

According to Claim 10 are leaf springs on one side firmly connected with the stringer, with which they form a profile of an open tetragon, which can be of a shape of a part of a parallelogram or a part of a rectangle.

According to Claim 13 are the leaf springs connected by the connecting wall and the closing wall into a profile of a closed tetragon, which can be of a shape of a parallelogram or a rectangle, while the connecting wall forms the stringer of the batten and the closing wall forms the fixing beam for a firm fixing of the frame of the weaving machine.

For production, assembly and also use of the batten in weaving machines it is advantageous if the batten is composed of an integral assembly consisting of the stringer and a pair of leaf springs.

The stringer of the batten is in the embodiments according to Claims 17 to 19 formed by a thickened or a double wall or a closed tetragon auxiliary profile.

Nevertheless the hollow space of the auxiliary profile is advantageously filled with a filler to increase the rigidity of the stringer of the batten. The filler is formed by a material of a low weight, for example a foam material, honeycomb filler etc.

In each embodiment it is advantageous if the batten is formed from a composite material, which can be formed by a fibrous reinforcing material in a polymer matrix.

Nevertheless the fibrous reinforcing material is advantageously formed by a system of direction oriented layers of separate parallel carbon fibers and the polymer matrix is advantageously composed of an epoxy resin.

Description of the drawing

Examples of embodiment are shown in the enclosed drawings where in the Fig. 1 to 10 are shown various arrangements of a batten of a weaving machine with a reed in a beat up and picking position, while from the other parts of the weaving machine is schematically shown a warp, a shed creation and a fabric. In the Fig. 11 is shown an axonometric projection of arrangement of the batten according to the invention.

Specific description

In the examples of embodiment shown in Fig. 1 to 10 is shown a beam **1** and a batten **2** of a weaving machine mounted on it. The beam **1** or a part of the batten **2** corresponding to the beam is mounted on the frame **3** of the weaving machine, while the frame **3** is shown only schematically. On the batten **2** is positioned a reed **4**, while the part of the batten **2**, on which is fixed the reed **4** is coupled with a connecting rod **51** of a driving device **5**, which is mounted on the frame **3** of the weaving machine. From the other parts of the weaving machine is schematically shown a warp **6**, creation of a shed **7** on the Fig. 2, 4, 6, 8 and 10 and a fabric **8**. Thus in all embodiments is the batten **2** a member of the multimember mechanism, whose members in the represented embodiments consist of the frame **3**, on which is pivoted a crank **52** coupled with the connecting rod **51**, which is coupled with the batten **2**, mounted on the frame **3** of the weaving machine. Thus the batten **2** in all shown and further described embodiments represents the inner member of the multimember mechanism, whose outer members are represented by the springs **210**, **220** and the crank **52**. The multimember mechanism can for example be a cam or a hinge mechanism.

In the embodiment shown in Fig. 1 and 2 is on the frame **3** of the weaving machine by a known not represented manner firmly fixed the beam **1**, on which are by one of their ends mounted the leaf springs **210**, **220**, which form deformable walls **21**, **22** of the batten **2**. On the opposite ends is between the leaf springs **210**, **220** firmly fixed the stringer **230**, which is made of a section from a light material. In the represented embodiment is the stringer **230** connected to the leaf springs **210**, **220** using straps and bolts, while it is necessary to maintain firm and stationary connection of the ends of the leaf springs **210**, **220** and the stringer **230**. The leaf springs **210**, **220** and the stringer **230** form an open rectangular profile, which form the batten **2** and whose length corresponds in a well known manner to the width of the weaving machine. On the stringer **230** of the batten **2** is fixed the reed **4** and with it corresponding accessory parts, for example auxiliary blowing jets, compressed-air line etc. On the stringer **230** of the batten **2** are further fixed consoles **231**, by which is the stringer **230** coupled with the driving device **5**, which is shown only schematically and which can be represented by a not represented cam or hinge mechanism or another appropriately chosen well known type of a drive. In the represented embodiment are on the consoles **231** pivoted connecting rods **51** of the drive hinge mechanism.

In not represented alternative embodiment the leaf springs **210**, **220** and the stringer **230** form an open profile in the shape of a parallelogram or a general tetragon, while the springs can have different lengths and they do not have to be mounted on a common beam but each of them can have its own beam. Rectangular profile shown and described in the embodiment according to Fig. 1, 2 and others appears to be the most advantageous to reach an optimal translation motion of the reed **4** and production simplicity.

The stringer **230** of the batten **2** is designed with regard to its transverse and longitudinal rigidity with purpose to prevent its deformations during the reverse motion within the weaving mode, i.e. particularly its twisting and bending within the length of the stringer **230**, in particular in the direction of a beat-up. Thus it can be made of a hollow section of appropriate rigidity. Nevertheless, rigidity of the leaf springs **210**, **220** must allow their deformation

providing translation, in principle horizontal movement of the stringer **230** and it must prevent at the same time deformations in vertical direction and twisting strain. In a deflected position of the batten **2** the leaf springs **210**, **220** are bent to two reversed arches, as apparent from Fig. 2 and in the balanced position they are upright, as shown in Fig. 1.

During the weaving process a driving device **5** imparts by the action of an external deflection force a reverse movement to the stringer **230** and also consequently the reed **4** and the stringer **230** of the batten, on which the reed **4** is positioned. The reverse movement of the stringer **230** and all parts fixed on it, in particular the reed **4** is realized between their beat up **AA** and shed positions **BB**, which are shown in Fig. 1 and 2. Due to deformation of the leaf springs **210**, **220** the stringer **230** with the reed **4** displays a curvilinear translation motion. The leaf springs **210**, **220** can be in the upright balanced position shown in Fig. 1 or in the deflected position shown in Fig. 2 or in the position deflected to the other side, which is not represented. The leaf springs **210**, **220** from each of deflected positions tend to return to their balanced position shown in Fig. 1, where they are upright. That means that the entire batten **2** tends to return to its balanced position shown in Fig. 1 and tends to stay in it. In the deflected position of the batten **2** is an energy accumulated in the leaf springs **210**, **220**, which generates restoring force acting while their reverse movement back to the balanced position.

In the above mentioned example of embodiment the leaf springs **210**, **220** are made of steel. The leaf springs can however be made of another appropriate material, for example carbon composite material or another appropriate composite material. Similarly the stringer **230** can be made of a body from a carbon composite material or another appropriate composite material and the leaf springs **210**, **220** can be made of steel. Also the number of leaf springs can be limited to two but it can also be higher. If required, it is possible to use three to four springs.

In the embodiment shown in Fig. 3 and 4 is the batten **2** composed of a body formed of deformable walls **21**, **22** connected by a connecting wall **23**, representing the stringer **230** of the batten, into an open rectangular profile. On

the stringer **230** is as well as in previous embodiment positioned the reed **4** with accessory parts and the consoles **231**, which are coupled with the driving device **5**. The deformable walls **21**, **22** of the batten are composed of the leaf springs **210**, **220**, whose ends **211**, **221** are firmly fixed on the beam **1**, which is mounted on the frame **3** of the weaving machine. In this embodiment is the batten composed of one piece of a shaped composite material, which is made of a fibrous reinforcing material in a polymer matrix. The fibrous reinforcing material can advantageously be made of a system of carbon fibers or direction oriented layers of separate carbon fibers. The polymer matrix is advantageously composed of an epoxy resin. The leaf springs **210**, **220** are mounted on the beam **1** and therefore the function of the batten **2** during weaving is consistent with the previous example of embodiment according to Fig. 1 and 2 described above.

In the embodiment shown in Fig. 5 and 6 is the batten **2** different from the embodiment according to Fig. 3 and 4 only in formation of the stringer **230** of the batten, which is formed by a hollow closed auxiliary profile **2301**, which is inserted into the inner space of the batten **2** formed by an open rectangular profile and in the inner space is braced by an inner connecting wall **24**. The hollow of the auxiliary profile **2301** is in the represented embodiment for increasing the rigidity of the stringer **230** of the batten filled by a filling **2302** formed by a foam material, honeycomb filler or another suitable material or it can stay empty. The leaf springs **210**, **220** are again by their ends mounted on the beam **1** and therefore the function of the batten **2** during weaving is consistent with the previous example of embodiment according to Fig. 1 and 2.

The batten **2** shown in Fig. 7 and 8 is composed of a hollow rectangular profile, which is composed of deformable walls **21**, **22** connected by the connecting wall **23**, while into the inner space of the hollow rectangular profile is in a certain distance from the connecting wall **23** inserted an inner connecting wall **24**, so that between the connecting wall **23** and the inner connecting wall **24** is formed a hollow space. The connecting wall **23** and the inner connecting wall **24** form together with a part of the walls **21**, **22** positioned in between them the stringer **230** of the batten. The rest of deformable walls **21**,

22 form the leaf springs 210, 220, which are in this embodiment on the other hand positioned on the frame 3 of the weaving machine using hinges 2101. Similarly as in previous embodiments is the stringer 230 of the batten fitted with the consoles 231 coupled with the driving device 5. The hollow space between the connecting wall 23 and the inner connecting wall 24 can be for increase of rigidity of the stringer 230 filled for example with a foam material which is not represented.

During reverse movement of the stringer 230 with the reed 4 the leaf springs 210, 220 due to their pivoted fixing in hinges 2101, 2201 of the machine frame 3 bend only into one arch as shown in Fig. 8. They are however able to take a deflected and the balanced position, while they can be deflected into any side of the batten 2. In the deflected position of the batten 2 is an energy accumulated in the leaf springs 210, 220, which generates restoring force acting while their reverse movement back to the balanced position.

In another alternative embodiment, which is not represented, is the batten composed of a stringer, which is using hinges fixed on the side non-deformable walls of the batten, which are hinged on the machine frame. The stringer of the batten is coupled with a driving device, which is a part of the multimember mechanism, where the stringer of the batten is an internal member. The multimember mechanism can for example be a cam or a hinge mechanism. Also in this embodiment the reed and the stringer of the batten displays a translation motion. Considering the construction and production complexicity of this embodiment it is not supposed for practical applications in a weaving machines workshop. However this solution can be applied in a laboratory.

In the embodiment shown in Fig. 9 and 10 is the batten 2 composed of a hollow rectangular profile, which consists of two deformable walls 21, 22 connected on their ends with a connection wall 23 and a closing connecting wall 25, where the connecting wall forming the stringer 230 is strengthened and the closing wall 25 is firmly fixed on the beam 1, which is mounted on the frame 4 of the weaving machine or it represents its part. The deformable walls 21, 22 are formed of the leaf springs 210, 220 and the function of the batten 2 is

consistent with the embodiment with the leaf springs **210**, **220**, where their ends are mounted on the beam **1** or directly on the frame of the machine.

In the Fig. 11 is shown an axonometric projection of the batten **2** according to the embodiment in Fig. 5 or 6 from which it is obvious, that the leaf springs **210**, **220** form with the stringer **230** of the batten one assembly in the shape of an open rectangular profile. In the leaf springs **210**, **220** are fabricated recesses, where some serve as passage of appropriate parts of the weaving machine, for example connecting rods **51** of the driving device **5**. The leaf springs **210**, **220** are firmly fixed on the beam **1** using straps and bolts. The reed **4** is on the stringer **230** fixed using holders. The beam **1** is an integral part of the weaving machine frame **3** or it is mounted in it.

The above mentioned and in drawings shown embodiments serve only as examples and it is possible combine them mutually to reach the particular technical solution. The batten can be made of different materials of various properties, thus today it seems to be the most advantageous a composite material consisting a fibrous reinforcing material in a polymer matrix, in particular carbon fibers in an epoxy resin. In this embodiment it is easy to reach a desired different rigidity of the stringer and the leaf springs of the batten during production. The number of the leaf springs can be selected according to the technological and construction needs.

CLAIMS

1. A weaving machine consisting of a reed reversibly adjustable between a shed position and a beat up position and mounted on a stringer of a batten, which is a member of a multimember mechanism, characterized by that the stringer (230) of the batten represents an inner member of the multimember mechanism.

2. A weaving machine as claimed in Claim 1, characterized by that the stringer (230) of the batten is fixed on the frame (3) of the weaving machine using at least two flexible members.

3. A device as claimed in Claim 2, characterized by that the flexible members are composed of leaf springs (210, 220).

4. A weaving machine as claimed in Claim 3, characterized by that the leaf springs (210, 220) are by their ends opposite to the ends fixed on the frame (3) of the weaving machine firmly fixed with the stringer (230) of the batten, on which is positioned a reed (5) with its accessory parts, while the stringer (230) of the batten is coupled with a drive for eliciting a reverse motion.

5. A weaving machine as claimed in Claim 4, characterized by that the leaf springs (210, 220) form with the stringer (230) of the batten a body, whose profile is of a shape of an open tetragon.

6. A weaving machine as claimed in some of Claims 3 to 5, characterized by that the leaf springs (210, 220) are on the frame (3) of the weaving machine firmly fixed.

7. A weaving machine as claimed in any of Claims 3 to 5, characterized by that the leaf springs (210, 220) are on the frame (3) of the weaving machine hinged.

8. A weaving machine as claimed in Claim 4, characterized by that the leaf springs (210, 220) form deformable walls (21, 22) of the batten (2), which are by a connecting wall (23) and a closing wall (25) connected into a profile of

an open tetragon, while the connecting wall (23) form a stringer (230) of the batten, on which is positioned the reed (5) and its accessory parts and the closing wall (25) form a fixing carrier of the batten, which is firmly fixed with the frame (3) of the weaving machine.

9. A batten of the weaving machine for positioning the reed and for transmission of a reversible motion of a drive on the reed, characterized by that it consists of at least two leaf springs (210, 220) serving to its positioning on the frame (3) of the weaving machine.

10. A batten as claimed in Claim 9, characterized by that the leaf springs (210, 220) are on one side firmly connected with the stringer (230), with which they form an open tetragon profile.

11. A batten as claimed in Claim 10 or a weaving machine as claimed in Claim 5, characterized by that the open tetragon profile is formed by an open parallelogram profile.

12. A batten as claimed in Claim 10 or 11, characterized by that the open tetragon profile or the open parallelogram profile is formed by a rectangular profile.

13. A batten as claimed in Claim 9, characterized by that the leaf springs (210, 220) are connected by the connection wall (23) and by the closing wall (25) into a closed tetragon profile, while the connecting wall (23) form the stringer (230) of the batten and the closing wall (25) forms a fixing beam for a firm fixing into the frame (3) of the weaving machine.

14. A batten as claimed in Claim 13 or a weaving machine as claimed in Claim 8, characterized by that the closed tetragon is formed by a parallelogram.

15. A batten as claimed in Claim 13 or 14 or a weaving machine as claimed in Claim 8 or 13, characterized by that the closed tetragon or parallelogram is formed by a rectangle.

16. A weaving machine as claimed in any of Claims 1 to 8, 11, 12, 14, 15 or a batten as claimed in any of Claims 9 to 15, characterized by that the stringer (230) of the batten and the leaf springs form an integral assembly.

17. A batten as claimed in Claim 16, characterized by that the stringer (230) is composed of a thickened wall.

18. A batten as claimed in Claim 16, characterized by that the stringer (230) of the batten is composed of a double wall.

19. A batten as claimed in Claim 16, characterized by that the stringer (230) of the batten is composed of a closed tetragonal auxiliary profile (2301).

20. A batten as claimed in Claim 19, characterized by that the hollow space of the auxiliary profile (2301) is composed of a filling (2302).

21. A batten as claimed in any of Claims 16 to 20, characterized by that it is made of a composite material.

22. A batten as claimed in Claim 21, characterized by that the composite material is a fiber reinforcing material in a polymer matrix.

23. A batten as claimed in Claim 22, characterized by that the fibrous reinforcing material is composed of a system of direction oriented layers of individual parallel carbon fibers.

24. A batten as claimed in Claim 22 or 23, characterized by that the polymer matrix is formed by an epoxy resin.

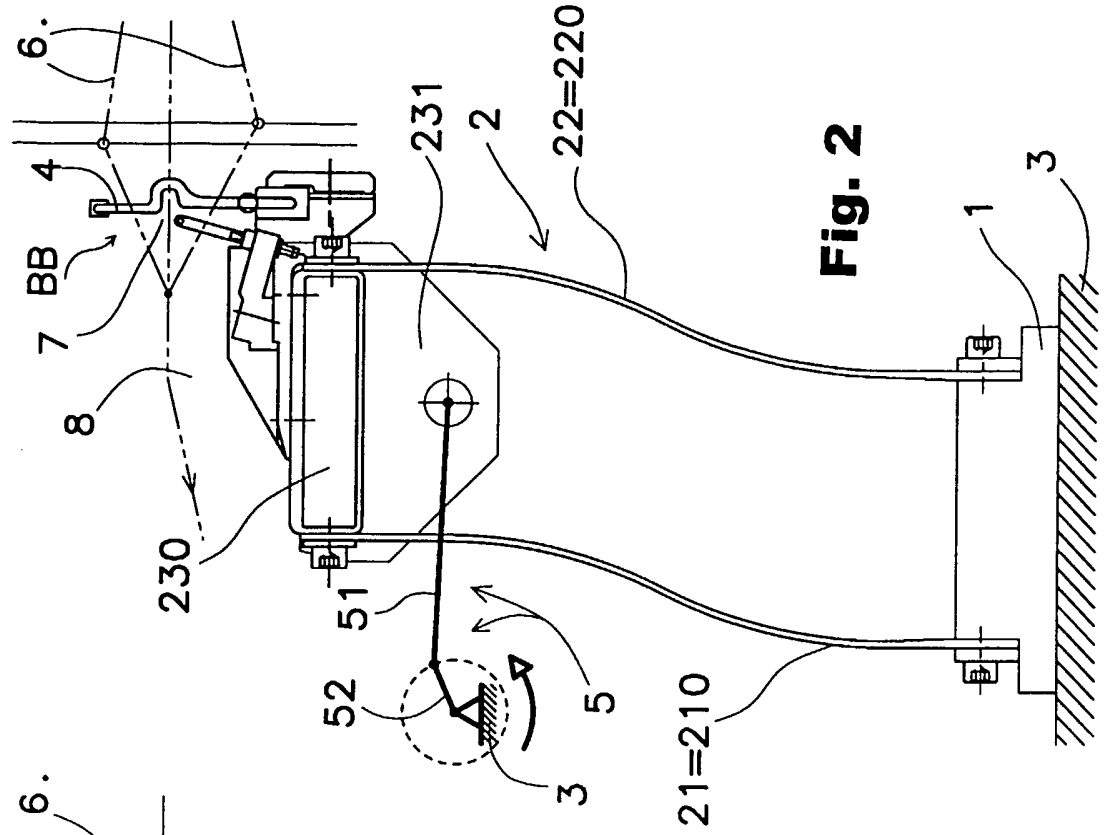
6.
4
BB
7
8
230
231
2
22=220
51
52
5
3
21=210
1
3

Fig. 2

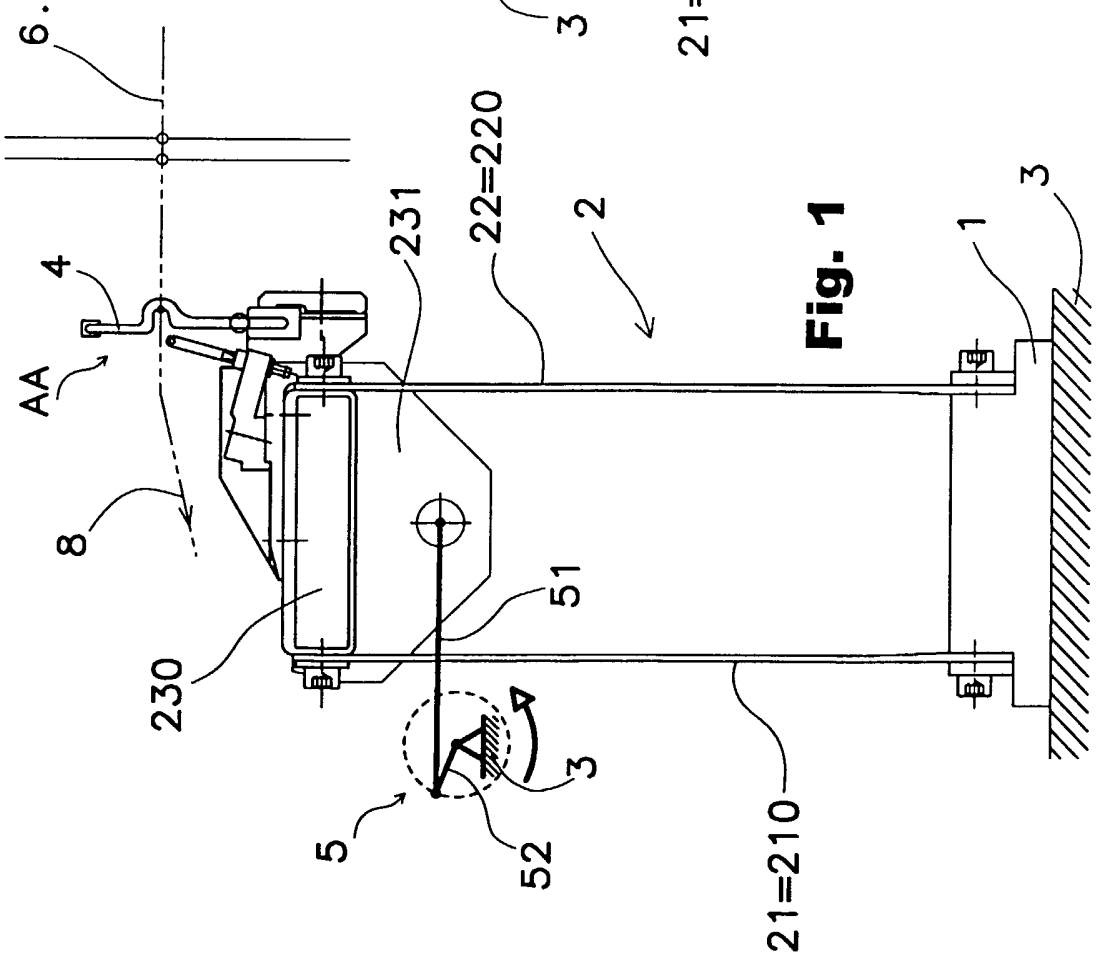
6.
4
AA
8
230
231
22=220
2
51
52
5
3
21=210
1
3

Fig. 1

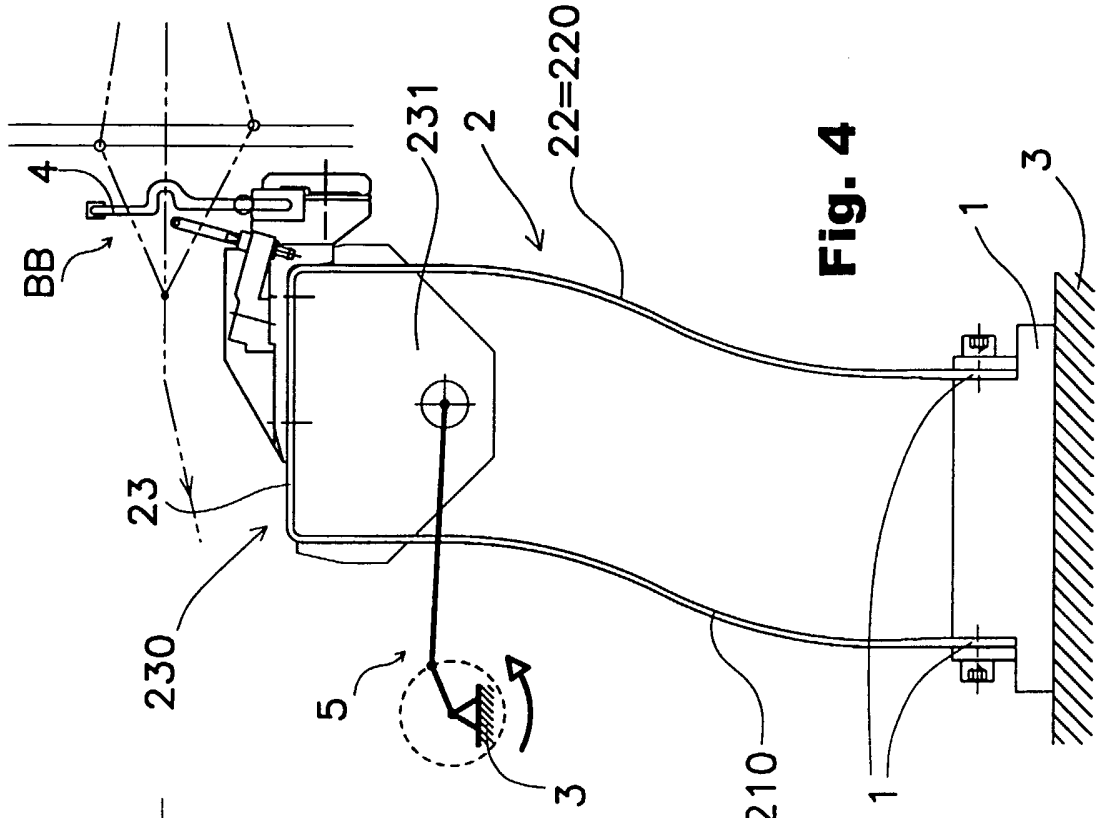
BB
4
231
2
22=220
3
1
23
230
5
3
21=210
211

Fig. 4

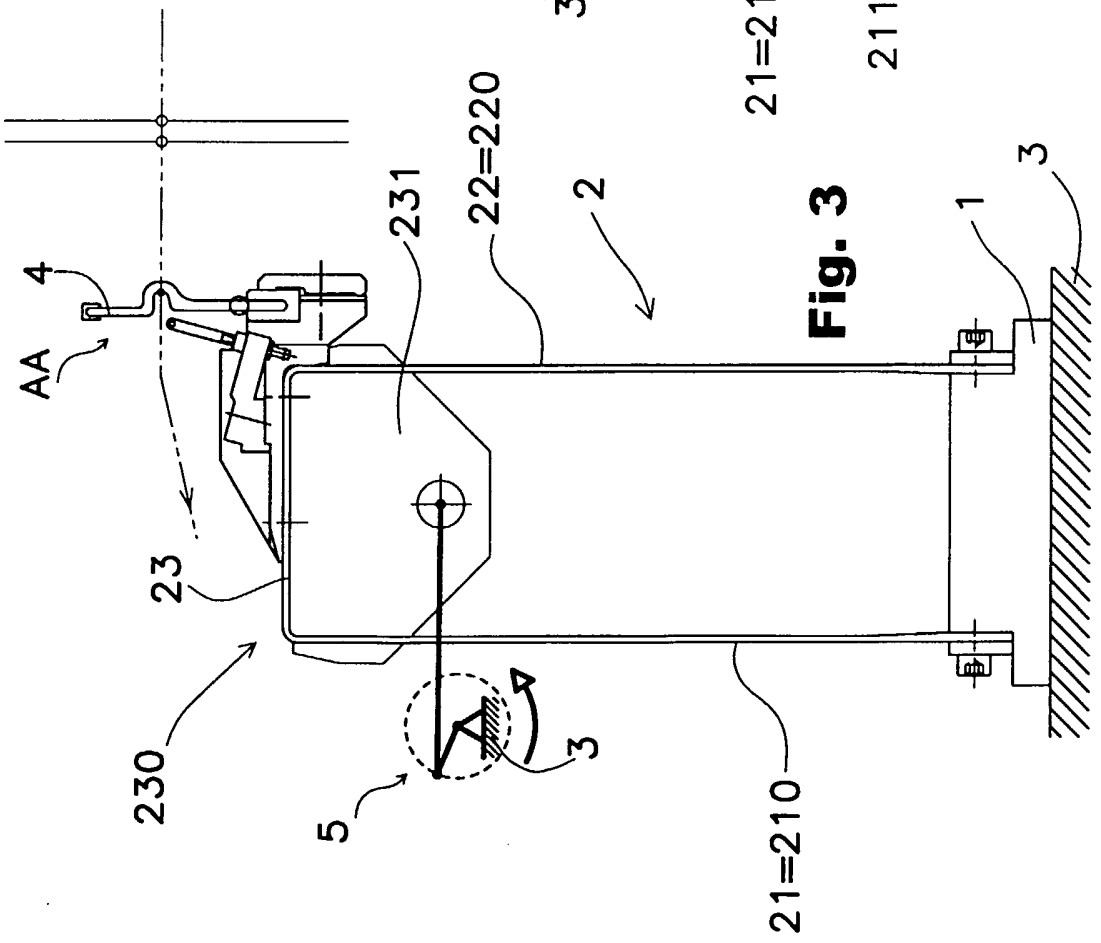
AA
4
231
22=220
2
3
1
23
230
5
3
21=210

Fig. 3

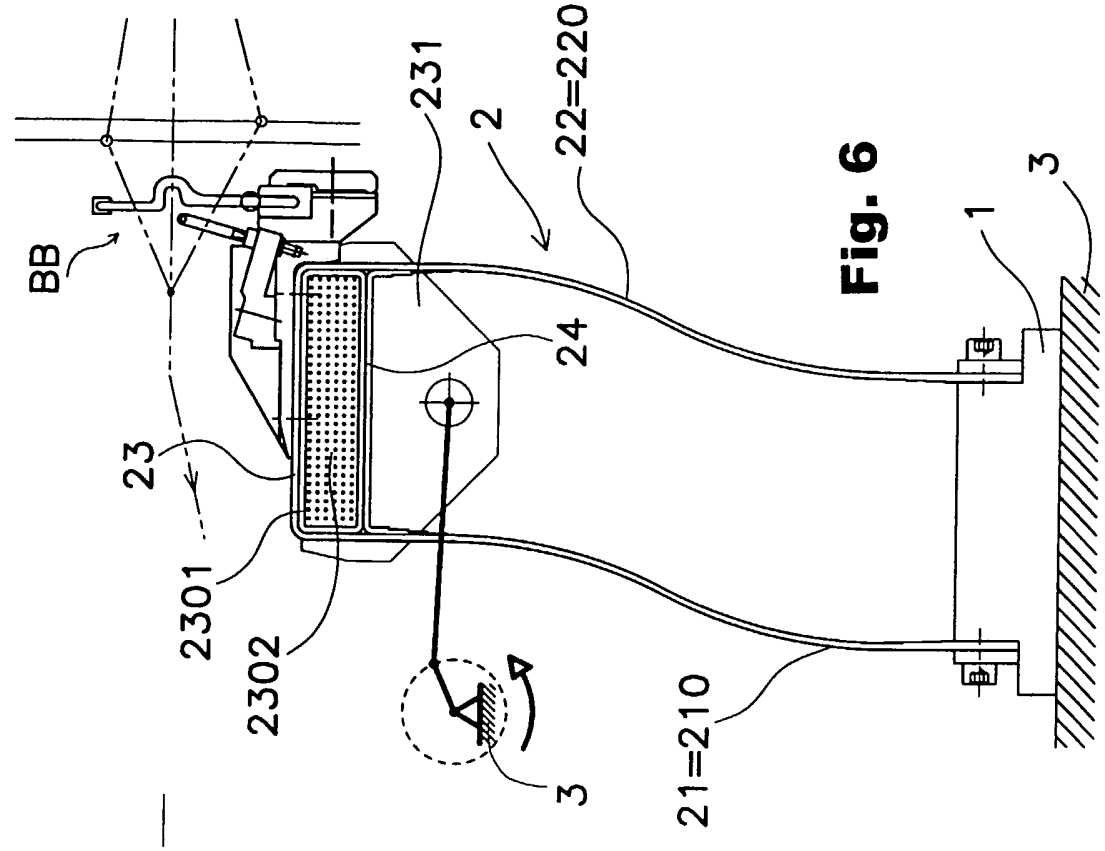
BB
231
2
22=220
3
1
24
23
2301
2302
3
21=210

Fig. 6

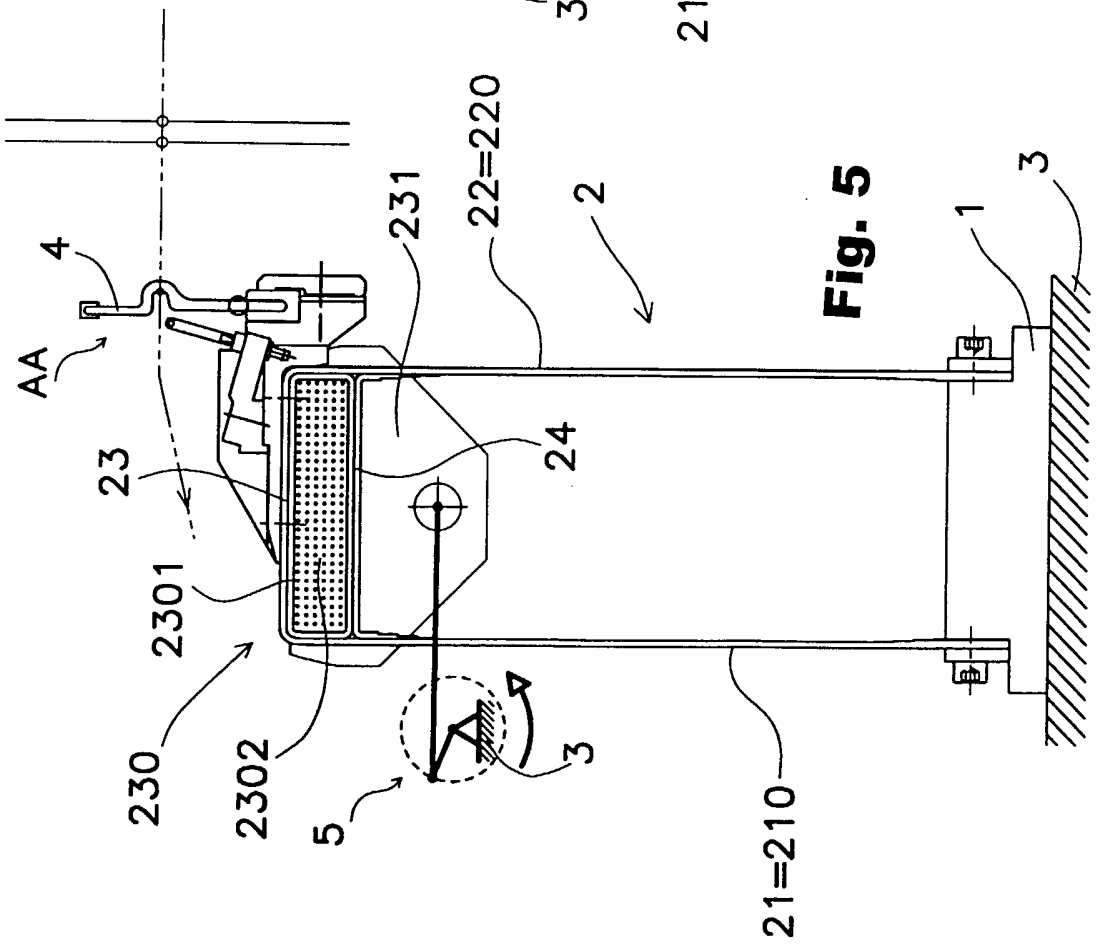
4
AA
231
22=220
2
3
1
23
24
2301
230
2302
5
3
21=210

Fig. 5

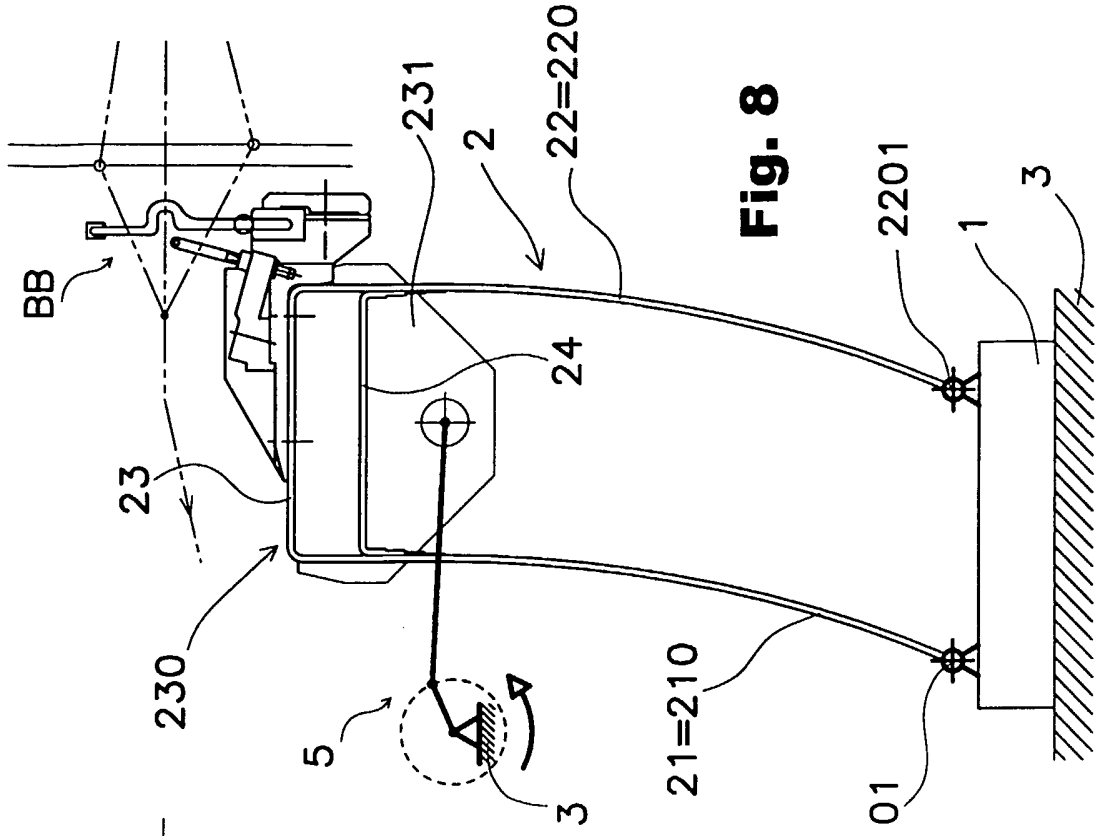
BB
231
2
22=220
2201
1
3
24
23
230
5
3
21=210
2101

Fig. 8

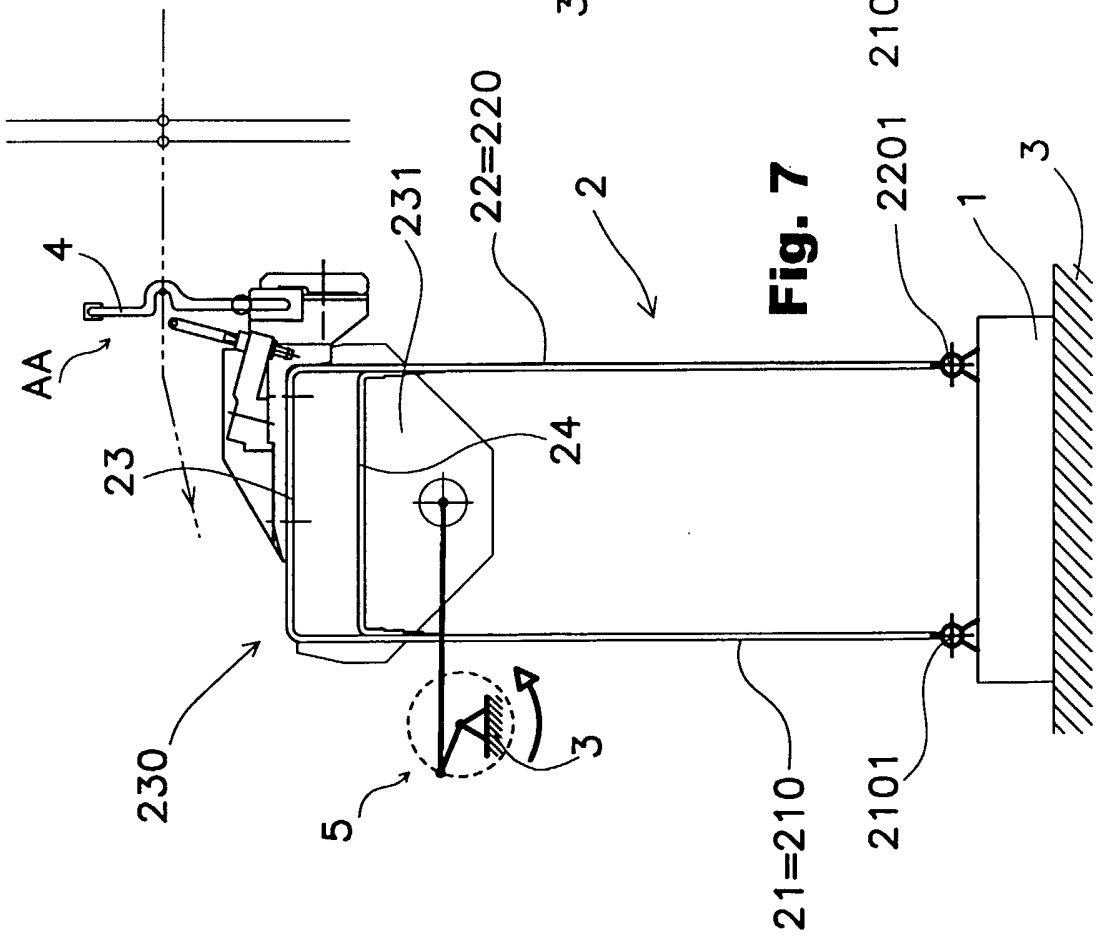
4
AA
231
22=220
2
2201
1
3
24
23
230
5
3
21=210
2101

Fig. 7

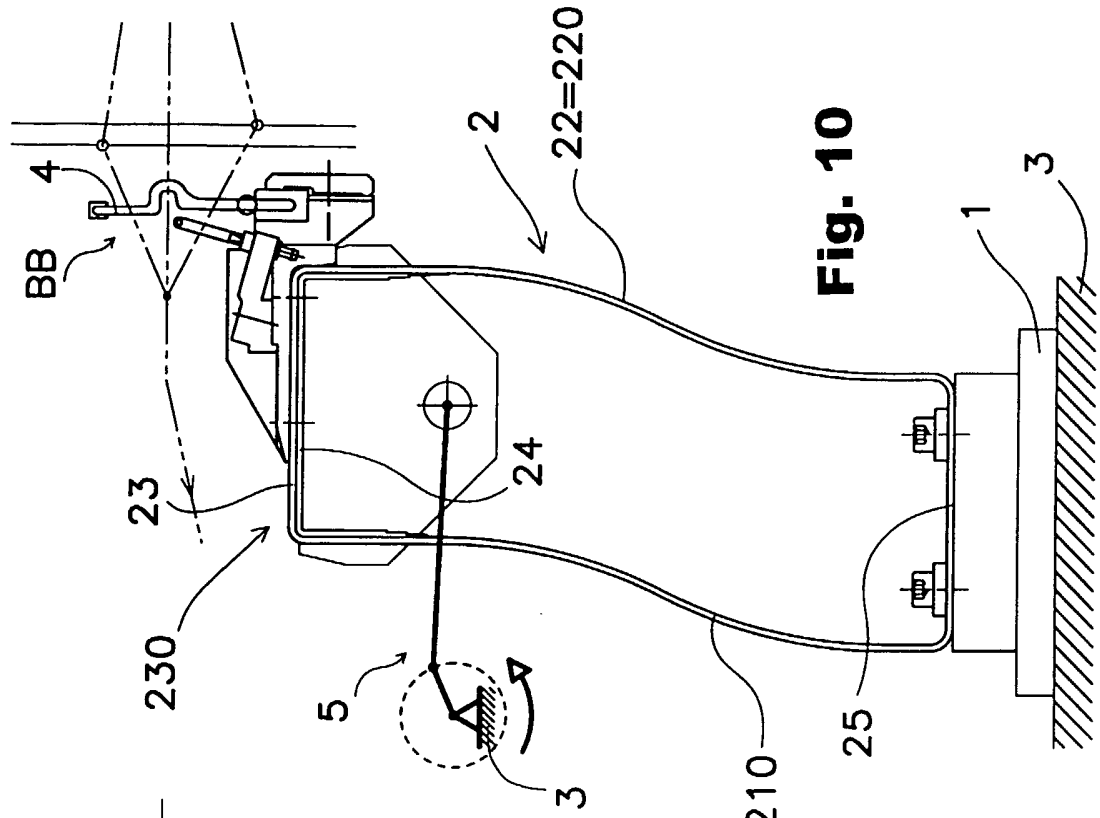
BB
4
2
22=220
3
1
23
24
230
5
3
25
21=210

Fig. 10

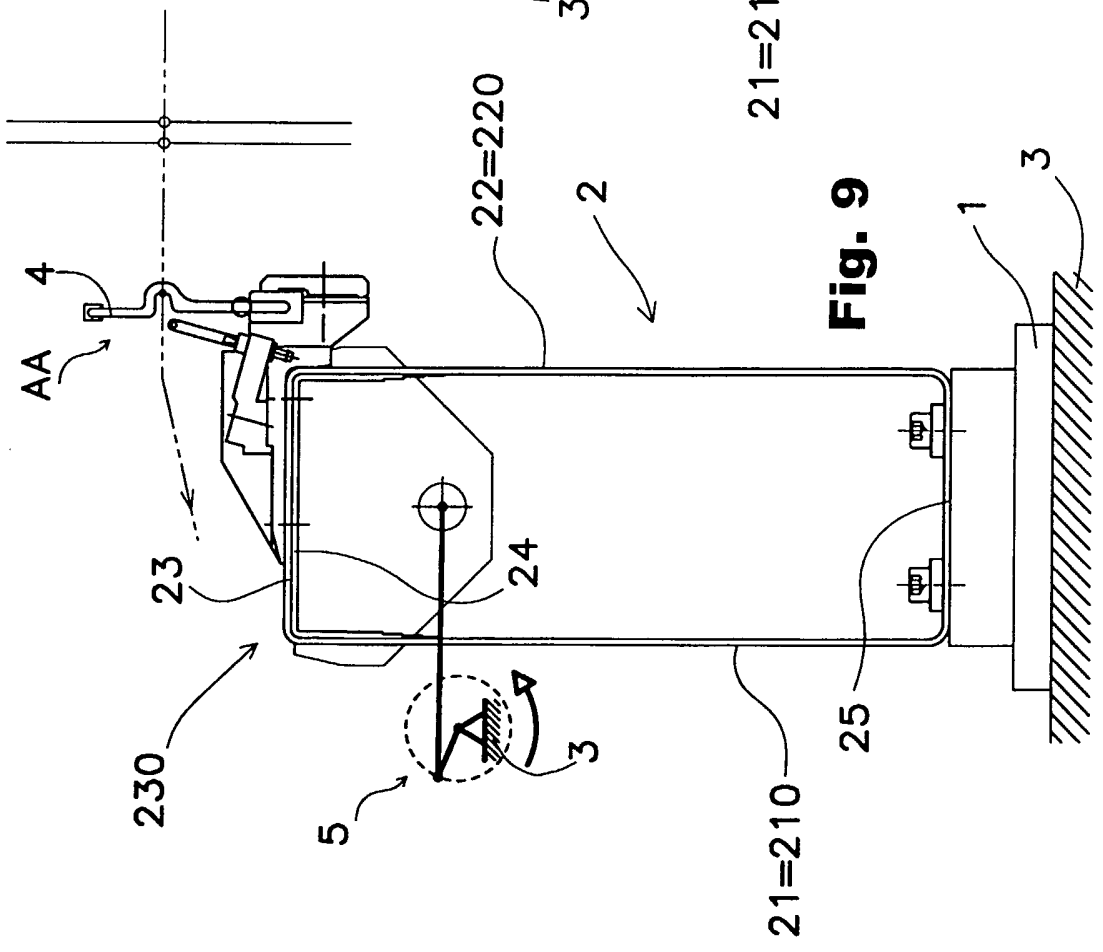
AA
4
22=220
2
3
1
23
24
230
5
3
25
21=210

Fig. 9

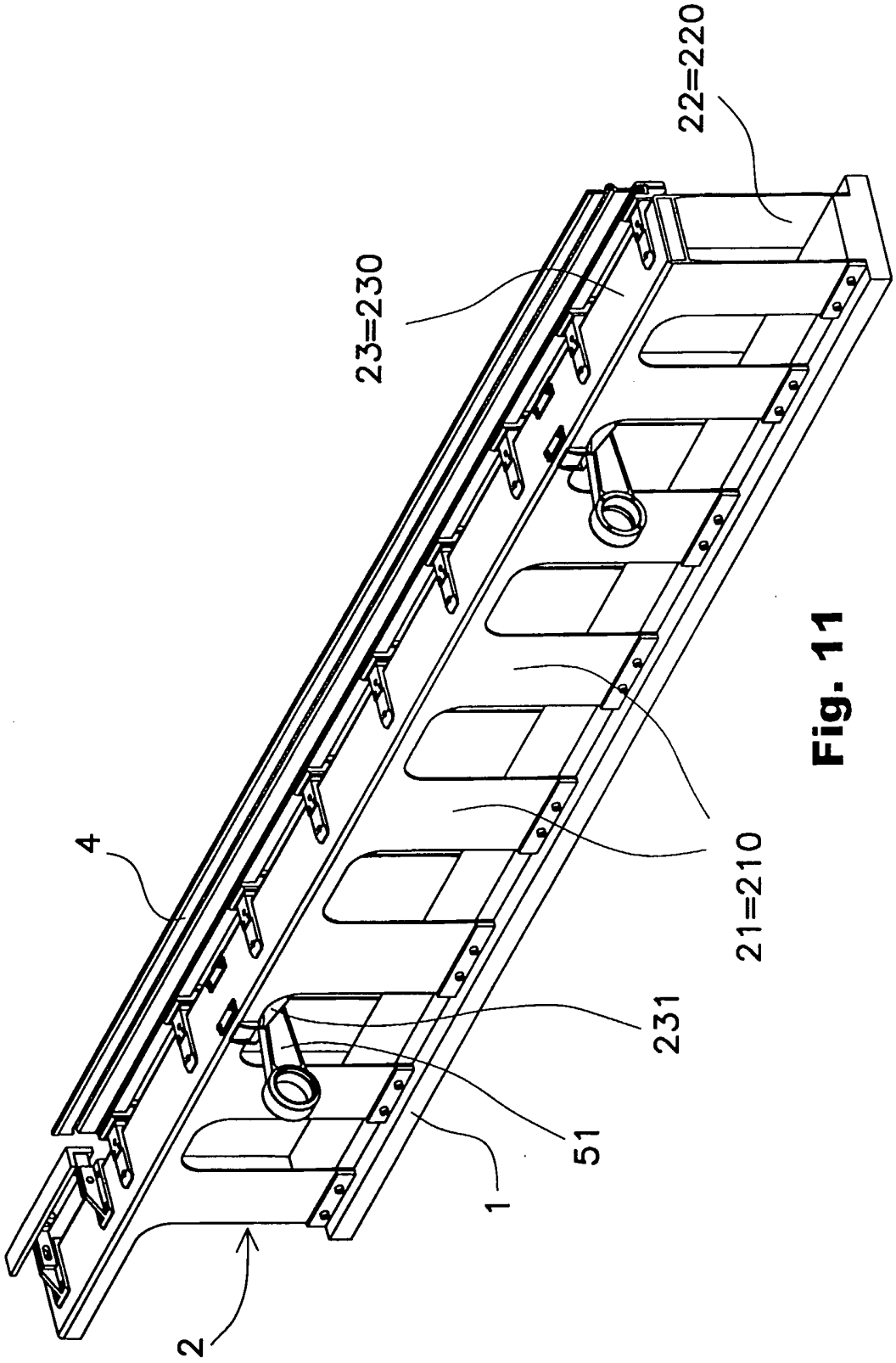

Fig. 11