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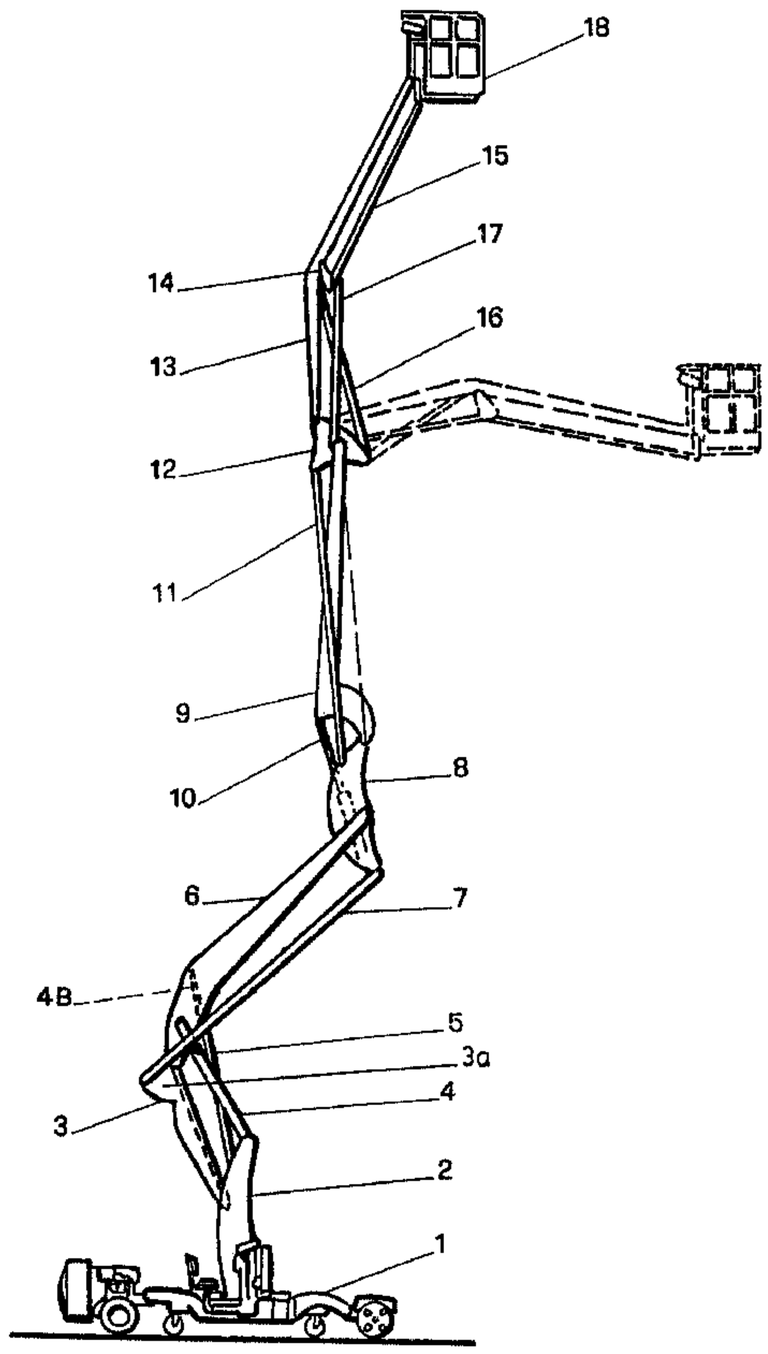
(54) Titre : MACHINE DE LEVAGE ET CAMION AUTOMOTEUR
(54) Title: HOIST MACHINE ASSOCIATED TO A SELF-PROPELLED TRUCK



(57) Abrégé/Abstract:
Hoist machine for aerial platforms (18) associated to self-propelled trucks (1), comprising a system of articulated levers constituting four lifting stages activated by three hydraulic jacks (5, 10, 16); the terminal stage being connected to a platform provided with driving means for the control of the positions and functions and of the truck and of the lifting stages.

ABSTRACT

Hoist machine for aerial platforms (18) associated to self-propelled trucks (1), comprising a system of articulated levers constituting four lifting stages activated by three hydraulic jacks (5, 10, 16); the terminal stage being connected to a platform provided with driving means for the control of the positions and functions and of the truck and of the lifting stages. Figure 3.

Hoist Machine Associated to a Self-Propelled Truck

The Applicant is the owner of Italian patents Nos. 1,154,479, 1,187,983 and 1,217,156.

These patents make known hoist machines which can be mounted onto motor vehicles; they are provided with platforms or nacelles suitable for carrying persons or differing loads and which can be raised to prefixed heights of a maximum limit, for the different machines, varying from 20m to 50m.

These machines comprise three or four phases of acticulated levers which are activated by hydraulic cylinders. They are mounted on platforms which can be rotated more than 360° around a vertical axis and are able to take the terminal nacelle to considerable heights thus allowing various kinds of work to be carried out. They are structurally stable, while the aerial nacelle is able to take up prominent overhang positions with respect to the base of the machine and can, for example, be positioned in space so as to be brought near to points on buildings and aerial electric lines which cannot be reached by other means. Thanks to their characteristic versatility, these machines have found use to a vast extent at an international level. These known machines, mounted on suitable motor vehicles, also when they are completely retracted, i.e. in the rest position with respect to the base platform, together with the support motor vehicle, require a space that is very wide to make them particularly suitable for work to be carried out at considerable heights; they cannot be used in environments defined by walls,

such as, for example, exhibition halls, museums and the like.

The subject of the present invention is a hoist machine mounted on a self-propelled truck, capable of carrying a platform with persons and various materials to a considerable height, 20 m and more.

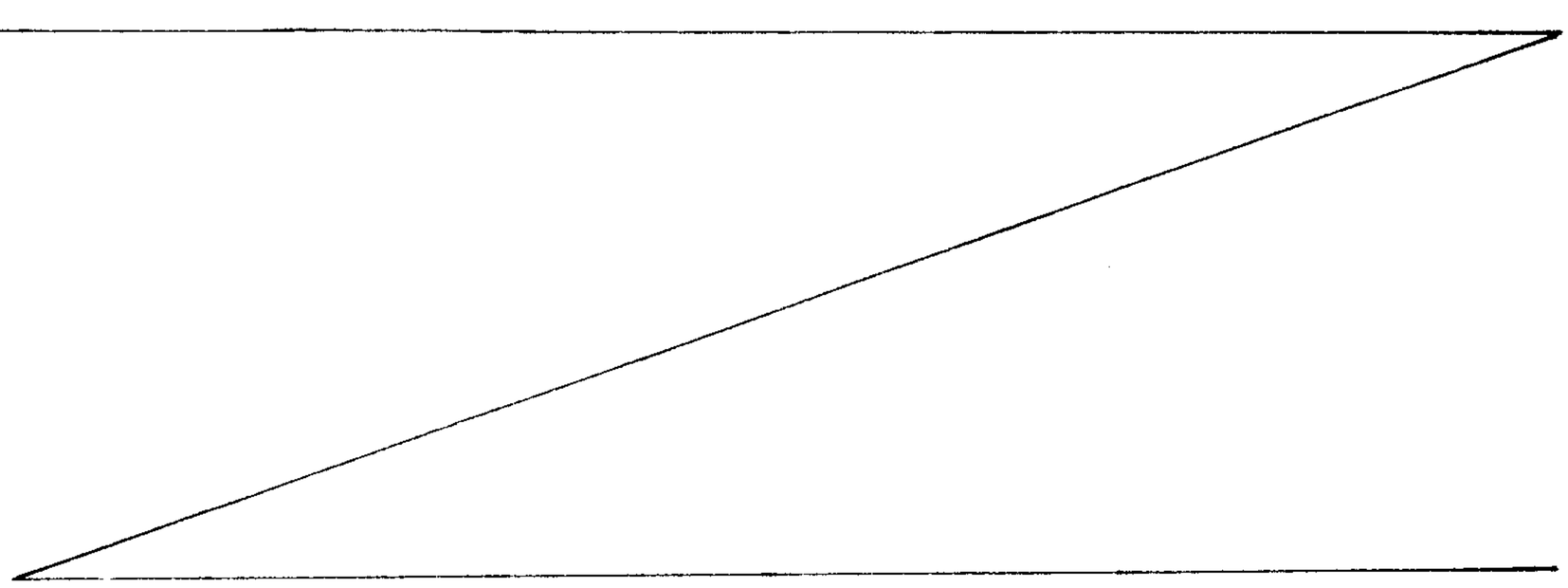
According to the present invention, there is provided a hoist machine for an aerial platform comprising a plurality of mutually articulated pantographic levers forming first, second, third and fourth lifting stages which can be activated in linear development by means of three hydraulic jacks controlled by control panels situated at a base of the machine and on an edge of the platform, characterised by the fact that it is mounted on a platform of a self-propelled truck by means of a turret revolving more than 360° on a bearing disc around a vertical axis, four radial stabilizers in two hinged parts and tyred bearing wheels, which are caused to rotate by a suitable motor, being part of the truck and of interchangeable modular groups; movable wheels being provided for distributing an overall weight when the truck is still and the machine is in action; further characterized by the fact that the aerial platform is hinged to a terminal angled arm which is part of the fourth lifting stage together with bars and a part called balancing element hinged both to said bars and to said arm; further characterised by the fact that the aerial platform is provided with a control panel comprising starting means for the motor and driving means for the truck.

Preferably, the machine comprises three hydraulic cylinders, for lifting stages constituted by parallelograms of levers with a boxed structure and variable geometry, in steel sheet, mutually articulated, shaped in such a way that the parallelograms of some of the levers, when the machine is retracted in the rest position, are contained within the perimeter of other parallelograms of levers so that the machine and its relative truck take up the minimum space possible in height when the relative platform is in the rest position.

Preferably the self-propelled truck also contributes to the containment of space in height when the machine is lowered, said truck comprising a frame supported by wheels with a reduced diameter activated by a suitable **motor; each couple of wheels being associated to a** modular group which can be replaced by another group with different sizes and working characteristics.

The special characteristics of the machine and of the relative truck are made clear in the patent claims. The description that follows refers to the illustrative drawings attached, on a variable scale, some of which represent the machine; others illustrate particulars of same, in elevation, in plane or in axonometric views.

- Figure 1 is a side view of the base truck and of



the machine, with the platform in the position of maximum elevation;

- Figure 2, on a different scale, illustrates the same machine, in the rest position, lowered onto the truck;

- Figure 3 is an axonometric view of the machine, with the platform in a partially raised position;

- Figure 4 is an axonometric view of the machine lowered onto the corresponding truck with radial stabilizers;

- Figure 5 is a plane view of only the truck;

- Figure 6 is a plane view of the aerial platform;

- Figure 7 is a side view of the same platform;

- Figure 8, on a different scale, illustrates a particular of the platform control means;

- Figure 9 is an elevated side view of a turret mounted revolving on a fixed bearing disc with respect to a platform fixed to the truck;

- Figure 10 is a plane top view of the same turret;

- Figure 11, in median vertical section, illustrates a lever that is part of the intermediate stage of the machine, hereunder called a radial lever;

- Figures 12 and 13 are side views of two different structures of one of the four radial arms and stabilizers of the truck;

- Figure 14, respectively -A1-, -B1-, represent on a side view rotated at 90° around its longitudinal axis, one of the branches of a frame, having a parallelepiped structure, articulated to the terminal stage

of the machine;

- in Figure 15, -A2- and -B2- respectively are views, as in the preceding figure, of a frame, hereunder called "crib";

- in Figure 16, -A3- and -B3- respectively, as in Figures 14 and 15, are views of a particular which is hereunder called "counter-crib".

In Figure 1, 1 indicates the truck which supports the entire machine; 2 indicates a turret which revolves on a bearing disc fixed to the truck 1. One end of the following are hinged to this turret: a connecting rod 3, a lever 4 and a jack or hydraulic cylinder 5. The opposite end 4B of the jack 5 is hinged to an angled lifting arm. The other end of the connecting rod 3 is hinged to one end of the arm 6. The other end of the lever 4 is hinged to a point of the arm 6, at an intermediate position, between the hinge of the jack 5 and the hinge of the connecting rod 3. A tie rod 7 presents one end hinged to a section 3a of a lever 3, while the opposite end is hinged to the frame 8, called "crib", illustrated in detail in Figure 15. A radial arm 9 is hinged to said crib 8, said arm being activated by a jack 10, Figures 1, 2, the latter being hinged to the lower end of the crib 8. A tie rod 11 is hinged to the crib 8 and respectively to the counter-crib 12. Another end of the radial arm 9 is also hinged to the counter-crib. One end of an angled lever 13 is also hinged to said counter-crib 12, as illustrated in particular in Figure 14, its opposite end being hinged to a platform 18. A hydraulic jack 16,

hinged to the counter-crib 12 enters into action at an intermediate point of the terminal lever 13.

The control of the horizontal position of the loading base of the platform 18 is carried out using two couples of bars 15, 17; one end of the bars 15 is hinged to the counter-crib 12; one end of the bars 17 is hinged to the platform 18; the opposite ends of both the couples of bars are hinged to a return device 14, Figure 3, which is in turn hinged to the lever 13.

The bearing disc on which the turret 2 is mounted revolving, Figure 5, is fixed to the platform 19 of the truck 1, provided with four radial stabilizing arms 20 having terminal anti-slide means 21.

With reference to Figures 1 through 4, the truck 1, in a plane view, Figure 5, comprises the central frame with the platform 19 which supports revolving the turret 2 and is provided with a propelling unit 22, such as a hydraulic power plant 22, or any other type of motor capable of transmitting rotary movement to the front and guiding bearing wheels 23 and the back bearing wheels 24. Reference number 25 indicatess two couples of pivoting wheels associated to front hinged balancing means 26, 27, 28, with three degrees of freedom, back balancing means 26a, 27a with two degrees of freedom, for the best possible distribution of the weight of the machine, particularly when the truck is working on wood floors, or floors in any other deteriorative material.

The propelling unit 22 and the relative driving unit, comprising the wheels 23, are modular and easily

interchangeable, according to the type and conditions of the ground to be covered by the truck 1.

Said truck comprises: the platform 19, the modular groups 23, 24 and 25 and the radial arms 20, hinged in 29, with terminal anti-slide elements 21.

As shown in detail in Figures 12 and 13, the radial arms 20 are hinged, in 29, at projections 30 fixed to the platform 19. Each arm 20 is associated to a jack 31. As illustrated in Figure 12, the hydraulic cylinder 31 enters into action between the fixed part 30 and the free end of the corresponding arm 20 which can take up a lowered position, illustrated by continuous lines, or a rest position, illustrated by broken lines.

In the variant according to Figure 13, the hinged arm 20 has a different structure, while the jack 31 is applied to the end of the arm 20 near to its joint. With this second solution, when the arm 20 is in the rest position, the jack 31 is housed in the boxed body of the part 30.

The structural differences and the sizes of the radial arms 20, as shown in Figures 12 and 13, are chosen according to the sizes of the truck 1 which, if it is large sized, is provided with radial arms according to Figure 13; if the sizes of the truck are limited, it is provided with radial arms as shown in Figure 12.

The couples of guiding wheels 23 and back wheels 24 have a steering angle of 90°, in both directions, controlled from the driving position 32, Figure 5,

fitted either to the truck or to the platform 18, Figures 3, 7, 8.

Preferably, the platform is provided with the driving position, though it should not be excluded that the machine be provided with two driving positions, on the truck and on the platform.

As illustrated in figure 2, when the machine is completely lowered onto the truck, the loading base of the platform 18 reaches a minimum height with respect to ground level, i.e. the height of the frame of the truck 1. When the machine is lowered, the driving position 33 of the platform 18 is provided with a steering wheel with a steering column 34, Figures 6, 7 and 8. The end of the steering column 34 is fixed to a pinion 35 which engages into a corresponding seat 36, Figures 2, 5 and 8. The seat 36 comprises a coupling socket with a tapered edge connected to a mechanical transmission system which, only when the pinion 35 is engaged in the corresponding seat 36, allows the stabilizer arms 20 to return to the rest position and allows for the truck 1 to be transferred, the driving wheels of said truck being controlled by the relative steering wheel.

As illustrated in Figure 8, a spring 37 co-operates with the steering column 34, said spring pushing by reaction to compression the end 35 into the corresponding seat 36; a universal joint 38 joins the parts 34 and 39 of the steering column. The spring 40 maintains the coaxial status between the parts 34 and 39 when the end 35 is released from the seat 36,

while still allowing the same end 35 to complete any transverse movements that may be necessary for engagement in the seat 36, provided with an entrance with a frustum tapered profile.

The working of the machine is described hereinbelow:

When the machine is in a completely lowered position on the truck 1, Figures 2 and 4, the stabilizers 20 are activated. Subsequently, the hydraulic jack 5 is set into action, hinged in 41 to the base of the revolving turret 2, crossing its space 42, Figure 10. The opposite end of the same jack, hinged in 43, with respect to the lifting arm 6, provides by this means the thrust to the crib 8. These parts comprise the mechanism of the first two stages of lifting.

The activation of a second hydraulic jack 10, Figures 1, 3, hinged in 9a, sets into action the radial lever 9 which gradually passes from the almost horizontal rest position to the almost vertical position of Figures 1 and 3. The tie rod constituted by the parallelogram 11 cooperates with the lever 9, hinged to the part 12, called "counter-crib", which makes up the third lifting stage, connected to the fourth stage which comprises the end angled lever 13, shown in detail in Figure 14, to the end of which is hinged the frame of the platform 18.

The bars 15 and 17 cooperate with the lever 13, said bars being hinged to an intermediate return part 14, called "balancing element" which constitutes the articulation between the lever 13 and the bars 15, 17.

The use of the balancing element 14 allows for the particular angled profile of the lever 13 which limits the space taken up by same and allows the turret 2 to penetrate into the quadrilateral of the last lifting stage, connected to the platform 18, Figure 4, thereby allowing the loading base of the platform itself to reach the minimum height of the frame of the truck 1, with evident advantages for the load to be made.

The advantages that derive from the overall mechanical structure of the machine and from the quadrilateral geometrical shape of the levers that make up the lifting stages, can be summarised as follows:

- modular support truck which can be fitted with either hydraulic or electric motors, or internal combustion motors;
- minimum space necessary, particularly in height, when the machine is lowered onto the truck 1, thanks to the interpenetration of the various parallelograms which make up the group of articulated levers;
- minimum space required, on the horizontal plane, when the machine is fully extended in height, thereby making it possible to bring the aerial platform 18 into very limited transversal spaces;
- maximum lightness thanks to the tubular structure of the parts which make up the various lifting stages of the machine;
- possibility to use the machine in both closed and open environments;
- considerable weight of the load to be lifted

such as, for example, 300 Kg up to 20 mt of height;

- minimum oscillation of the overall hinged structure even at maximum elevation, contained by the structure of the machine which, thanks to the minimum space taken up transversally, offers a better performance than the well known telescopic lifting machines;

- finally, the machine according to the invention, without the truck, but provided with a base bearing plate, can be mounted on any kind of suitable motor vehicle.

WHAT IS CLAIMED IS:

1. Hoist machine for an aerial platform (18) comprising a plurality of mutually articulated pantographic levers forming first, second, third and fourth lifting stages which can be activated in linear development by means of three hydraulic jacks (5, 10, 16) controlled by control panels (32) situated at a base of the machine and on an edge of the platform (18), characterised by the fact that it is mounted on a platform of a self-propelled truck (1) by means of a turret (2) revolving more than 360° on a bearing disc around a vertical axis, four radial stabilizers in two hinged parts (20, 30) and tyred bearing wheels (23, 24), which are caused to rotate by a suitable motor (22), being part of the truck (1) and of interchangeable modular groups (27); movable wheels (25) being provided for distributing an overall weight when the truck is still and the machine is in action; further characterized by the fact that the aerial platform (18) is hinged to a terminal angled arm (15) which is part of the fourth lifting stage together with bars (15, 17) and a part (14) called balancing element hinged both to said bars and to said arm; further characterised by the fact that the aerial platform (18) is provided with a control panel comprising starting means for the motor (22) and driving means (34, 35, 36) for the truck.

2. Hoist machine according to claim 1, characterised by the fact that said driving means comprise a steering column (34) with a terminal pinion (35) which, when the machine lowered onto the truck, engages into a corresponding seat

(36) thereby allowing the stabilizers (20, 30) to be deactivated and the motor (22) to be started so as to move the machine.

3. Hoist machine according to claim 2, characterised by the fact that the steering column (34) is subjected to a thrust of an elastic means (37) while a lower end (35) thereof is hinged to an upper part of the steering column (34) by means of a universal joint (38); a spring (40) tending to maintain said joint in a coaxial position with the upper part of the steering column (34) and allows for an engagement of an end of said column into a corresponding seat (36) provided on an edge thereof with a flared frustum tapered entrance.

4. Hoist machine according to claim 1, characterised by the fact that the mutually articulated pantographic levers which make up a mechanical unit for a movement of the platform (18) are structurally made up of parallelograms of tubular elements and are sized in such a way that when the machine is lowered onto the truck (1) a perimeter of some parallelograms contains a perimeter of others, so as to reduce a space required by the machine to a minimum in height when the machine is in a rest position, to a height of the turret (2).

5. A hoist machine for an aerial platform according to claim 1, wherein said stages are in the form of parallelograms of differing sizes and at least one of said stages is disposed within a perimeter of another of said stages when said stages are retracted for reducing height of said hoist machine when said aerial platform is in a

rest position, the aerial platform having a bottom which is at the height of said truck when said stages are retracted.

6. Hoist machine according to claim 1, characterised by the fact that the radial stabilizers of the truck (1) comprise a first part (30) fixed to the platform (19) of the truck and a second part (20) hinged in to the first part; a hydraulic windlass (31) with ends hinged to the mutually articulated pantographic levers which can be controlled in axial alignment, in work position; the second part which is a terminal part (20) being capable of bending at an elbow with respect to the first part which is a fixed part (30) when the machine is in a rest position.

7. Hoist machine according to claim 6, characterized by the fact that the hydraulic windlass (31) of each radial stabilizer is contained in a boxed part (30) fixed to the platform (10) of the truck.

FIG.1

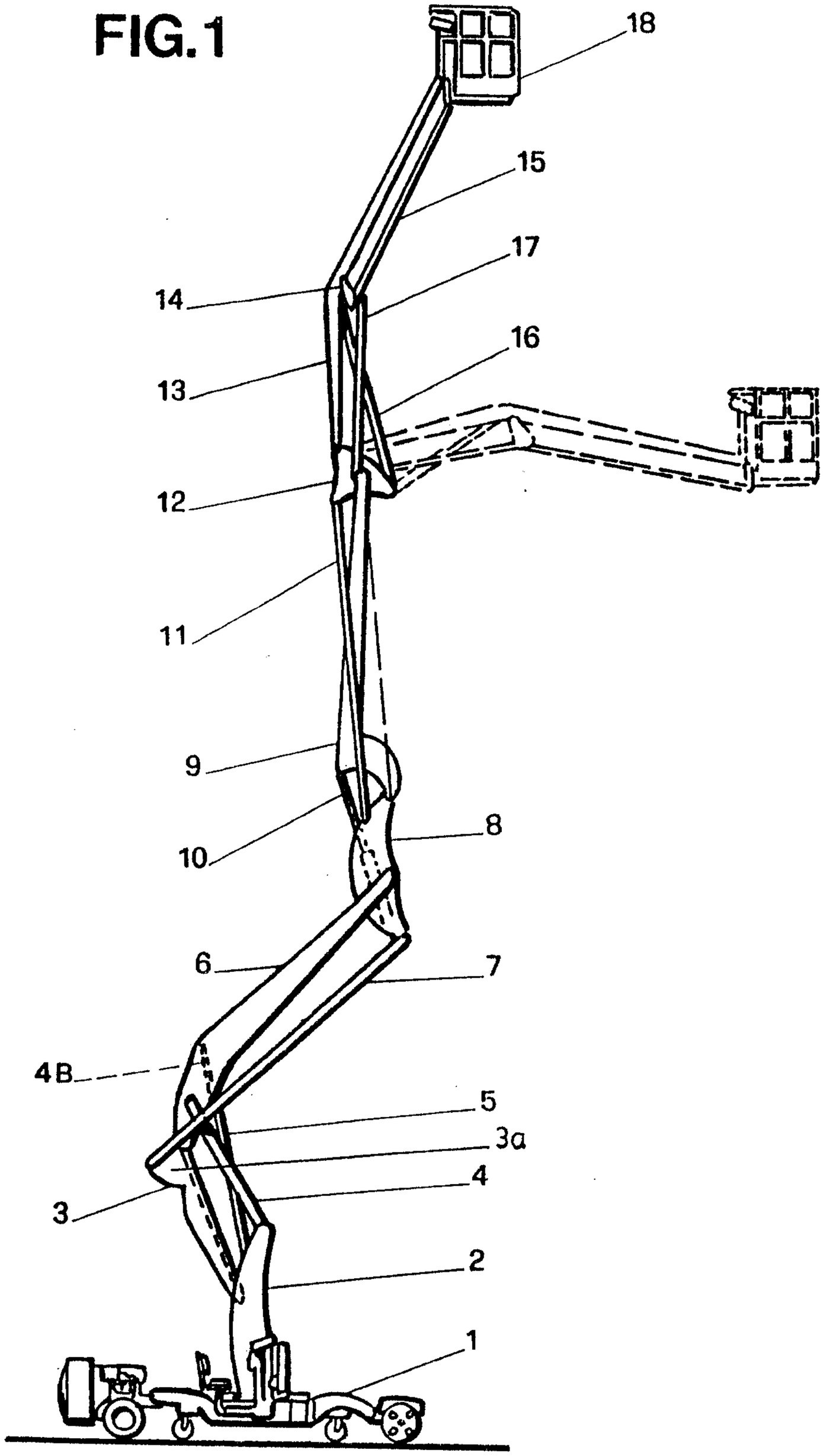
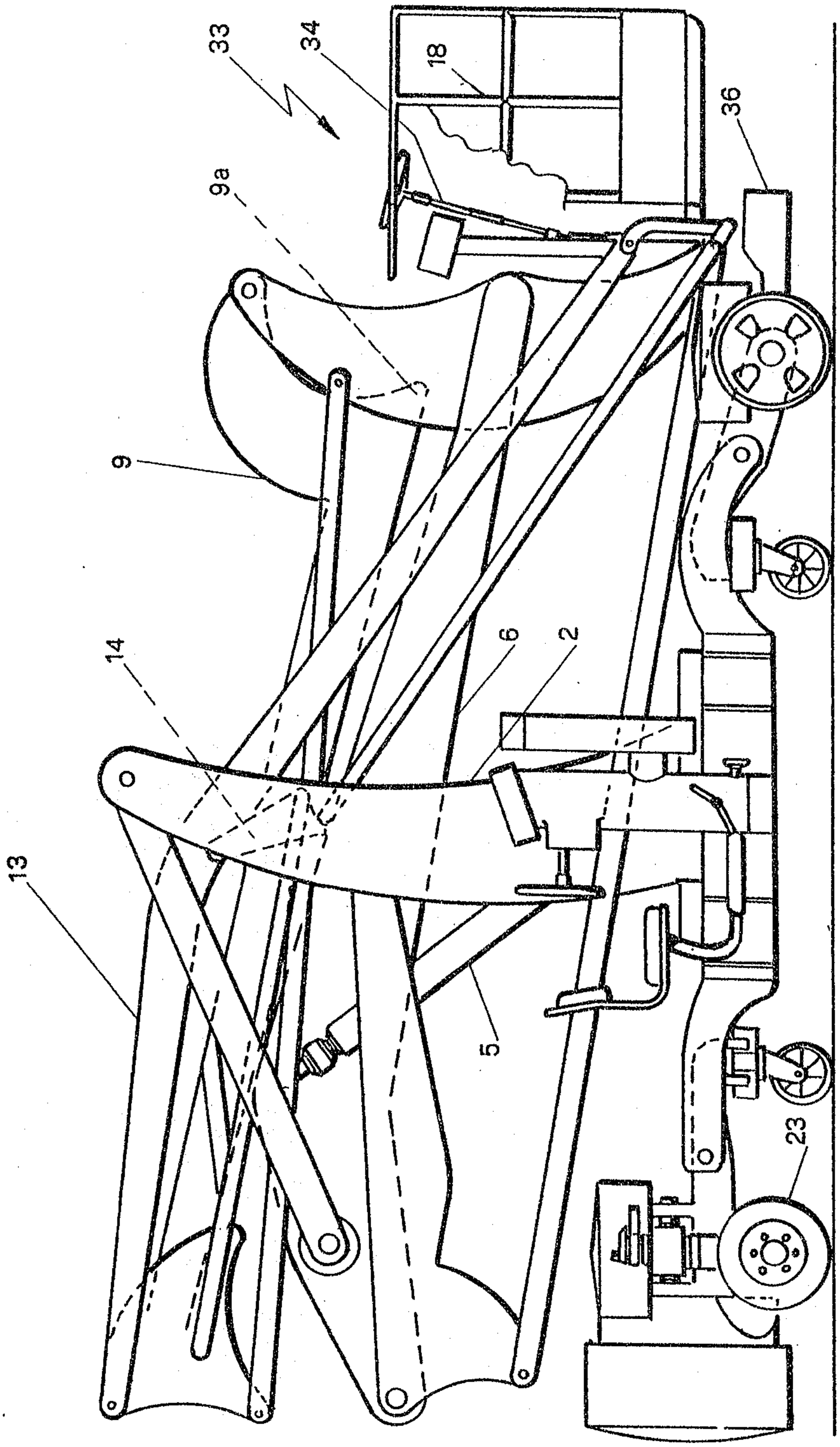


FIG.2



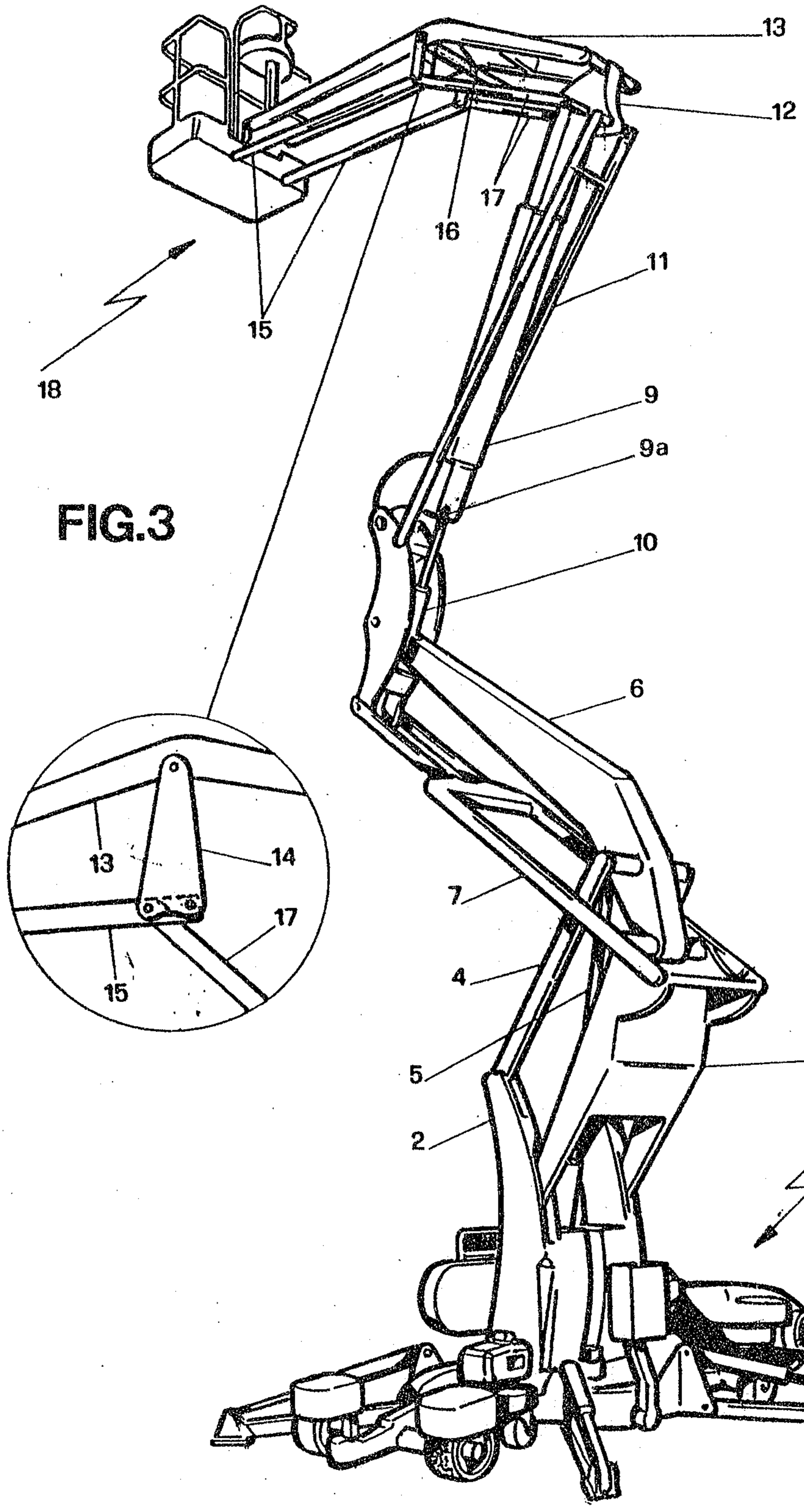
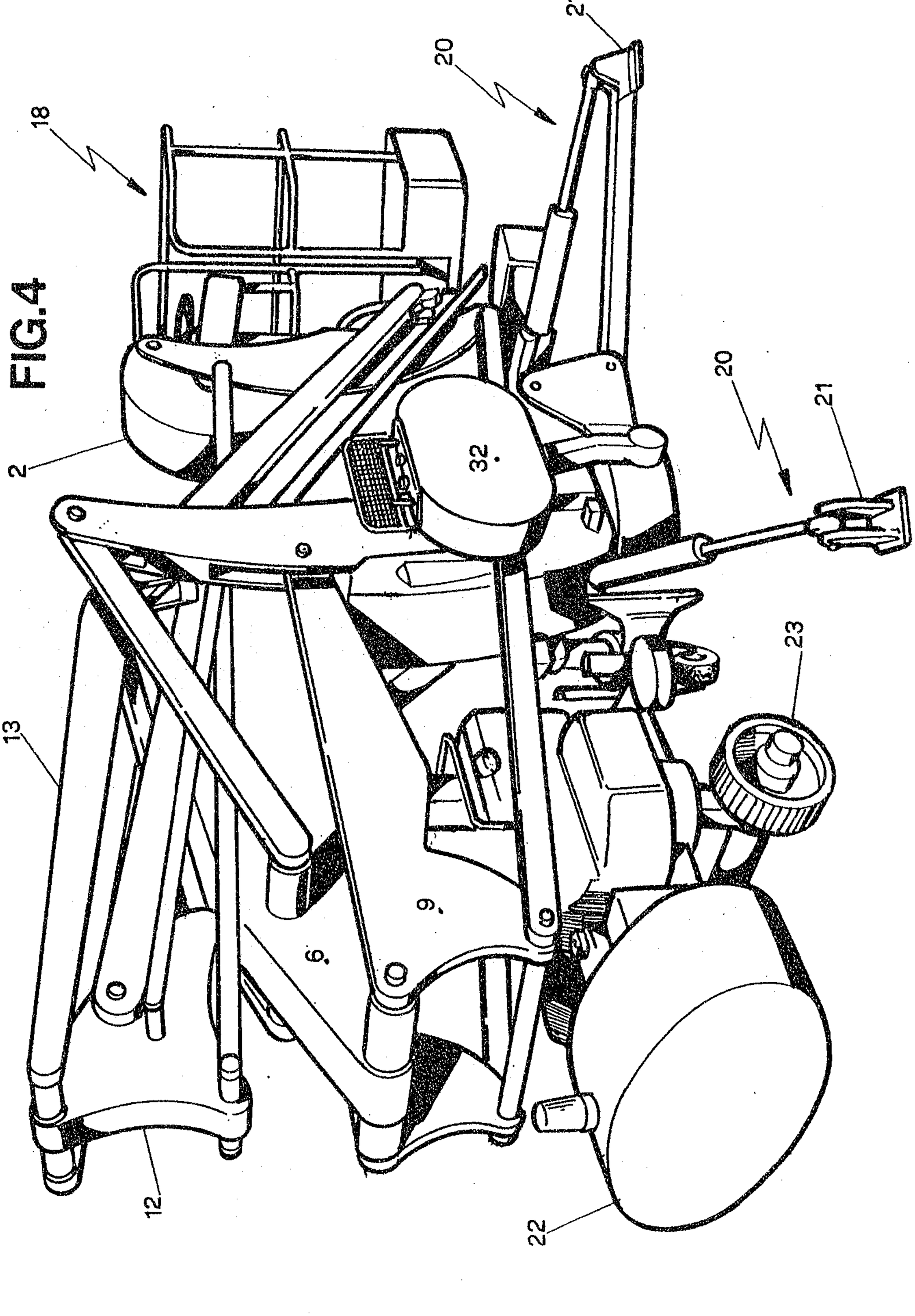


FIG.3

FIG.4



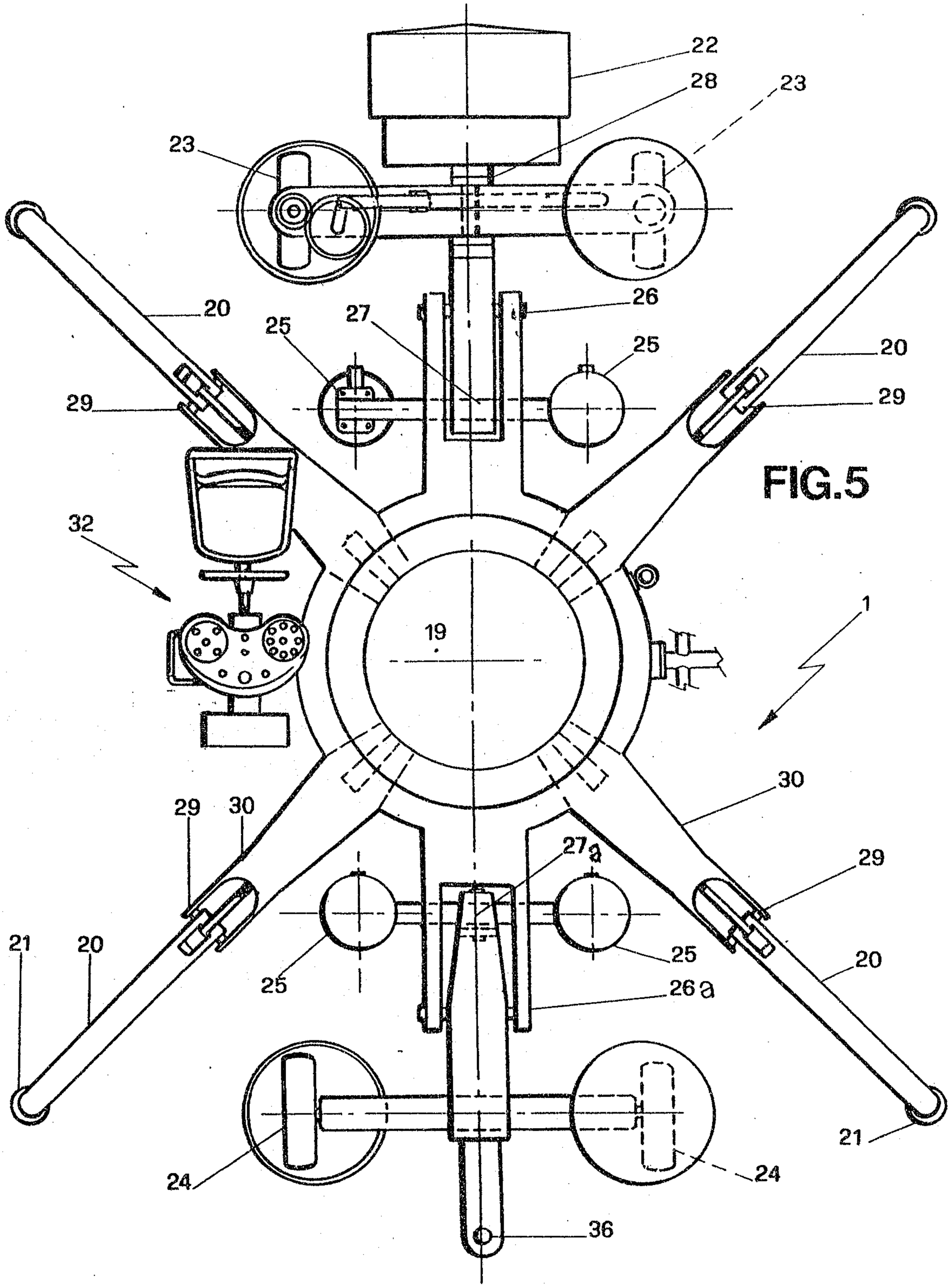

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FIG.5

FIG.8

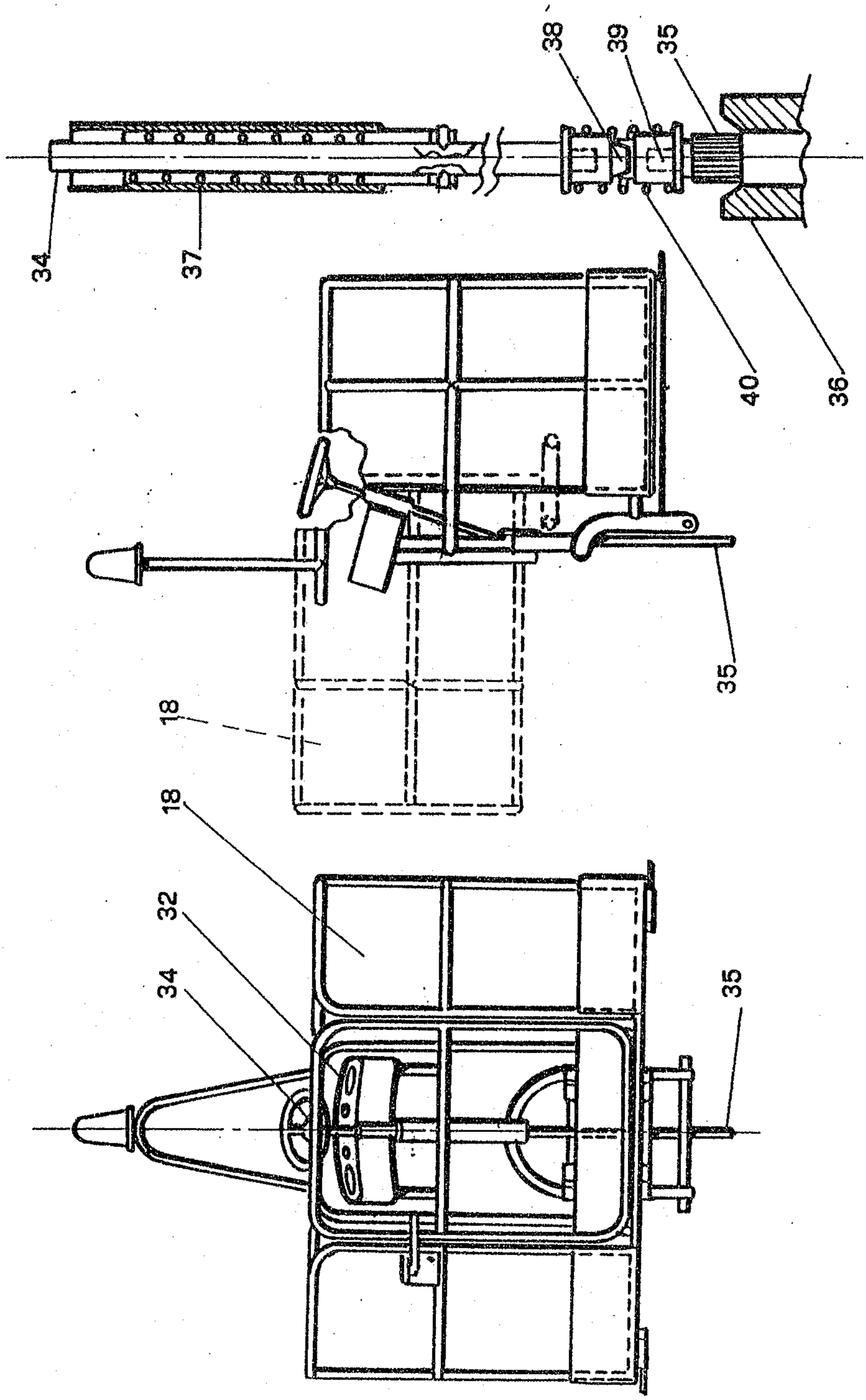


FIG.7

FIG.6

FIG.9

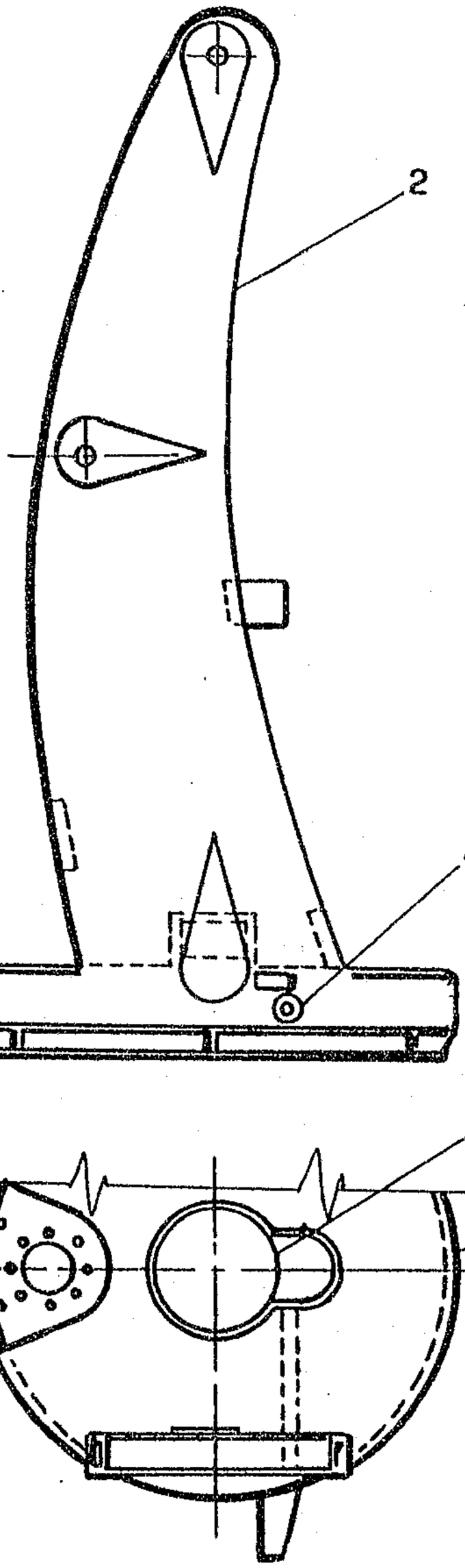


FIG.10

FIG.11

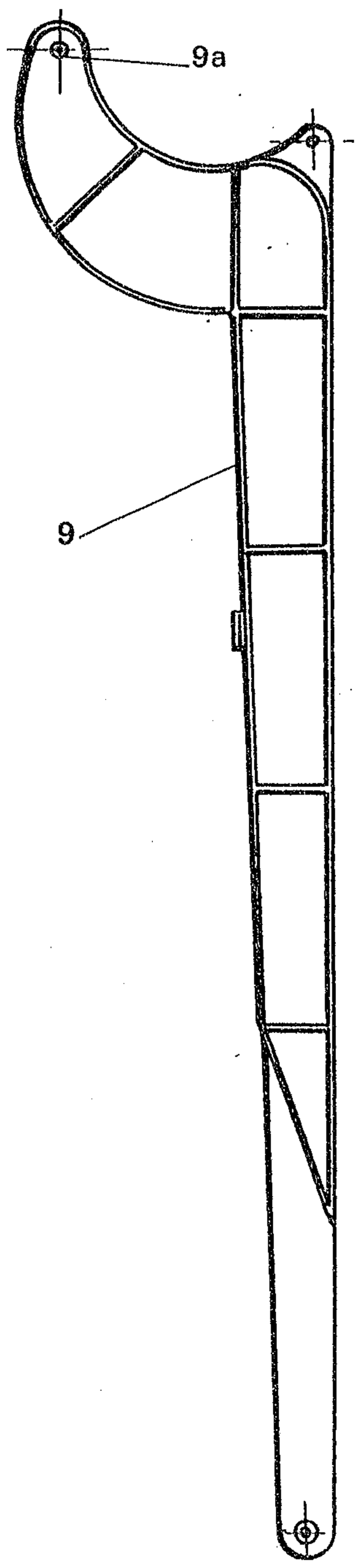


FIG.12

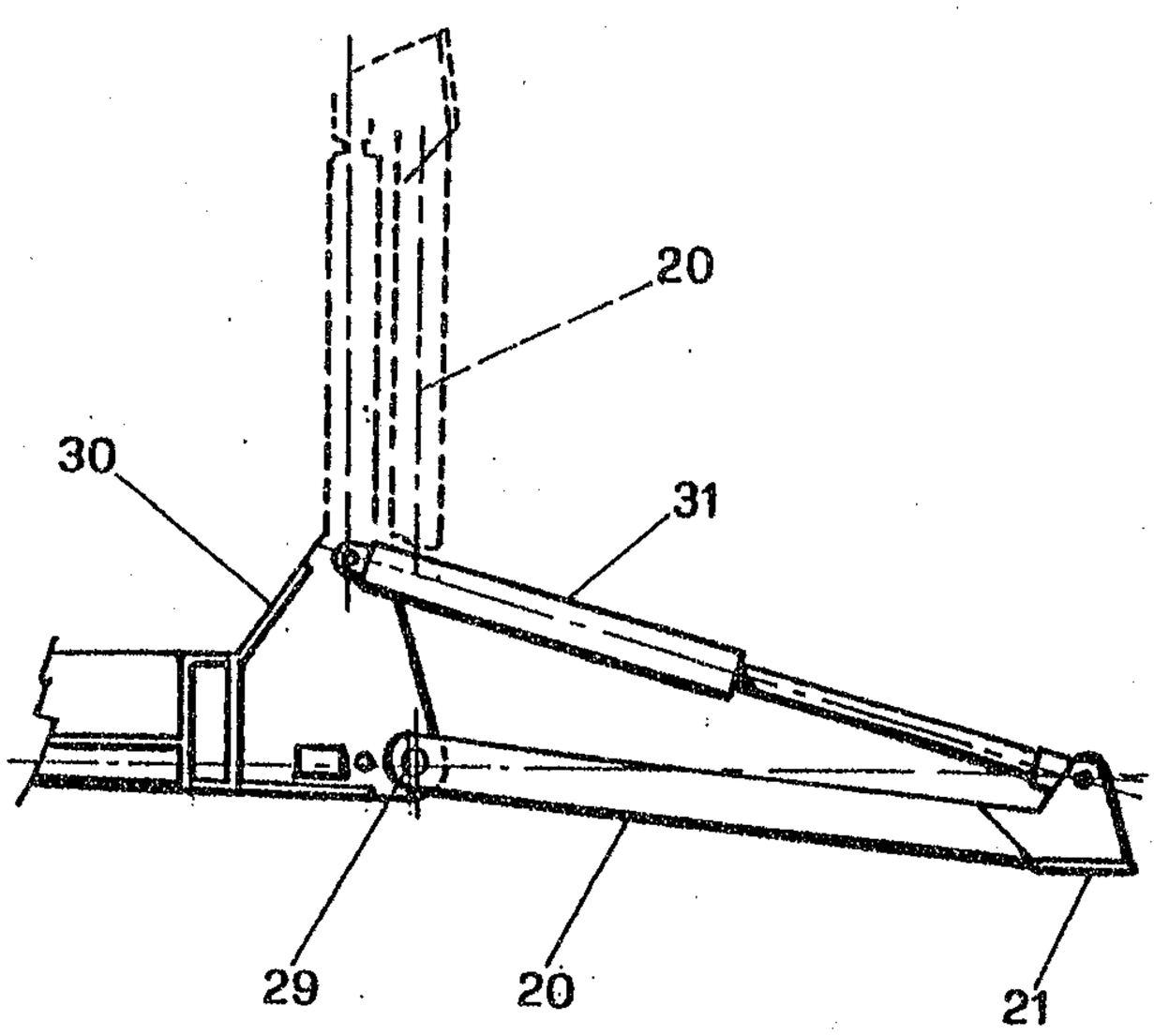


FIG.13

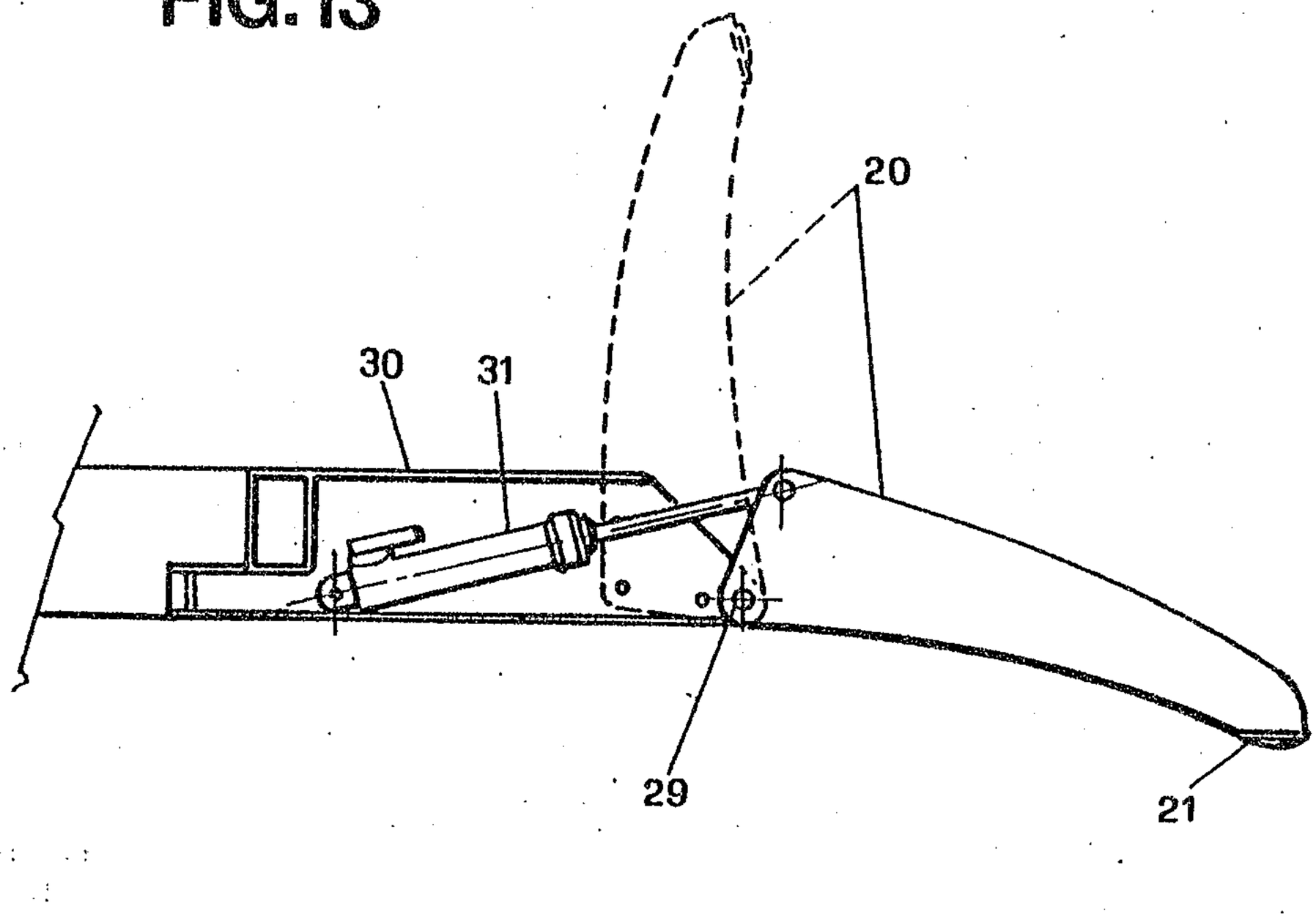


FIG.14

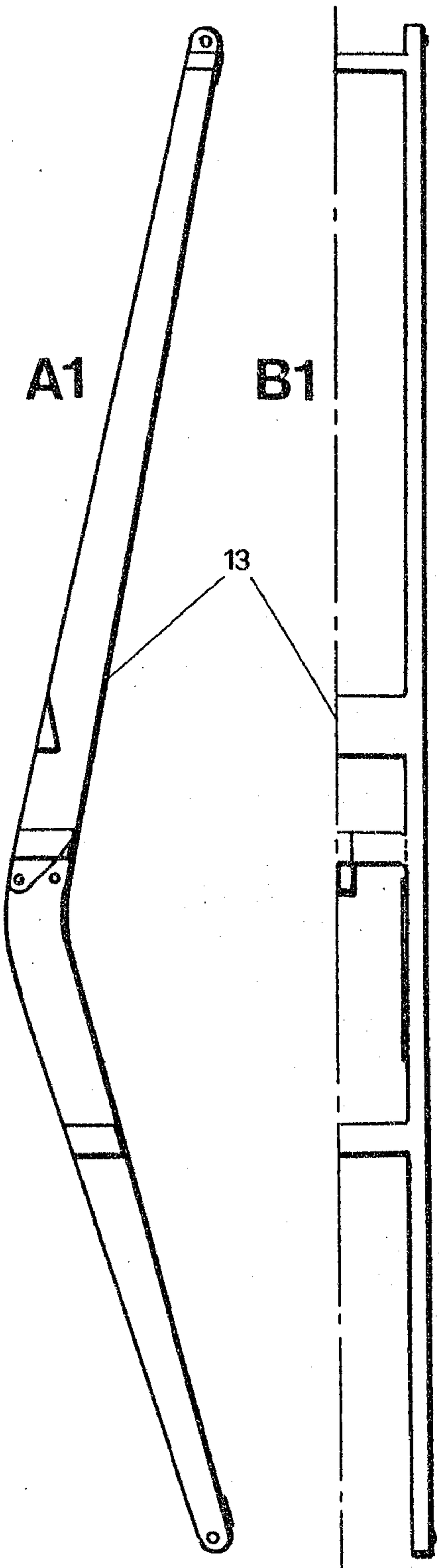


FIG.15

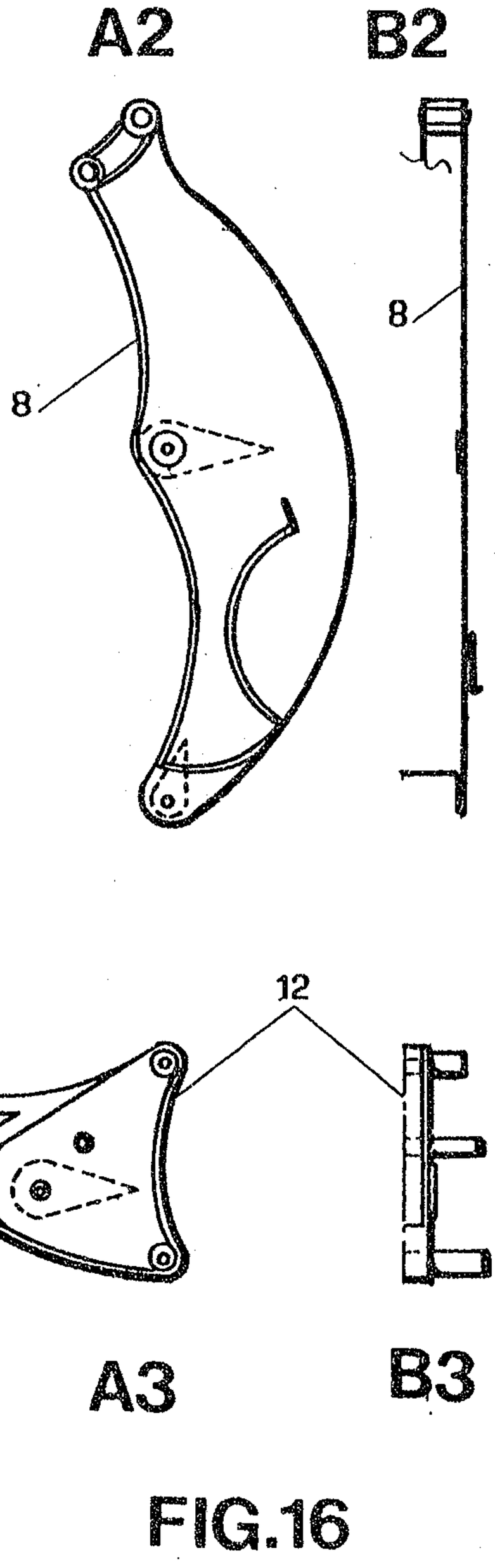
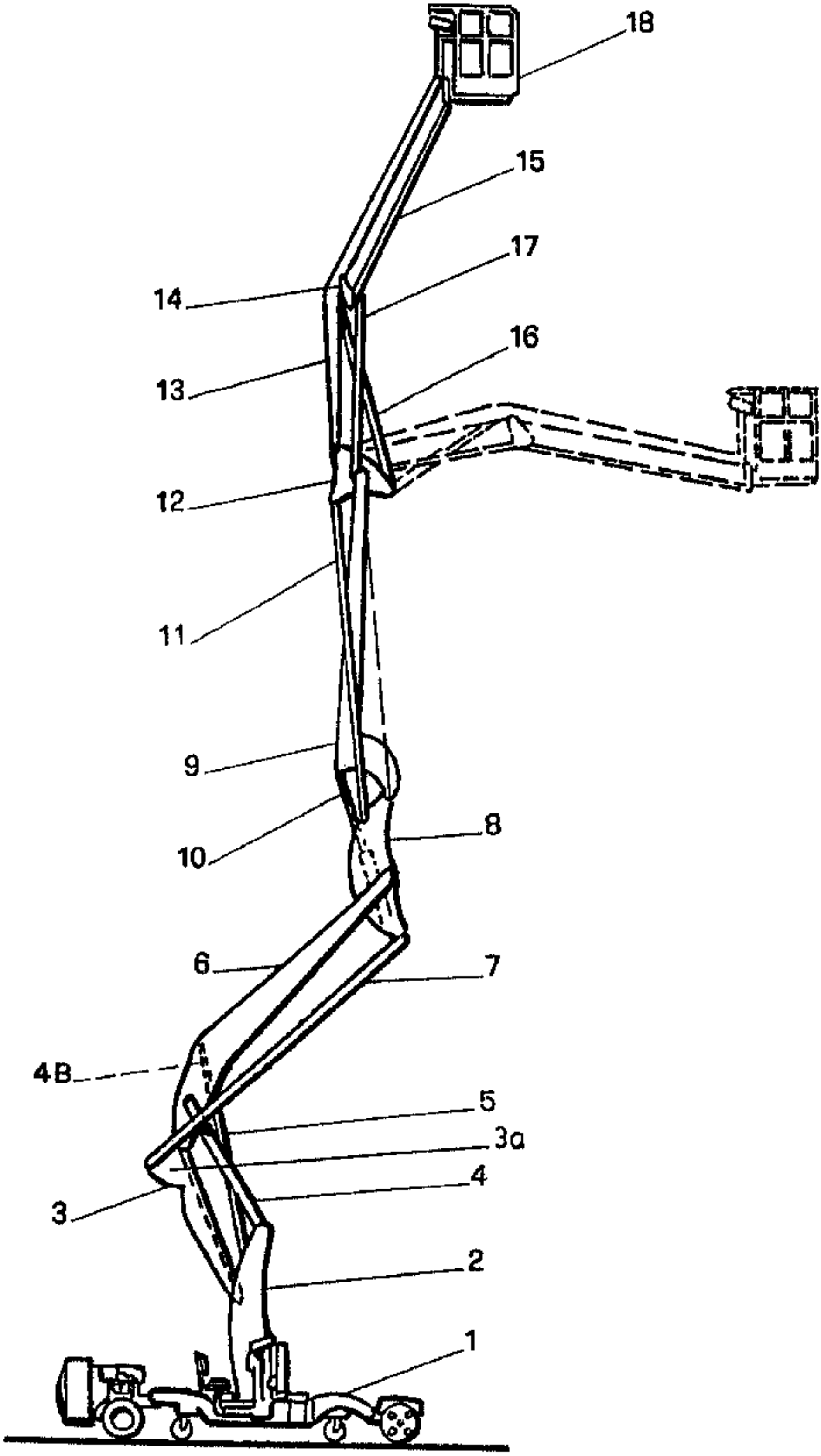


FIG.16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