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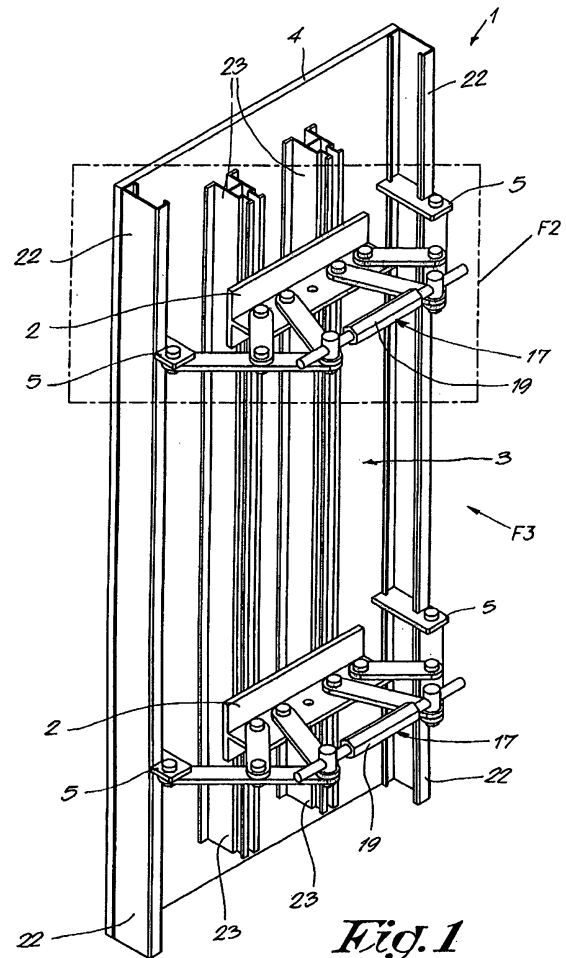
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(54) **Device for making a curved shuttering**

(57) Device (1) for making a curved formwork (25), characterised in that it consists of a central part (2) and of coupling means (5) on either side (6) of the central part (2) with which the device (1) can be coupled to the form board (4), whereby a pair of hinged arms (7,8) is provided on either side (6) of the central part (2) which are hinge-mounted to the central part (2) with one far end (9,10) and which are hinge-mounted to a lever (13) with their other far end (11,12), which lever (13) is hinge-mounted to the coupling means (5) concerned, whereby between the above-mentioned levers (13) or hinged arms (7,8) are provided clamping means (17) to move the hinged arms (7, 8) towards each other or away from each other.



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## Description

**[0001]** The present invention concerns a device for making a curved formwork.

**[0002]** Devices for making a curved formwork are already known, whereby flat form boards are coupled to one another by means of a tapered connecting piece.

**[0003]** In these known devices, the flat form boards retain their flat shape and the curved form is actually approached by a polygon.

**[0004]** A disadvantage hereby is that the desired curved shape is not exactly obtained.

**[0005]** Another disadvantage of these known devices is that for every different radius of curvature of the curved form, other tapered connecting pieces must be used, which implies that a lot of installation material must be available.

**[0006]** Further, working with tapered connecting pieces is not simple at all, and it is easy to make mistakes, for example by using the wrong tapered connecting piece.

**[0007]** In the case of other known devices for making a curved formwork, flat form boards are bent in the desired shaped with clamping means.

An advantage of these devices is that they make it possible to actually obtain the desired curved shape.

**[0008]** However, these devices are usually very complicated, and clamping the form boards into the desired curved shape is far from simple, often very time-consuming and hence disadvantageous to the cost price of the construction.

**[0009]** The present invention aims to remedy one or several of the above-mentioned and other disadvantages.

**[0010]** To this end, the present invention concerns a device for making a curved formwork, formed of a central part which is made to rest against a flat form board and of coupling means on either side of the central part, with which the device can be coupled to the form board, whereby a pair of hinged arms is provided on either side of the central part which are hinge-mounted to the central part with one far end and which are hinge-mounted to a lever with their other far end, which lever is hinge-mounted to the coupling means concerned, whereby between the aforesaid levers or hinged arms are provided clamping means for moving the hinged arms towards each other or away from each other.

**[0011]** An advantage of such a device according to the invention is that the required shape can be obtained very quickly by means of the clamping means.

**[0012]** The combination of several hinged arms with a lever hereby provides for a very efficient transmission of energy, whereby only a very slight tightening of the clamping means results in large deformation of the form board.

**[0013]** Another advantage of such a device according to the invention is that curved shapes with very diverse radiuses of curvature can be realised without any addi-

tional adapters being required.

**[0014]** According to a preferred embodiment of a device according to the invention, the clamping means consist of a single clamping means, preferably in the form of two threaded rods that are connected by means of a nut, whereby the nut is provided with left-handed internal screw thread on one side and with right-handed internal screw thread on the other side.

**[0015]** An advantage of such a device according to the above-mentioned embodiment is that the clamping means can be very easily made and that they are easy to handle. By a simple turn of the nut, for example with a hexagonal spanner, the threaded rods are moved further towards each other or further away from one another, which results in the required tension or release, such that adjusting the clamping means is very simple.

**[0016]** Moreover, such a device according to the invention for clamping a form board requires only one manipulation, whereas with the known devices, the clamping is very complicated and requires several manipulations, among others as adjustments are necessary to make connecting form panels fit.

**[0017]** Further, it is possible to obtain curved formworks having a small radius of curvature with such clamping means, for example up to 150 cm, which is certainly not evident with the known devices for making a curved formwork.

**[0018]** This is advantageous in that extremely curved concrete shapes can be formed with a device according to the invention.

**[0019]** According to another preferred embodiment of a device for making a curved formwork according to the invention, the device is symmetrical.

**[0020]** With such a device according to this embodiment, it is extremely simple to bend a form board into a cylindrical segment.

**[0021]** The invention also concerns a form board comprising at least one device according to the invention as described above.

**[0022]** In order to better explain the characteristics of the invention, the following preferred embodiment of a device for making a curved formwork is given as an example only without being limitative in any way, with reference to the accompanying drawings, in which:

figure 1 shows two devices according to the invention in perspective, provided on a form board;  
figure 2 represents the detail indicated by F2 in figure 1 to a larger scale;

figure 3 is a front view of the devices and the form board from figure 1, whereby the viewing direction is indicated by arrow F3;

figure 4 represents the detail indicated by F4 in figure 3 to a larger scale;

figure 5 is a top view whereby the viewing direction is indicated with arrow F5 in figure 4;

figure 6, analogous to figure 5, represents the device according to the invention, but in a clamped condi-

tion; and,  
 figure 7 illustrates the use of a device according to the invention seen from above;  
 figure 8, analogous to figure 5, is a top view of an alternative embodiment of a device for making a curved formwork according to the invention.

**[0023]** The form board represented in figure 1 comprises two devices 1 according to the invention in the given example.

**[0024]** These devices 1 consist of a central part 2 that is made to rest against a side 3 of a flat form board 4 and coupling means 5 on either side 6 of the central part 2 with which the device can be coupled to the form board 4.

**[0025]** On either side 6 of the central part 2 is each time provided a pair of hinged arms 7 and 8 that are hinge-mounted to the central part 2 with their respective far ends 9 and 10 and that are hinge-mounted to a lever 13 with their respective other far ends 11 and 12, which lever 13 is hinge-mounted to the coupling means 5 concerned.

**[0026]** The distances between the different hinged arms 7 and 8 and the levers 13 preferably have a certain ratio.

**[0027]** According to a preferred embodiment of a device 1 according to the invention, the distance A between the hinge points on the far ends 9 and 10 of the hinged arms 7 and 8 amounts to 82.5 mm, the distance B between the hinge points on the far ends 9 and 11 of the first hinged arm 7 amounts to 165 mm, the distance C between the hinge points on the far ends 10 and 12 of the second hinged arm 8 amounts to 247.5 mm and the distance D between the hinge points on the other far ends 10 and 12 of the hinged arms 7 and 8 amounts to 165 mm.

**[0028]** Naturally, other dimensions are not excluded, but for a good working order of the device 1 according to the invention are preferably applied about the same ratios.

**[0029]** In the given example, a first hinged arm 7 of each aforesaid pair of hinged arms 7 and 8 is practically provided at one far end 14 of the central part 2 with one far end 9, and practically in the centre 15 of the lever 13 with its other far end 11.

**[0030]** The other hinged arm 8 of each aforesaid pair of hinged arms 7 and 8 is provided on the central part 2 with one far end 10 between the above-mentioned first hinged arms 7, and with its other far end 12 practically at the far end 16 of the lever 13.

**[0031]** The length L of the first hinged arm 7 is shorter than the length M of the other hinged arm 8 of each pair of hinged arms 7 and 8.

**[0032]** Moreover, when in rest, the hinged arms 7 and 8 are directed slantingly in relation to the surface 3 of the form board 4, and the hinged arms 7 and 8 are directed outward in relation to the central part 2.

**[0033]** Further, the levers 13 and the hinged arms 7 and 8 are situated in a plane at right angles to the form board 4.

**[0034]** Further, clamping means 17 are provided between the above-mentioned levers 13 or hinged arms 7 and 8 to move the hinged arms 7 and 8 towards each other or away from each other.

**[0035]** In the given example, these clamping means 17 consist for example of two threaded rods 18 that are mutually connected by means of a nut 19.

**[0036]** The nut 19 is provided with left-handed internal screw thread on one side and with right-handed internal screw thread on the other side.

**[0037]** In order to make a symmetrical arch, the device 1 is preferably made symmetrical.

**[0038]** The coupling means 5 are preferably provided on the side edges 20 of the form board 4.

**[0039]** In the given embodiment, these coupling means 5 are mainly formed of a gusset 5 provided with recesses 21 which make it possible to shift the gusset 5 over a lateral strut 22 of the form board 4.

**[0040]** Such lateral struts 22 are provided as standard on the flat form boards 4, such that the coupling means 5 make sure that the device 1 can be coupled to a standard flat form board 4 in a very simple manner.

**[0041]** The working and use of a device 1 according to the invention for making a curved formwork is simple and is illustrated hereafter.

**[0042]** In order to form a curved formwork, standard flat form boards 4 are taken as a basis.

**[0043]** In the case of figures 1 to 5, two devices 1 according to the invention are coupled to the form board 4 by means of the coupling means 5.

**[0044]** This can be simply done by shifting the gussets 5 over the lateral struts 22 of the form board 4.

**[0045]** Naturally, it is possible to provide more devices 1 on larger form boards 4.

**[0046]** The central part 2 of the devices 1 rests against the form board 4 with two longitudinal struts 23.

**[0047]** This results in an even distribution of energy over the length of the form board 4.

**[0048]** Transforming the flat form board 4 into a curved form board 4 is now possible by clamping the clamping means 17 by way of tightening the nut 19, for example by means of a hexagonal spanner or tongs or the like.

**[0049]** When the nut 19 is turned in a specific direction, the threaded rods 18 will move towards each other, such that the original distance N between the far ends 12 with which the hinged arms 7 and 8, as well as the levers 13 are mutually coupled on either side 6 of the central part 2 is reduced to a distance N', as represented in figure 6.

**[0050]** Thanks to the cooperation of the hinged arms 7 and 8 with the levers 13, as a result of said shortened distance N', the far ends 24 of the levers 13 at the coupling means 5 will move towards the central part 2 and away from the original plane in which the form board 4 is situated.

**[0051]** This results in a certain concave curvature of the form board 4.

**[0052]** Naturally, by tightening the nut 19 ever further, the curvature is enlarged.

**[0053]** However, when the nut 19 is turned as of the position of rest in the direction opposite to the above-mentioned direction, then the original distance N between the far ends 12 will increase.

**[0054]** Thus is obtained a convex curvature of the form board 4.

**[0055]** Further, it is also clear that the first hinged arms 7 provide for a certain reinforcement of the movement of the far ends 24, such that a small rotation of the nut 19 results in a large curvature of the form board 4.

**[0056]** By appropriately selecting the dimensions and ratios of the hinged arms 7 and 8 and the levers 13 as well as the mutual distances of the hinge points, one can make sure that the form board 4 is transformed according to a cylindrical segment.

**[0057]** Figure 7 illustrates how, by mutually coupling several form boards 4 according to the invention that are provided with several devices 1, a curved formwork 25 can be obtained, consisting of an inner formwork 26 and an outer formwork 27, in between which concrete 28 can be poured.

**[0058]** One only has to bend the original flat form boards 4 into the desired curved shape by means of the devices 1 by tightening the nuts 19.

**[0059]** The form boards 4 of the inner formwork 26 are hereby transformed into a convex arch, whereas the form boards 4 of the outer formwork 27 are transformed into a concave arch.

**[0060]** It is clear that in this way, any curved shape whatsoever can be obtained, whereby the radius of curvature of the bending may strongly vary.

**[0061]** It is also clear that additional adapters, such as tapered connecting pieces, are no longer required to obtain the desired curved shape.

**[0062]** Figure 8 shows the most preferred embodiment of a device 1 for making a curved formwork.

**[0063]** The device 1 is entirely analogous to the preceding embodiment represented in figures 1 to 7 included.

**[0064]** It should be noted, however, that the central part 2 rests on the form board 4 in this device 1 by making use of only one longitudinal strut 23 provided in the centre of the form board 4.

**[0065]** The strut 23 is made somewhat larger than in the preceding embodiment, such that a good bearing surface is nevertheless obtained.

**[0066]** Another point of difference between the embodiment of figures 1 to 7 and that of figure 8 is that the gussets 5 and especially the sidelong struts 22 are somewhat different.

**[0067]** The sidelong struts 22 on the form board 4 are also provided on the back side 3 of the form board 4.

**[0068]** However, in the case of figure 8, the sidelong struts 22 are moreover provided with a bearing surface 29 extending in the length of the sidelong strut 22 and on which a crosscut side 30 of the form board 4 can rest or can be fixed.

**[0069]** Such sidelong struts 22 are advantageous in

that they effortlessly stay at right angles to the side 3 of the form board 4 while the form board 4 is being bent with the clamping means 17.

**[0070]** Thus, in case of a symmetrical embodiment of the device 1, a form board 4 can be easily bent into a cylindrical segment, whereby the sidelong struts 22 are directed to the centre of the formed arc.

**[0071]** The fact that the sidelong struts 22 remain at right angles to the form board 4 as such is very practical in this case, as several curved form boards 4 can be easily coupled to one another in this way without having to use tapered adapters or the like.

**[0072]** In this manner, it is easy to obtain a cylindrical formwork consisting of several coupled, curved form boards 4.

**[0073]** Further, it is also important that in the embodiment represented in figure 8, the lengths of the different parts of the device 1 are in other proportions to one another than in the embodiment of figures 1 to 7.

**[0074]** The same applies to the distances between the different parts of the device 1.

**[0075]** In particular, for a form board 4 having a width J of 900 mm, which is a standard measurement, the following measurements will be used:

- the distance A between the hinge points of each pair of hinged arms 7 and 8 at the far ends 9 and 10 on the central part 2, as well as between the centre of the central part 2 and the hinge point of a second hinged arm 8 at the far end 10, preferably amounts to 82.5 mm;
- the distance B between the hinge points at the far ends 9 and 11 of each first hinged arm 7 preferably amounts to 161 mm;
- the distance C between the hinge points at the far ends 10 and 12 of every second hinged arm 8 preferably amounts to 260 mm;
- the distance E between the hinge point with which the lever is connected to the gusset and the hinge point at the far end 11 of the first hinged arm 7 with which the latter is coupled to the above-mentioned lever 13, preferably amounts to 232.5 mm;
- the distance F between the hinge points of every pair of hinged arms 7 and 8 at the far ends 11 and 12 on the lever 13 preferably amounts to 163.5 mm;
- the distance G, measured at right angles to the form board 4 between the form board 4 and the hinge with which the lever 13 is connected to the gusset 5, preferably amounts to 148 mm;
- the distance H, measured at right angles to the form board 4 between the form board 4 and the hinge points of the pairs of hinged arms 7 and 8 at their far

ends 9 and 10 on the central part 2 preferably amounts to 180 mm; and,

- the distance I between the hinge points with which the lever 13 is connected to the gusset 5 preferably amounts to 826 mm.

**[0076]** These mutual distances A to H prove to be particularly suitable for the good working order of the device 1 according to the embodiment of figure 8.

**[0077]** According to the invention, the above-mentioned distances should preferably be adjusted for form boards 4 having other dimensions, but always in respect of the same ratios.

**[0078]** A whole lot of other embodiments of a device 1 for making a curved formwork are possible according to the invention.

**[0079]** Thus, it is not excluded to realise the clamping means 17 otherwise, for example in the form of a hydraulic jack or the like.

**[0080]** Further, it is for example also possible to make the longitudinal struts 23 somewhat more flexible, such that they can easily follow the deformation of the curved form board 4.

**[0081]** Many alternatives for the coupling means 5 are possible as well, whereby the shape of the longitudinal struts 22 of the form boards 4 must be taken into account of course.

**[0082]** The invention is by no means limited to the device for making a curved formwork described as an example; on the contrary, such a device can be made in all sorts of variants while still remaining within the scope of the invention.

## Claims

1. Device (1) for making a curved formwork (25), **characterised in that** it consists of a central part (2) that is made to rest against a side (3) of a flat form board (4), and coupling means (5) on either side (6) of the central part (2) with which the device (1) can be coupled to the form board (4), whereby a pair of hinged arms (7,8) is provided on either side (6) of the central part (2) which are hinge-mounted to the central part (2) with one far end (9,10) and which are hinge-mounted to a lever (13) with their other far end (11,12), which lever (13) is hinge-mounted to the coupling means (5) concerned, whereby between the above-mentioned levers (13) or hinged arms (7,8) are provided clamping means (17) to move the hinged arms (7,8) towards each other or away from each other.
2. Device according to claim 1 or 2, **characterised in that** a first hinged arm (7) of the above-mentioned pairs of hinged arms (7,8) is provided with one far end (9) practically at a far end (14) of the central part

(2) and with its other far end (11) practically in the centre (15) of the lever (13).

3. Device according to claim 3, **characterised in that** the other hinged arm (8) of the above-mentioned pairs of hinged arms (7,8) is provided on the central part (2) between the above-mentioned first hinged arms (7) with one far end (10) and practically at the far end (16) of the lever (13) with its other far end (12).
4. Device according to any one of the preceding claims, **characterised in that** there is only one clamping means (17).
5. Device according to any one of the preceding claims, **characterised in that** the clamping means (17) are formed of two threaded rods (18) connected by means of a nut (19), whereby the nut (19) is provided with left-handed internal screw thread on one side and with right-handed internal screw thread on the other side.
6. Device according to any one of the preceding claims, **characterised in that** the coupling means (5) are provided on the side edges (20) of the form board (4).
7. Device according to any one of the preceding claims, **characterised in that** the length (L) of the first hinged arm (7) is shorter than the length (M) of the other hinged arm (8) of each pair of hinged arms (7,8) .
8. Device according to any one of the preceding claims, **characterised in that** the hinged arms (7,8), when in rest, are directed slantingly in relation to the surface of the form board (4) and **in that** the hinged arms (7,8) are directed outward in relation to the central part (2).
9. Device according to any one of the preceding claims, **characterised in that** the device (1) is symmetrical.
10. Device according to any one of the preceding claims, **characterised in that** the levers (13) and the hinged arms (7,8) are situated in a plane at right angles to the form board (4).
11. Device according to any one of the preceding claims, **characterised in that** the measures of the components stand in relation to the width J of the form board 4 in the following way:
  - 82.5/900 for the distance A between the hinge points of every pair of hinged arms 7 and 8 at the far ends 9 and 10 on the central part 2, as well as between the centre of the central part 2 and the hinge point of a second hinged arm 8 at the far end 10;

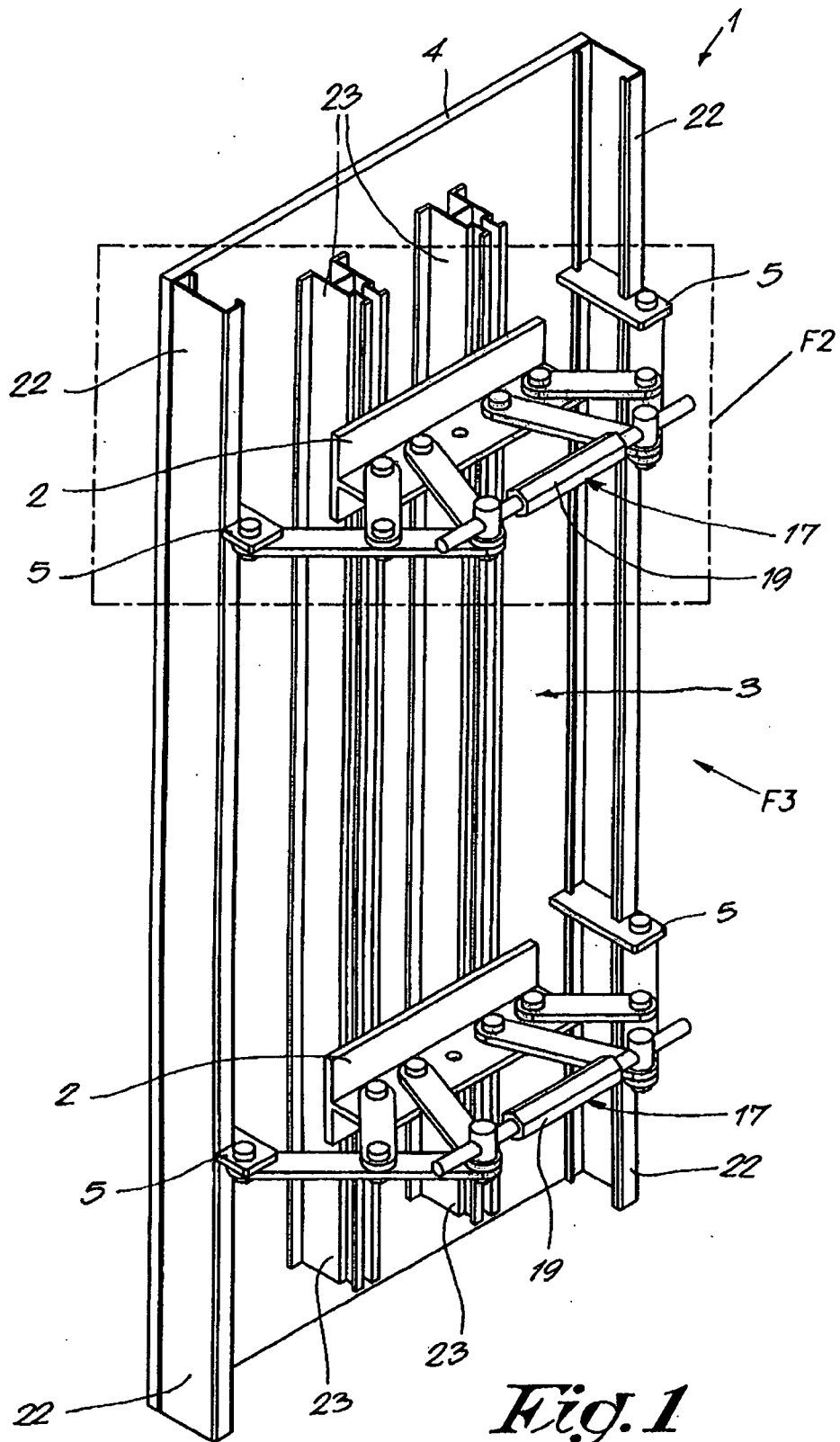
- 161/900 for the distance B between the hinge points at the far ends 9 and 11 of, every first hinged arm 7;
  - 260/900 for the distance C between the hinge points at the far ends 10 and 12 of every second hinged arm 8; 5
  - 232.5/900 for the distance E between the hinge point with which the lever 13 is connected to the gusset 5 and the hinge point at the far end 11 of the first hinged arm 7 with which the latter is coupled to the above-mentioned lever 13; 10
  - 163.5/900 for the distance F between the hinge points of every pair of hinged arms 7 and 8 at the far ends 11 and 12 on the lever 13;
  - 148/900 for the distance G measured at right angles to the form board 4 between the form board 4 and the hinge with which the lever 13 is connected to the gusset 5; 15
  - 180/900 for the distance H measured at right angles to the form board 4 between the form board 4 and the hinge points of the pairs of hinged arms 7 and 8 at their far ends 9 and 10 on the central part 2; 20
  - 826/900 for the distance I between the hinge points with which the lever 13 is connected to the gusset 5. 25
12. Form board, **characterised in that** it comprises at least one device (1) according to any one of the preceding claims. 30
13. Form board according to claim 11, **characterised in that** the central part (2) rests on at least two longitudinal struts (23) provided against the form board (4). 35

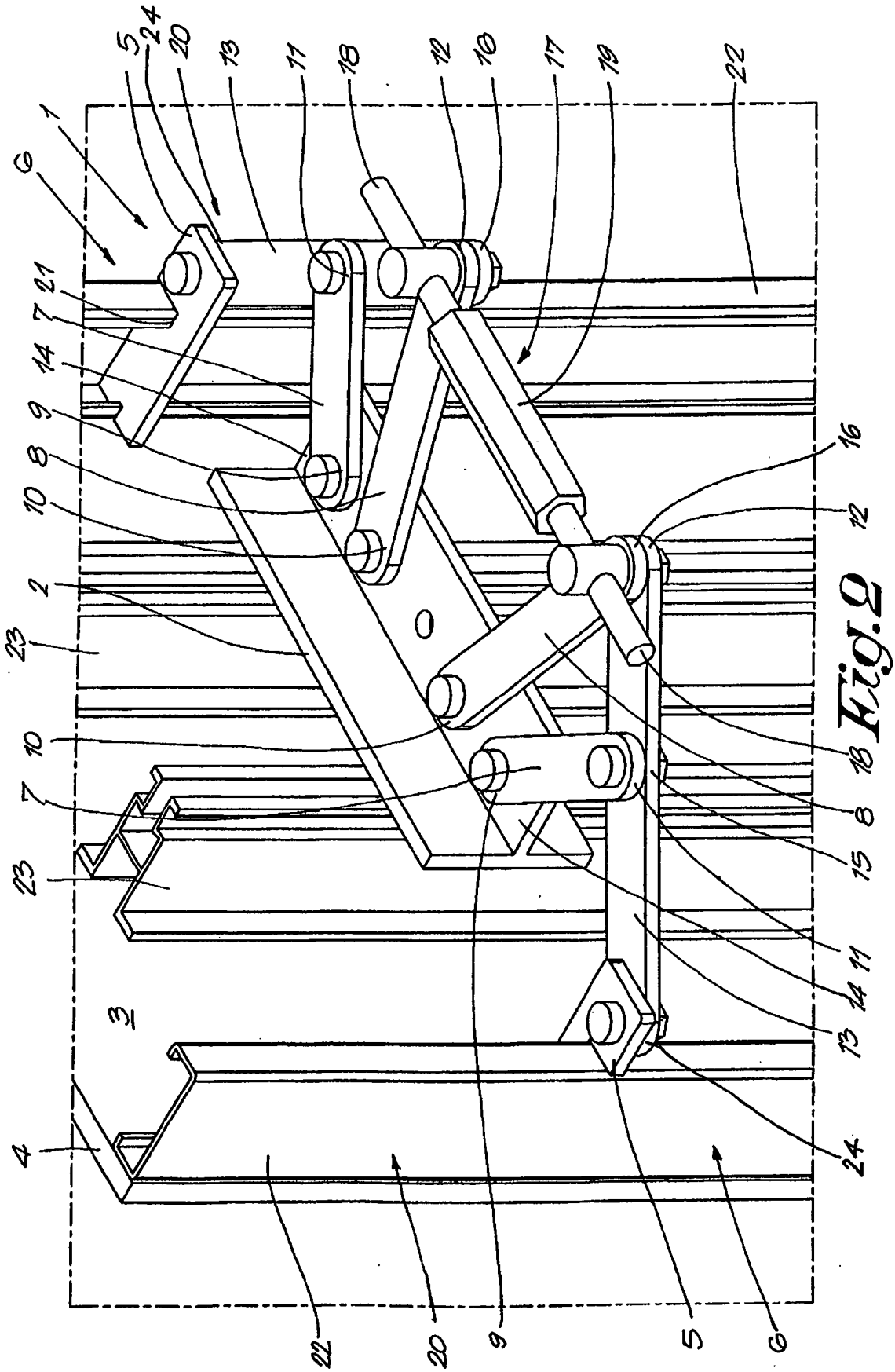
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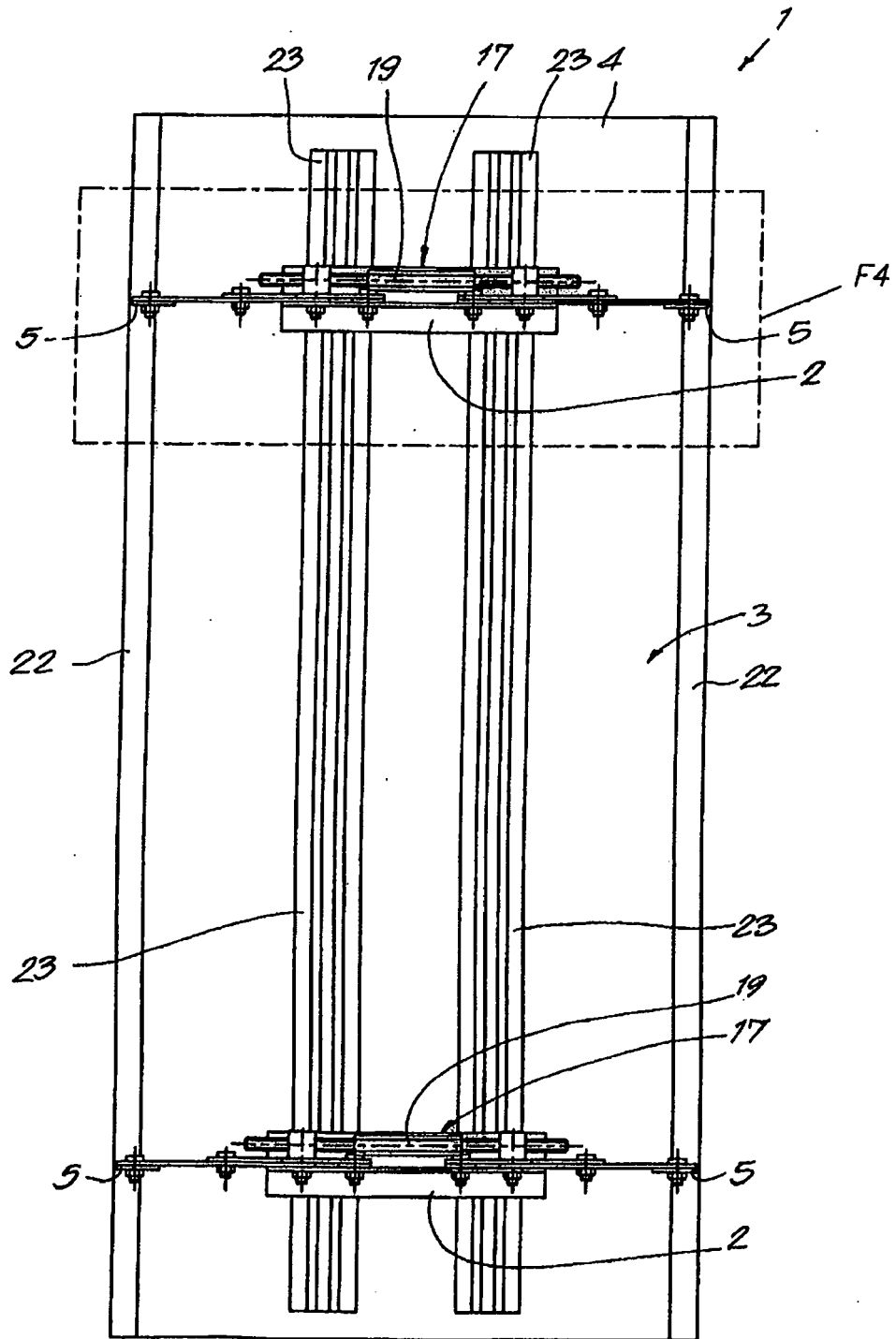
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**Fig. 2**



*Fig.3*

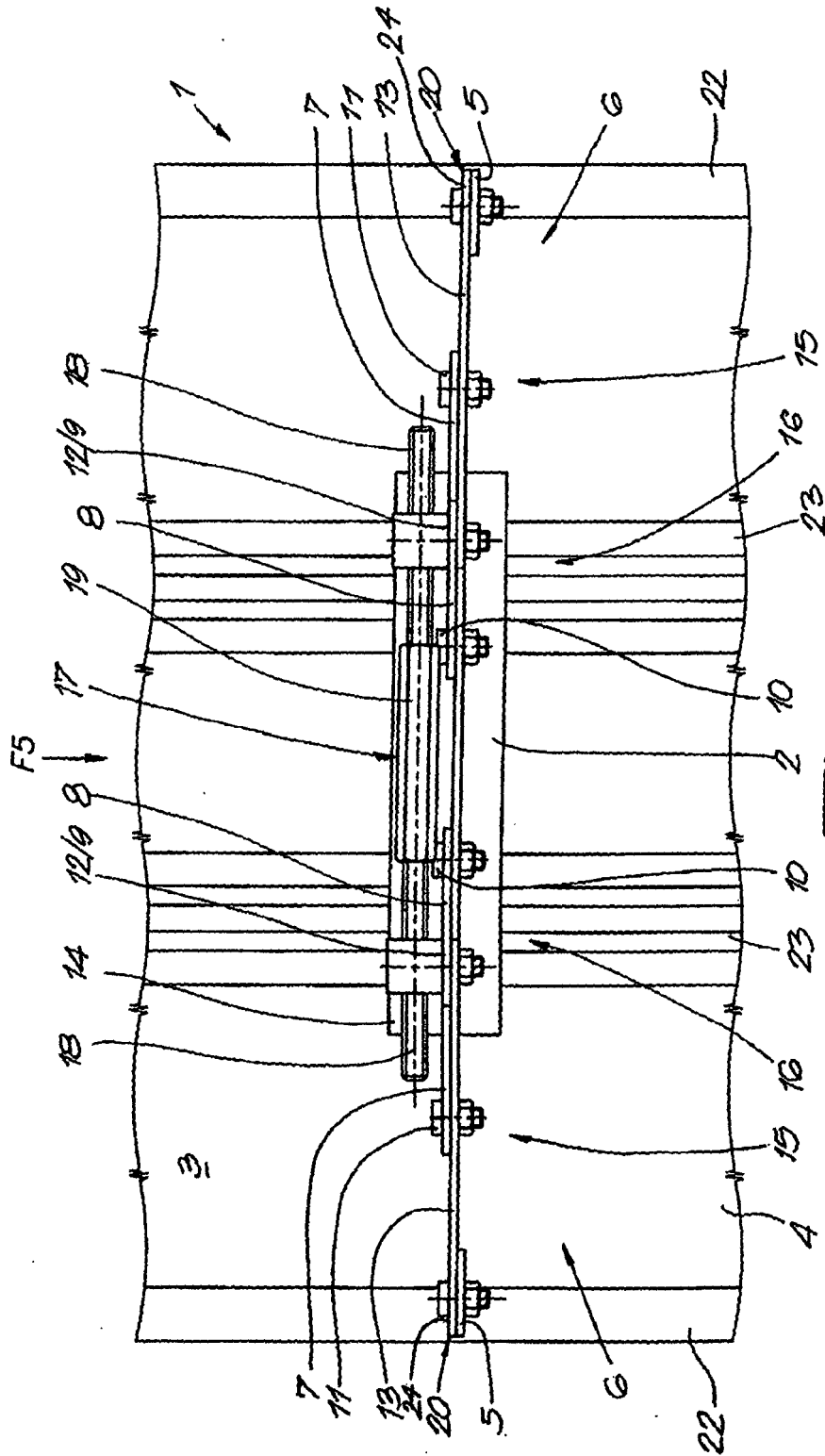


Fig. 4

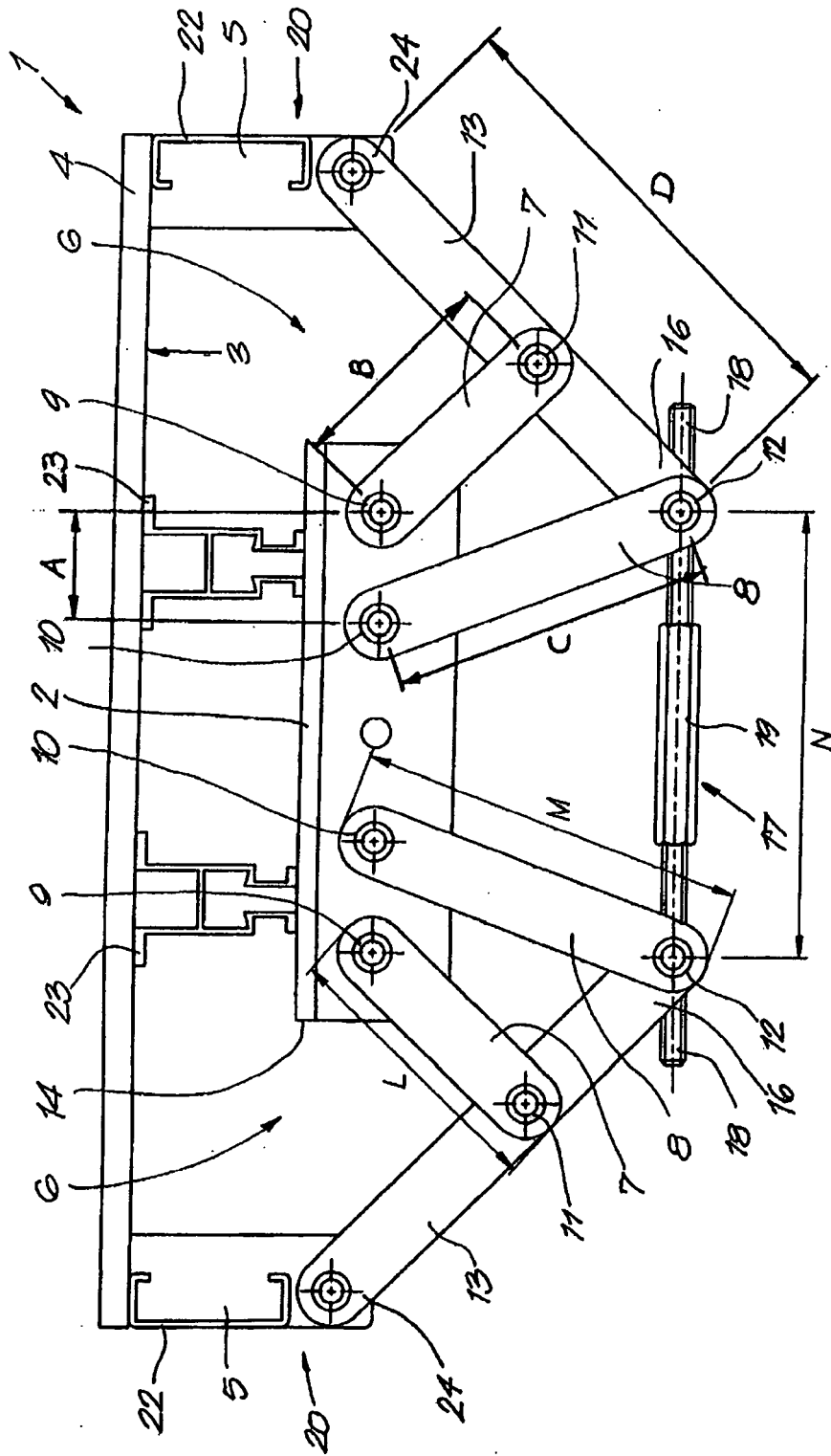


Fig. 5

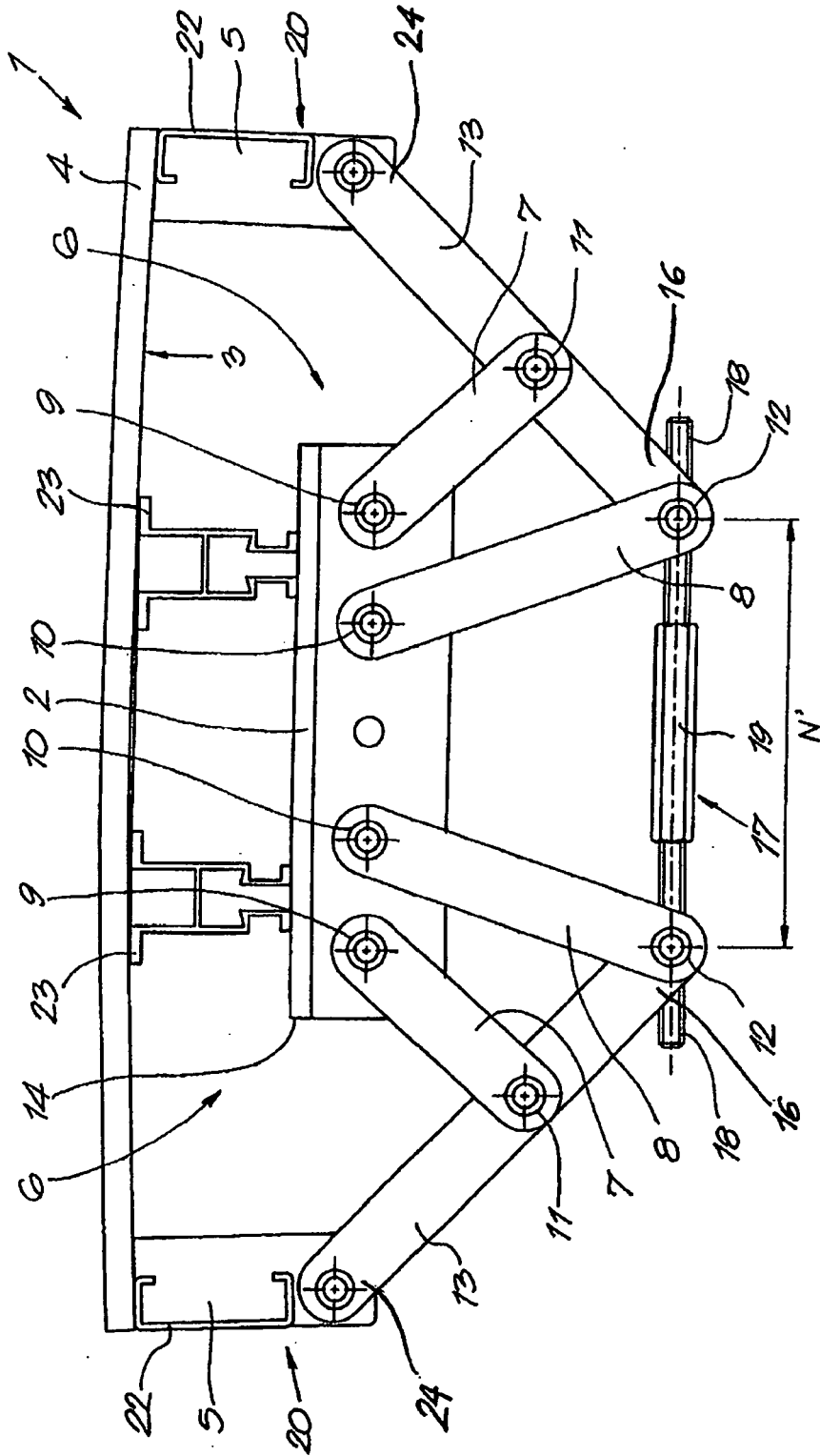


Fig. 1

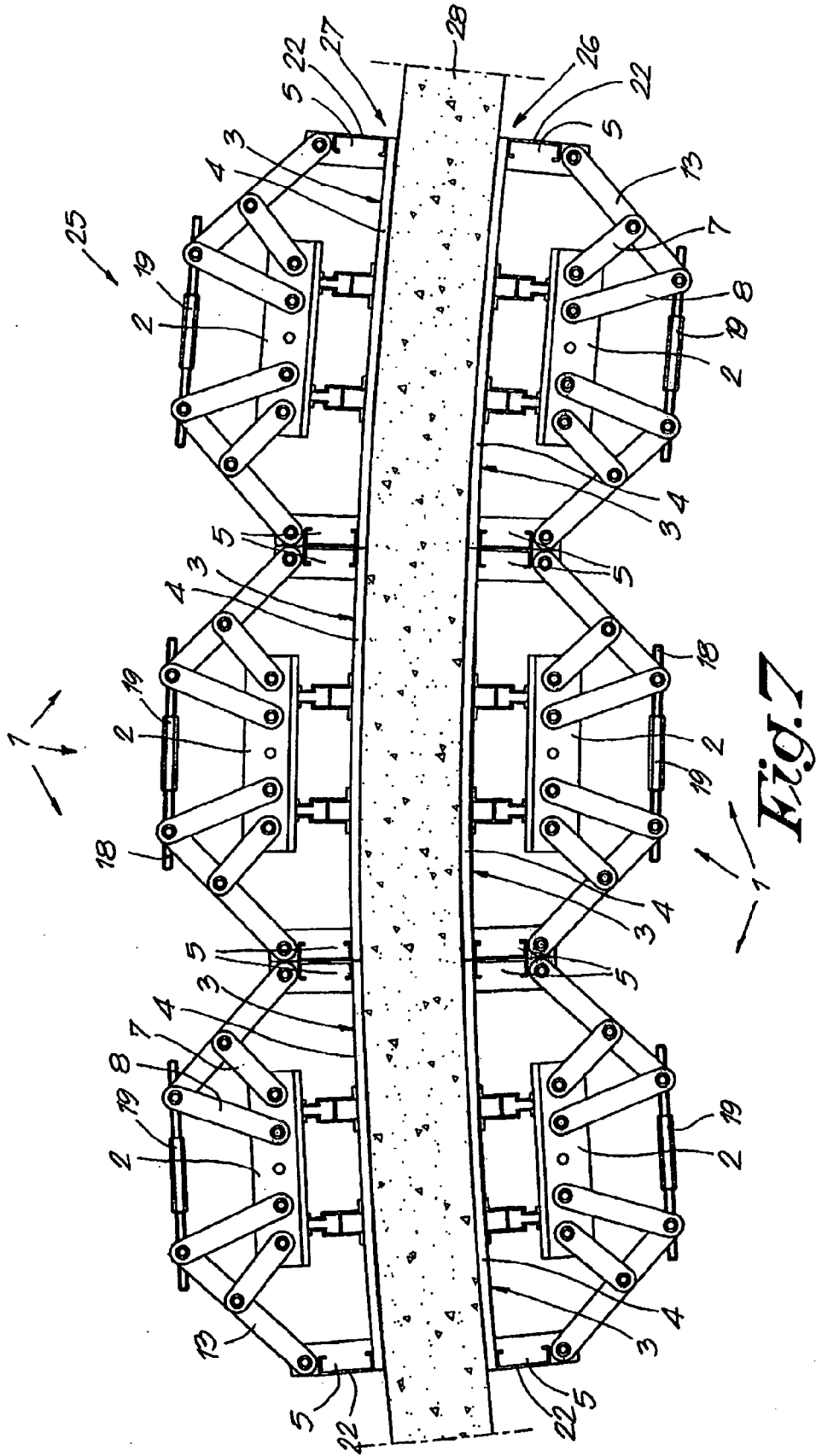


Fig. 7

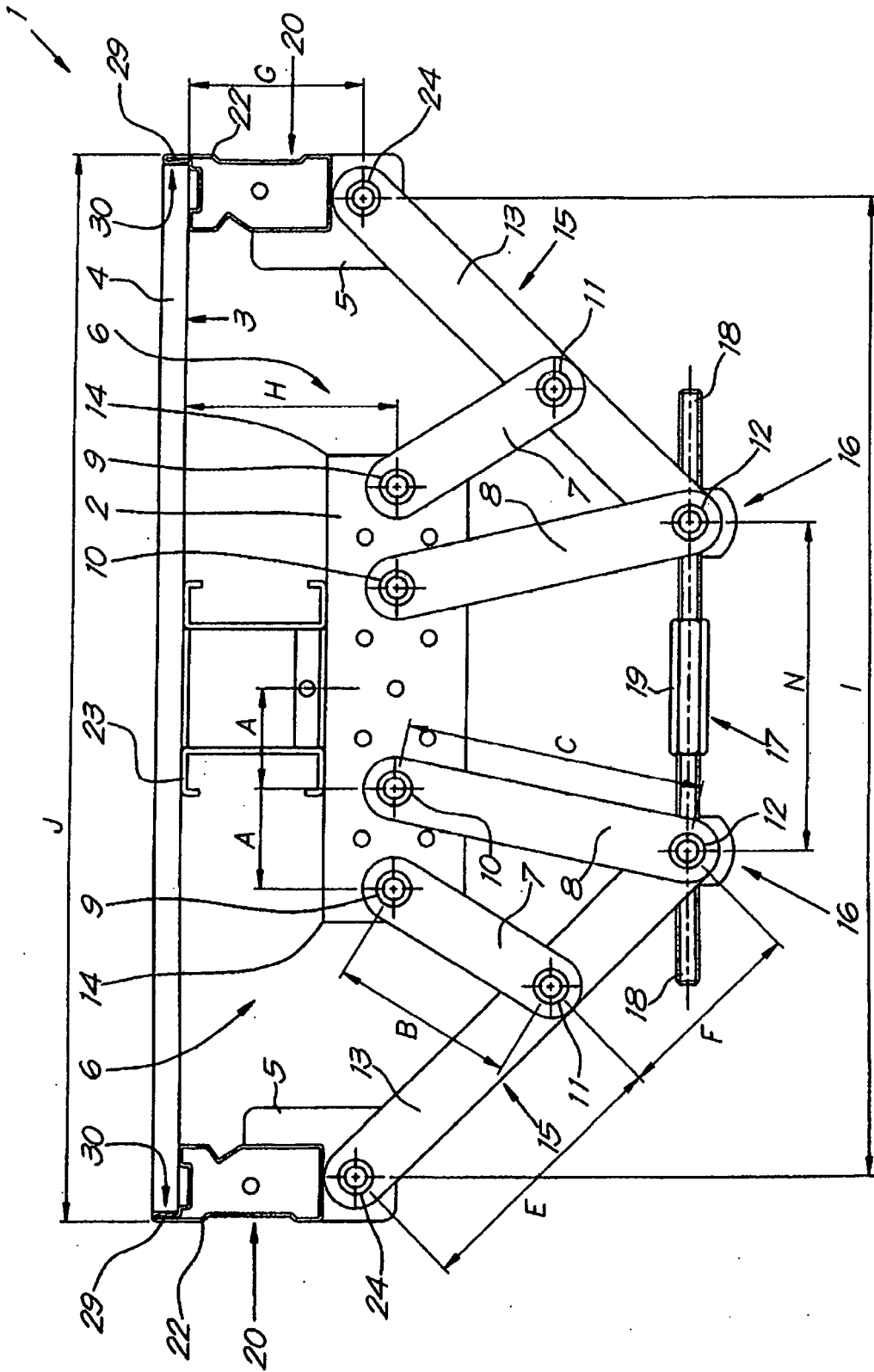


Fig. 8