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54 **Device for treating a wall e.g. a ship's wall.**

57 A device for treating a wall, for example, a ship's wall comprising a supporting device having a head (3) movable along the wall and an elongate carrier connected with the head and carrying processing members. The carrier comprises a basic segment (12) connected with the head and a plurality of relatively pivotable, elongate segments (13-16) connected with one another and with the basic segment to form a chain on at least one side of the basic segment. Moving and guiding means (21, 20) are provided for the pivotable movements of the segments relative to one another, the guiding means (20) comprising a bearing support (25) rigidly secured to the basic segment, a bearing support (24) rigidly secured to the second segment (14), viewed from the basic segment (12), and a coupling rod (26) pivotally connected with said bearing supports. The coupling rod (26) and the first segment (13) define a non-parallellogram-shaped four bar linkage. The moving means comprise a hydraulic jack (21) arranged between a bearing support rigidly secured to the basic segment and a bearing support rigidly secured to one of the plurality of segments.

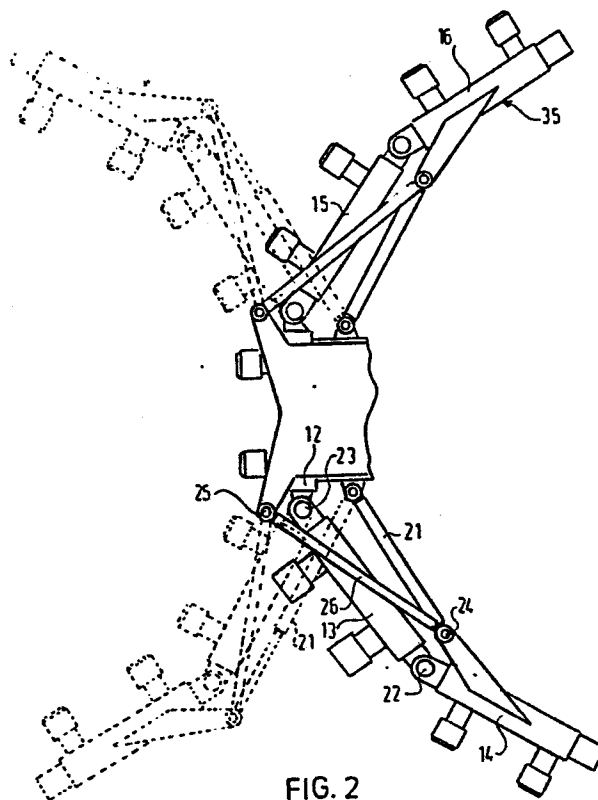


FIG. 2

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Device for treating a wall e.g. a ship's wall.

The invention relates to a device for treating a wall, for example, a ship's wall comprising a supporting device having a head movable along the wall and an elongate carrier connected with the head and carrying processing members.

5 Such a device is known from Dutch Patent Application 8004610. The elongate carrier for the processing members may be a spraying boom. The processing members in the form of spraying heads can spray water under very high pressure onto a ship's wall in order to remove fouling and loose paint. The
10 processing members may also be grit blasting heads or paint sprayers. By means of such a known device a flat or slightly curved ship's wall can be treated stripwise. It has been found that in the case of stronger curves of the wall, for example at the area of the stem and stern of a ship and on the bottom
15 side the known device with an elongate carrier for the processing members does no longer operate effectively.

The invention has for its object to provide a device of the kind set forth in the preamble by means of which even strongly curved walls can be effectively treated.

20 This is achieved with a device embodying the invention in that the carrier comprises a basic segment connected with the head and a plurality of relatively pivotable, elongate segments forming a chain with the basic segment on at least one side of the basic segment and in that moving and

guiding means are provided for the pivotable movement of the segments relative to one another, the guiding means comprising a bearing support rigidly secured to the basic segment, a bearing support rigidly secured to the second segment, viewed
5 from the basic segment and a coupling rod pivotally connected with said bearing supports, whilst the coupling rod and the first segment define a non-parallelogram-shaped, four bar linkage and in that the moving means comprise a hydraulic jack arranged between a bearing support rigidly secured to
10 the basic segment and a bearing support rigidly secured to one of the plurality of segments.

It has been found that the processing members operate satisfactorily only within a limited, varying distance from the wall to be treated. By the device according to the inven-
15 tion it is ensured that the optimum distance for the processing members can be maintained throughout the length of the elongate carrier since the segments can appropriately match the curvature of the wall to be treated. The movement of the second segment from the basic segment is coupled by the coupling rod with the movement of the first segment so that the
20 two segments can be moved by means of only one hydraulic jack.

In a further development of the device according to the invention in which the number of segments is more than two, the guiding means comprise a bearing support rigidly
25 secured to each segment after the second segment, a bearing support secured to the pre-preceding segment and a coupling rod pivotally connected with said bearing supports, the coupling rod and the intermediate segment defining a non-parallelogram-shaped four bar linkage. In this way the movement of
30 each next segment is coupled with that of the preceding segments so that the single hydraulic jack governs the movements of all segments of the carrier. The control of the segmented carrier thus becomes very simple.

A satisfactory interdependence of the segment move-
35 ments is obtained when in accordance with the invention the coupling rod crosses each time the intermediate segment extending over substantially the same distance. Thus the segments can advantageously assume the shape of a circular arc

with acceptable approximation. Since the curves of walls such as ship's walls can be approached by a series of parts of a circle, this embodiment is particularly suitable.

According to the invention the end of the last segment is preferably provided with a sensor coupled with the moving means. This sensor detects the distance from the wall to be treated. As soon as the distance becomes too small, the moving means are actuated so that the segments are bent away from the wall. If the distance becomes too large, the moving means move the segments towards the wall. In this way by a simple coupling between the sensor and the moving means an automatic adaptation of the carrier to the curvature of the wall to be treated can be obtained.

In order to collect the substances given off by the processing members during the treatment of the wall and, as the case may be, the material removed from the wall, a hood is connected with the carrier in accordance with the invention, said hood leaving the carrier free only with respect to the wall. According to the invention this hood is preferably designed in the form of bellows provided at the edges with brush elements. The bellows can follow the movements of the carrier and ensure a satisfactory seal with the wall. Preferably the hood is made from chrome leather which has the suitable properties to enable the use in a bellow-shaped hood as well as to withstand the loads occurring in operation and the substances employed thereto.

The invention will be described more fully with reference to the embodiments of the invention shown in the Figures.

Fig. 1 is a perspective view of a carrier embodying the invention connected with the aid of a supporting device.

Fig. 2 is a side elevation of the carrier of Fig. 1 in two extreme working positions.

Fig. 3 is partly an elevational view of a further embodiment of a carrier in accordance with the invention also in two outermost working positions.

Fig. 4 is partly a side elevation of a further embodiment of a carrier in accordance with the invention.

Fig. 5 is partly a perspective view of a carrier embodying the invention in which the processing members are formed by brushes.

Fig. 6 is partly a sectional view and an elevational view of a carrier embodying the invention; the processing member being formed by a grit blasting device.

Fig. 7 is a perspective view like Fig. 1 of a further development of the device embodying the invention.

The device 1 comprises a supporting device 2, an arm 4 and at the end of said arm a movable head 3 shown in Fig. 1. The head 3 is pivotally connected with the arm 4 by means of a bearing 8. The angular position of the head 3 with respect to the arm 4 is determined by a hydraulic jack 6, which engages a pivotal shaft 5 of the head 3. The supporting device 2 can reciprocately move the head 3 in the direction of the double arrow 27 and also in a direction perpendicular thereto.

On the head 3 is rotatably mounted a carrying plate 30 by means of a bearing 7. The carrying plate 30 can be turned with the aid of a jack 9 arranged between said plate and an extension arm 31 of the head between the position shown in Fig. 1 and a position turned through 90° with respect to the former.

The carrying plate 30 is provided with a console 10 in which a holder 32 is pivotally arranged by means of a bearing 11. The first segment 12 of the carrier 35 is rigidly secured to the holder 32.

According to the invention the carrier 35 comprises the basic segment 12 connected with the head 3 and a plurality of elongate segments 13, 14, 15, 16 pivotally connected with said basic segment 12. The segments 13 to 16 are pivotally interconnected to form a chain with one another and with the basic segment. The segment 13 is connected with the basic segment 12 by means of a hinge 23, whereas the segment 14 is connected with the segment 13 by means of a hinge 22. In a similar manner the segments 15 and 16 are pivotally connected with one another and with the basic segment 12 on the other side of the basic segment 12.

Fig. 1 shows that the segments 13 to 16 are provided with spray nozzles 17 capable of spraying water supplied under high pressure through a duct 19 in the form of a jet 18 onto a wall. This wall is not shown in the Figure. The supply of pressurized water to the spray nozzle 17 may be performed in various ways, for example, through separate ducts or through a duct incorporated in the carrier. This mode of supply does not form part of the present invention, however, and will, therefore, not be further discussed.

The segments 13 to 16 can relatively turn in a programmed way with the aid of the guiding means 20 and the moving means 21. The guiding means 20 for the segments 13, 14 on the underside of the basic segment 12 comprise a bearing support 25 rigidly secured to the basic segment 12, a bearing support 24 rigidly secured to the second segment 14 and a coupling rod 26 pivotally connected with said bearing supports 25, 24. The relative movements of the pivotable segments will be discussed in detail with reference to Figs. 2 ff.

Fig. 1 furthermore shows that the holder 32 is provided with an arm 33, between the free end of which and the carrying plate 30 is arranged a jack 34. By sliding the jack 34 in or out the carrier 35 connected with the holder 32 can be turned about the axis of a bearing 11 so that the nozzles 17 can be set at an appropriate angle to the wall to be treated.

The console 10 is furthermore provided with extension arms 28, which carry wheels 29 at their projecting ends. The rotary axis of these wheels 29 is parallel to the longitudinal axis of the carrier 35. The supporting device 2 can urge the assembly of carrier 35 and head 3 with the wheels 29 against the wall to be treated. By moving the head 3 in the direction of the arrow 27 the processing members formed by the spray nozzles 17 can treat a wall in strips.

Fig. 2 shows that the coupling rod 26 constitutes with the first segment 13 a non-parallelogram-shaped four bar linkage. It is thus ensured that each pivot position of the first segment 13 with respect to the basic segment 12 is associated with a given pivot position of the second segment

14 with respect to the first segment 13. In other terms the movement of the second segment 14 is coupled with the movement of the first segment 13. The moving means 21 comprise a jack engaging the bearing support 24. Fig. 2 shows the outermost retired position of the carrier by solid lines, whereas the outermost advanced position is indicated by broken lines.

According to a further aspect of the invention the coupling rod 26 crosses the intermediate segment covering substantially the same distance, whilst the distances of the bearing supports 25, 24 from the centre line of the associated segments 12 and 14 respectively are substantially the same. Fig. 2 shows that in this way the segments 13, 14 together with the basic segment 12 can occupy a position approaching the shape of a circular arc both in the retired and in the advanced state.

As is shown in Figs. 1 and 2 the device 1 comprises a carrier 35 comprising a basic segment 12 and two further segments 13, 14 and 15, 16 respectively on each side of the basic segment 12. However, in accordance with the intended use the number of segments on both sides of the basic segment may be different and need not be equal to two.

Fig. 3 shows an embodiment of the invention in which on one side of the basic segment 40 three further segments 41, 42, 43 are arranged. The constructions of the basic segment 40 and the first segment 41 and of the second segment 42 together with the guiding means including the coupling rod 44 and the moving means including the jack 45 are mainly identical to those of the embodiment shown in Figs. 1 and 2. The third segment 43 is pivotally connected with the end of the second segment 42. Moreover, the third segment 43 comprises a bearing support 48, whilst the first segment 41 is provided with a corresponding bearing support 47. Between these bearing supports is arranged a coupling rod 46. The coupling rod 46 constitutes together with the second segment 42 a non-parallelogram-shaped four bar linkage. In this embodiment this four bar linkage has the same dimensions as the four bar linkage formed by the coupling rod 44 and the first segment 41. In this embodiment of the invention it is ensured that also the

third segment 43 moves in dependence on the first segment 41. Thus all segments 41 to 43 can be moved with the aid of a single jack 45 between the retired position shown in Fig. 3 by solid lines and the advanced position indicated by broken lines. Also in the four bar linkage governing the movement of the third segment 43 the distances of the bearing supports 47 and 48 from the centre line of the associated segments 41 and 43 respectively are substantially the same so that a substantially symmetrical movability with respect to the stretched position is obtained.

In the device 50 of Fig. 4 comprising a first segment 51 and a second segment 52 the bearing support 53 for the coupling rod 56 is provided with a plurality of points of application 54. By displacing the point of application of the coupling rod 56 on the bearing support 53 a different movement of the second segment 52 can be obtained by the action of the jack 55. The Figure shows two outermost positions by broken lines in the situation in which the coupling rod engages the point of application 54 lying nearest the centre line of the segment 52. It is apparent that the second segment 52 in the extreme positions has turned with respect to the first segment 51 further than the first segment 51 has turned with respect to the basic segment 57. When a point of application 54 further away from the centre line of the segment 52 is engaged, the relative turn of the second segment 52 with respect to the first segment 51 is smaller. In this way the segments of the carrier can be adapted to the profile to be treated. Apart from the possibilities of adjustment at the area of the bearing support 53, there may be provided possibilities of adjustment near the basic segment 57.

In the embodiments of the device in accordance with the invention described above the processing members of the carrier are formed by spray nozzles rigidly secured to the carrier. According to a further aspect of the invention each segment may comprise at least one mounting support for releasably mounting a processing member.

Fig. 5 shows a segment 60 of a carrier designed in the way described in the foregoing. The segment 60 is connect-

ed by means of a hinge at one of its ends with a further segment (not shown) of the carrier. The guiding and moving means for this segment 60 are omitted for the sake of clarity. The segment 60 is provided with two mounting supports 62, 63. On these supports 62, 63 are mounted holders 65 with the aid of bolts 64. These holders 65 form part of brush devices 66. The brush devices 66 furthermore comprise a brush 68 journaled in the end of the holders 65 and driven by a hydromotor 67. The hydromotor 67 is connected with inlet and outlet ducts 69 for hydraulic fluid by pressure to the motors 67. The brushes 68 may be steel wire brushes for removing rust and dirt and for polishing the wall 59. The brushes 68 may also be fibre brushes for cleaning the wall 59.

Fig. 6 is a side elevation of a segment 70 of a device embodying the invention. This segment 70 is connected by a hinge tag 71 with an adjacent segment of the carrier. The segment 70 of this carrier is also provided with a mounting support 72. On this support 72 is mounted a grit blasting member 74 by means of bolts 73. The grit blasting member 74 comprises a hood 75, in the top end of which is mounted a supply blade wheel 76 which is rotatably driven. Below the hood 75 comprises a stock reservoir 81 for grit. From this reservoir 81 grit is supplied to the blade wheel 76 by means of air supplied through a duct 82. The grit is fed by the blade wheel 76 via the guide plates 77 to high-speed conveyor belts 78. These conveyor belts 78 project the grit with high speed in a jet 79 against the wall 80. From the wall 80 the reverberating grit with the removed dirt falls back into the hood 75 and is collected in the reservoir 81, from where it can be used again.

The brush devices 66 and the grit blasting members 74 are examples of processing members which can be arranged on a carrier embodying the invention. In themselves they do not form part of the present invention, but they only serve as examples of processing members releasably mounted on the carrier.

Fig. 7 shows a device 84 embodying the invention which mainly corresponds with the device 1 of Fig. 1. The

device 84 comprises a carrier 85. In accordance with the invention the carrier 85 has connected with it a hood 86 leaving it free only towards the wall (not shown). The hood 86 has the form of bellows 87 provided at the edges with brush elements 88. Owing to the bellows effect the brush elements 88 at the edge of the bellows 87 are held in contact with the wall to be treated when the carrier 85 of the device 84 is moved along said wall. The hood collects the material released by the processing members and dirt removed from the wall.

10 When the processing members are formed, as is shown, by spray nozzles, the hood 86 collects sprayed water and when the processing members are formed by grit blasting members of the kind of Fig. 6 or of another kind any released grit is collected. Moreover, the material loosened from the wall, for

15 example, paint residues, is collected. When the wall to be treated is a ship's wall, the latter is very important since the paint used for ship's walls is usually poisonous to avoid fouling. The hood 86 ensures that undesirable materials will not get into the environment.

20 The material collected in the hood 86 is conducted away through a funnel 90 to a drain tube 91. The bellows 86 have folds 89 at the level of the hinges of the segments. Thus the bellows 86 can follow the relative movements of the segments and intimately engage by the brush elements 88 the

25 curved walls.

According to the invention the device 84 is provided with sensors 92, which are arranged in this embodiment at the ends of the carrier 85. These sensors 92 detect the distance from the wall to be treated. As is shown quite schematically

30 in Fig. 7 the signal from the sensors 92 can be directly used for controlling the moving means formed by the jacks 100 and 101. Each sensor 92 co-operates with the associated jack. Fig. 7 only shows the control of the jack 100. The control of the jack 101 is identical.

35 The signal of the sensor 92, which may comprise a terminal switch or an approach switch, is applied to a control-device 93. In dependence on the value of the detected signal a corresponding control-signal is given off by the con-

trol-device 93 through the control-conductor 95. The control-conductor 95 is connected with the control-member 94 of a control-valve 96 designed in the form of a three-position valve. The valve 96 can connect the hydraulic pressure duct 98 (shown schematically) and the drain duct 97 with the hydraulic ducts 99 of the jack 100. When the sensor 92 detects that the distance from the wall becomes too small, the signal applied through the control-conductor 95 to the control-member 94 is such that the valve 96 is shifted to the right. As a result pressurized hydraulic fluid is fed from the duct 98 to the front of the jack 100, which thus slips in and the distance of the associated segments and hence of the sensor 92 from the wall becomes larger. When the sensor 92 detects that the distance from the wall becomes too large, the control-device 93 applies through the conductor 95 to the control-member 94 a signal such that the valve 96 shifts to the left so that the jack 100 slips out and the distance from the wall is reduced.

As stated above the control-devices for the lower segments of the carrier 85 can operate completely independently of the control-devices for the upper segments of the carrier 85. In this way completely automatic adaptation of the relative positions of the segments of the carrier to the curvature of the wall to be treated is ensured. In the device 84 the supporting device need, therefore, be actuated so that the carrier 85 is moved in strips along the wall to be treated. Owing to the effect of the control-devices 93 the shape of the carrier 85 automatically follows the curvature of the wall to be treated.

Figs. 1 and 7 show that the distance of the carrier from the wall to be treated is defined with the aid of guide wheels. As a matter of course, the supporting device may also be designed so that the desired distance is maintained with the aid of contactless sensors. The effect of the sensors of the carriers remains the same.

When the processing members are formed by paint sprayers, no brush elements can be used on the hood, which would remain in contact with the ship's wall. In this case a

hood is used, the dimensions of which are such that the edge remains at a small distance from the ship's wall. By means of a corresponding construction air containing the paint fog can be withdrawn through the outlet tube 91. Thus the wall can be
5 treated in any possible manner without polluting the environments.

C L A I M S

1. A device for treating a wall, for example, a ship's wall comprising a supporting device having a head movable along the wall and an elongate carrier connected with the head and carrying processing members c h a r a c t e r -
5 i z e d in that the carrier comprises a basic segment connected with the head and a plurality of relatively pivotable, elongate segments connected with one another and with the basic segment to form a chain on at least one side of the basic segment and in that moving and guiding means are provid-
10 ed for the pivotable movements of the segments relative to one another, the guiding means comprising a bearing support rigidly secured to the basic segment, a bearing support rigidly secured to the second segment, viewed from the basic segment, and a coupling rod pivotally connected with said bearing
15 supports, the coupling rod and the first segment defining a non-parallelogram-shaped four bar linkage and in that the moving means comprise a hydraulic jack arranged between a bearing support rigidly secured to the basic segment and a bearing support rigidly secured to one of the plurality of seg-
20 ments.

2. A device as claimed in Claim 1 c h a r a c t e r -
i z e d in that the number of segments is more than two and in that the guiding means comprise a bearing support rigidly secured to each segment after the second segment, a bearing
25 support secured to the preceding segment with respect to the

former and a coupling rod pivotally connected with said bearing supports, the coupling rod and the intermediate segment defining a non-parallelogram-shaped four bar linkage.

3. A device as claimed in Claim 1 or 2 c h a r a c -
5 t e r i z e d in that the coupling rod crosses the intermediate segment covering substantially the same distance and in that the distances of the bearing supports from the centre line of the associated segment are substantially the same.

4. A device as claimed in anyone of the preceding
10 Claims c h a r a c t e r i z e d in that at the end of the last segment there is provided a sensor coupled with the moving means.

5. A device as claimed in anyone of the preceding
Claims c h a r a c t e r i z e d in that each segment com-
15 prises at least one mounting support for releasably mounting a processing member thereon.

6. A device as claimed in anyone of the preceding
Claims c h a r a c t e r i z e d in that a hood is connect-
ed with the carrier so that it leaves the carrier free only
20 towards the wall.

7. A device as claimed in Claim 6 c h a r a c t e r -
i z e d in that the hood is designed in the form of bellows provided at the edges with brush elements.

8. A device as claimed in Claim 7 c h a r a c t e r -
25 i z e d in that the hood is made from chrome leather.

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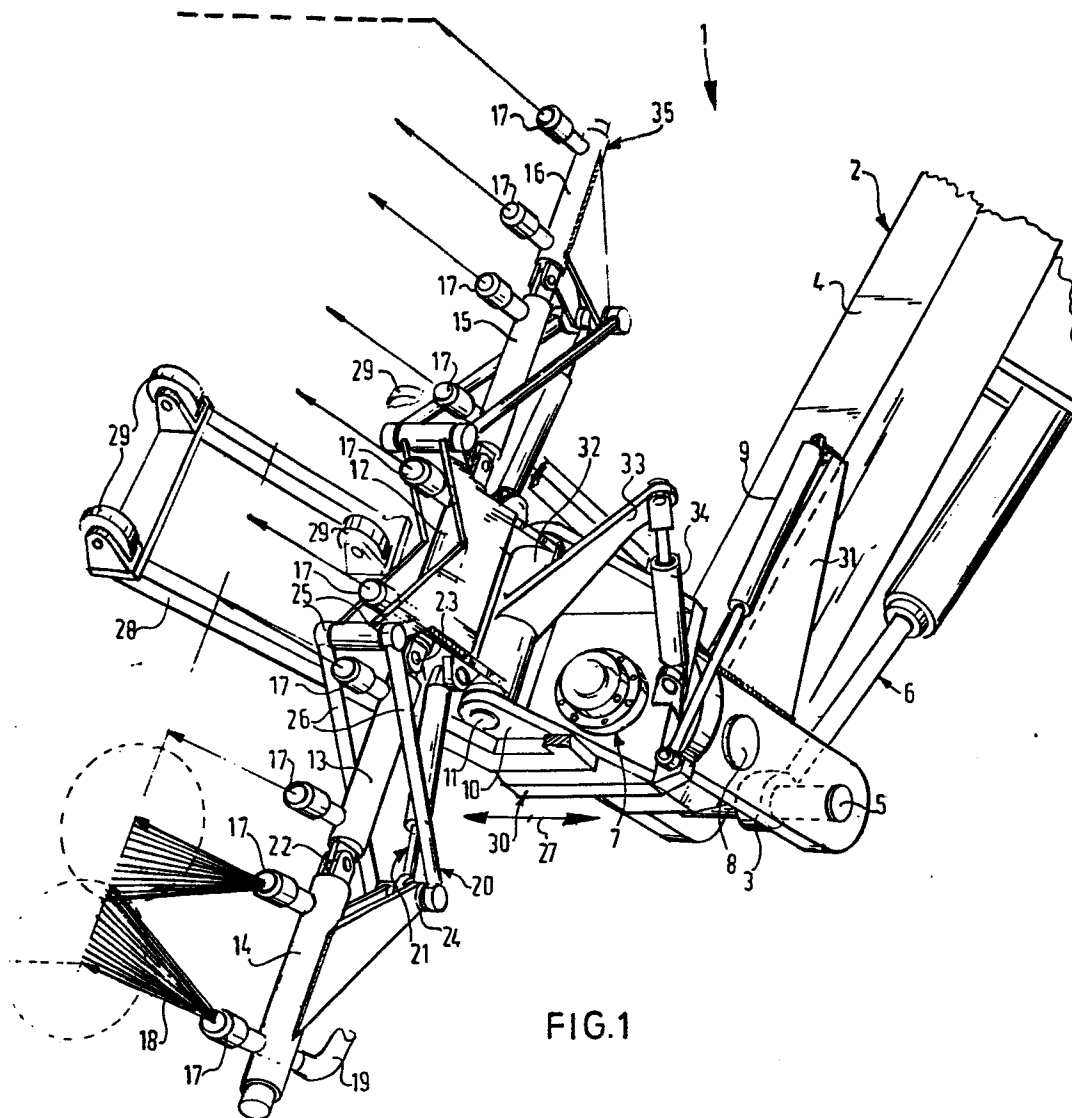
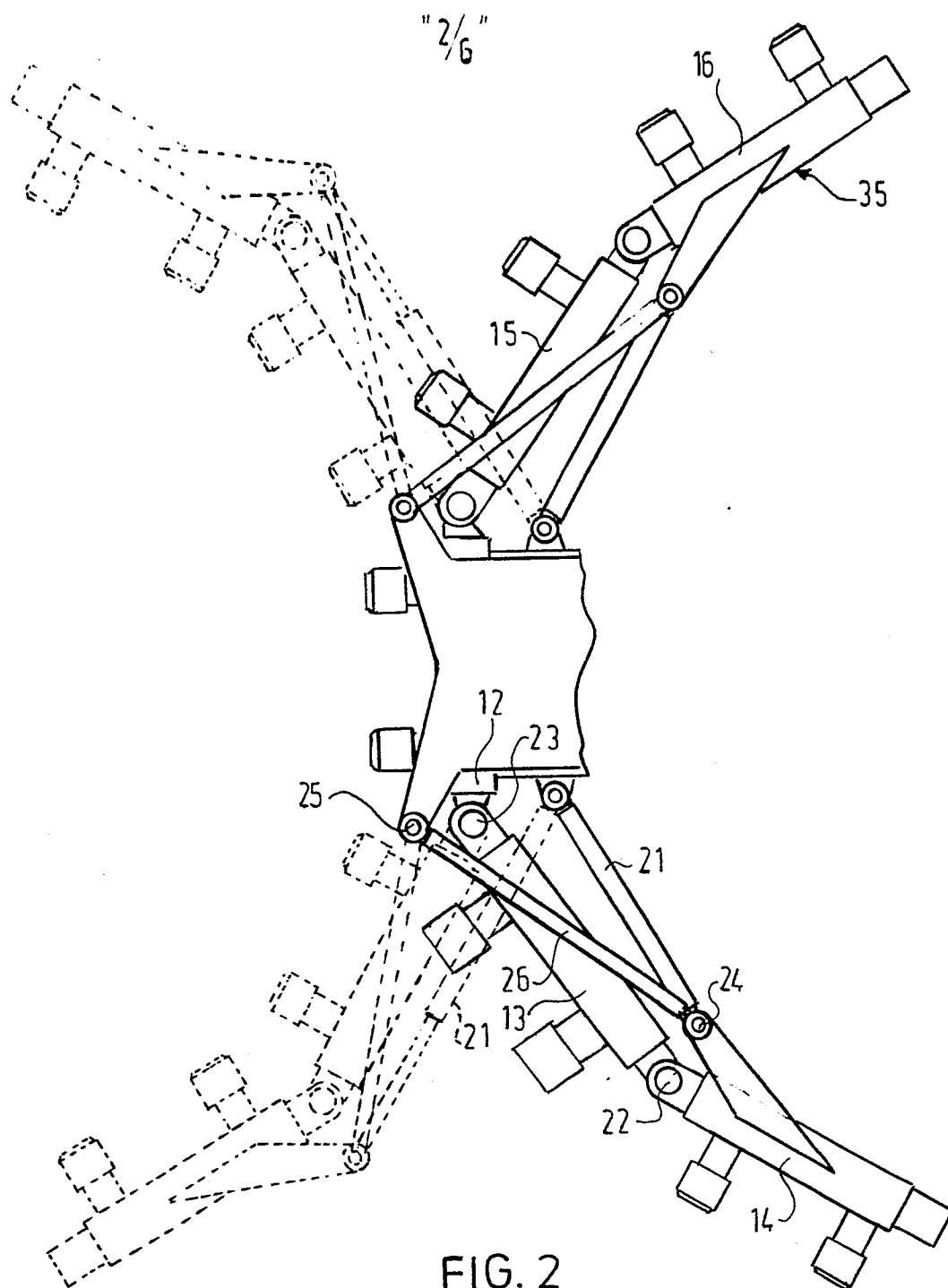
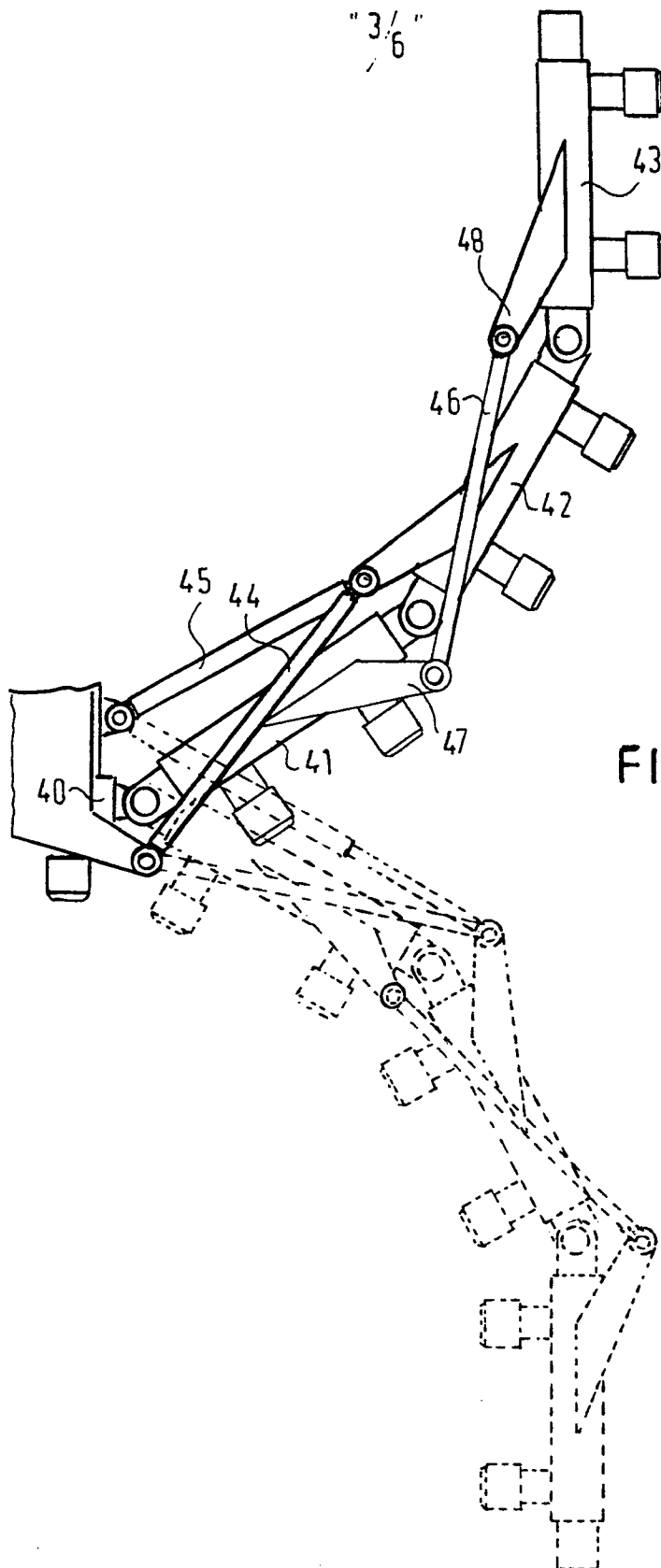


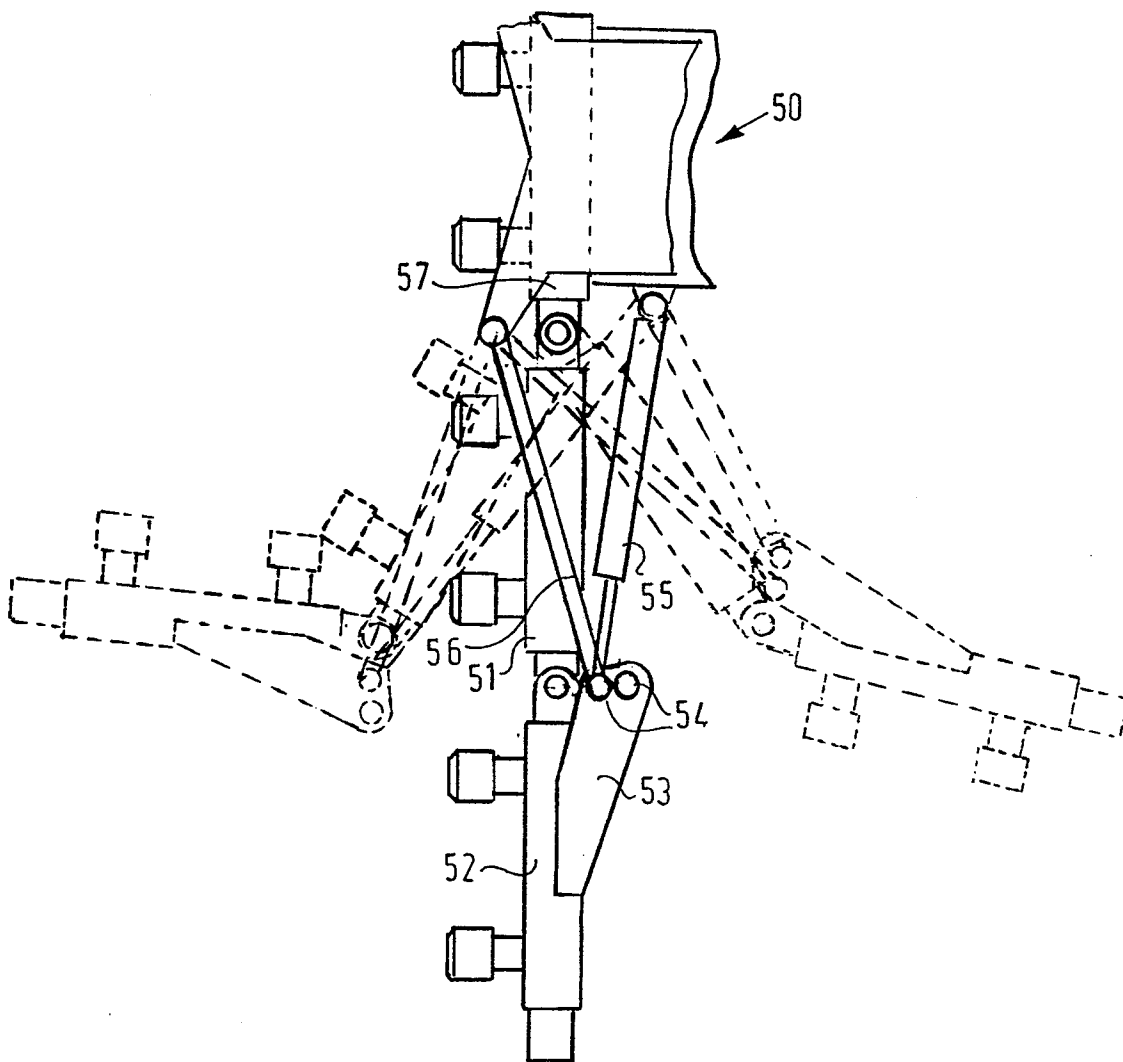
FIG.1



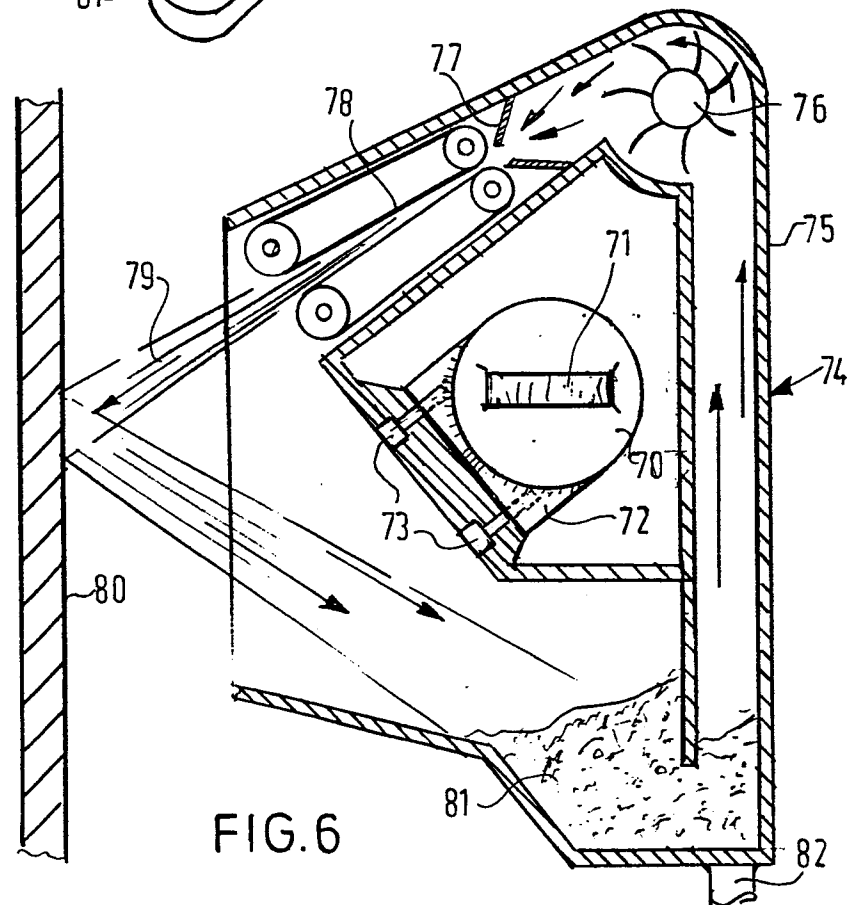
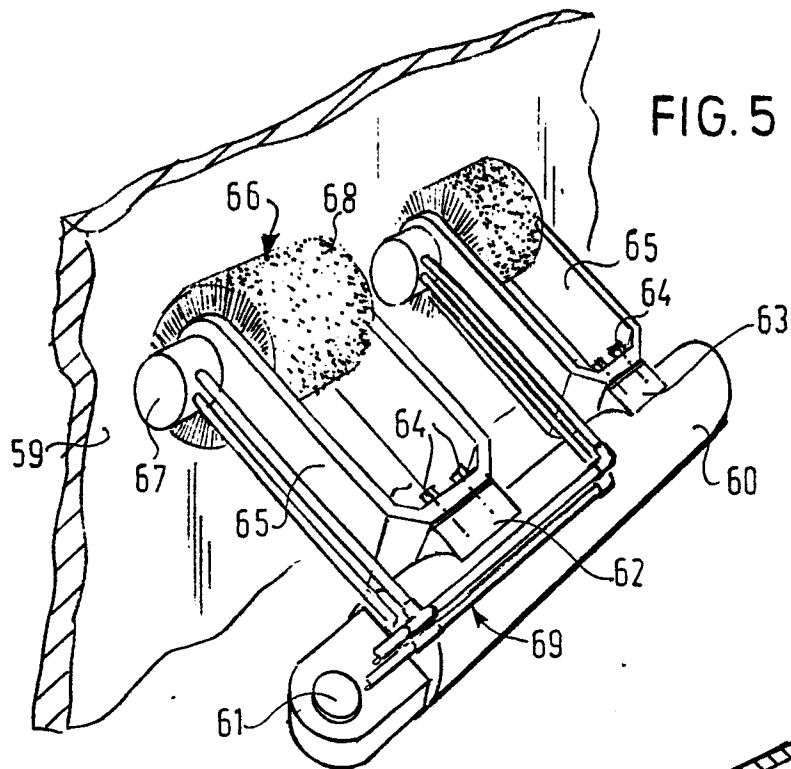


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FIG. 4



"5/6"



"6/6"

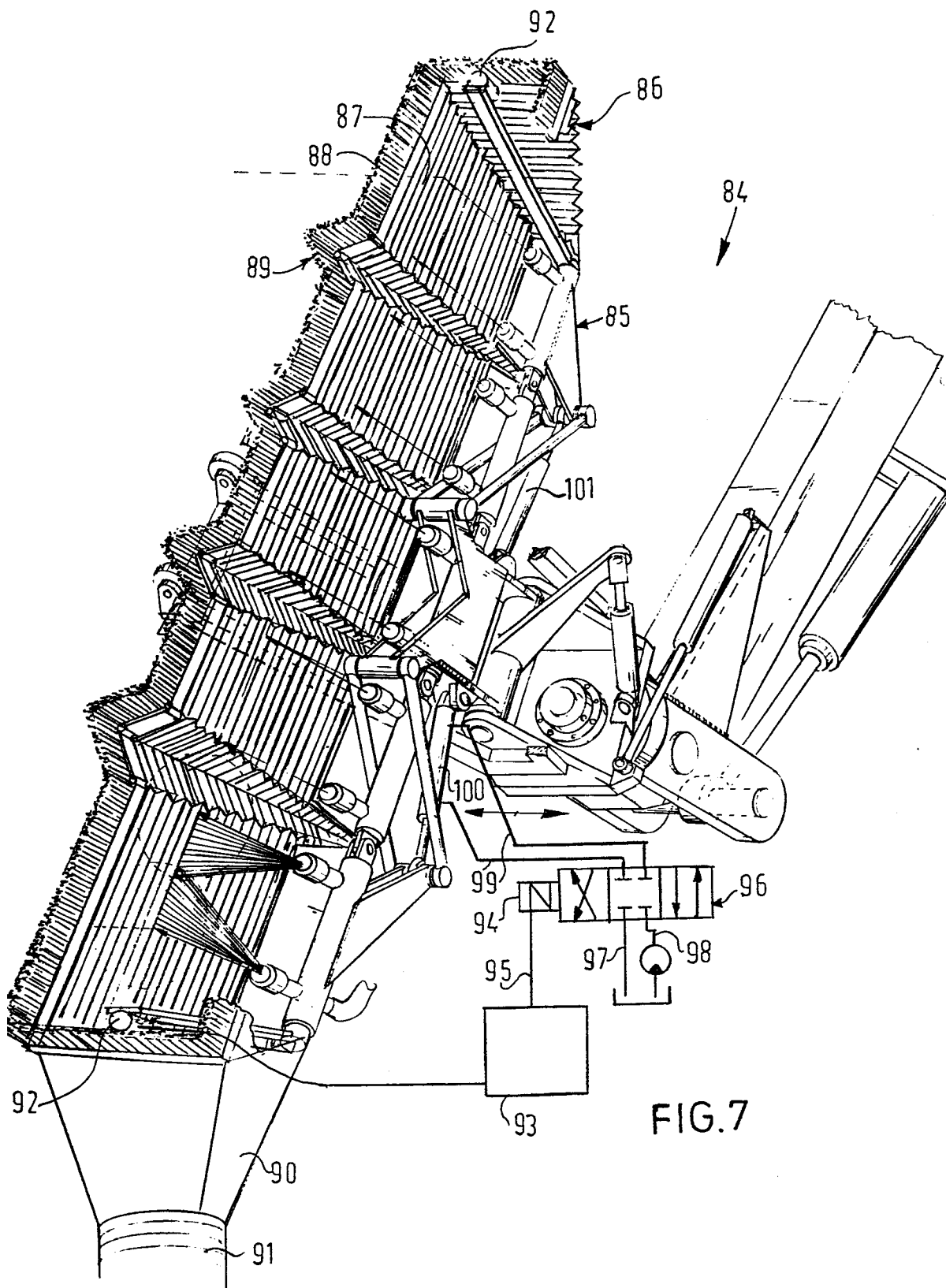


FIG. 7