

(19)



Europäisches Patentamt  
European Patent Office  
Office européen des brevets



(11)

**EP 0 803 615 A2**

(12)

## EUROPEAN PATENT APPLICATION

(43) Date of publication:  
**29.10.1997 Bulletin 1997/44**

(51) Int Cl.<sup>6</sup>: **E02F 3/96, E02F 3/30**

(21) Application number: **97660044.5**

(22) Date of filing: **17.04.1997**

(84) Designated Contracting States:  
**DE ES FR GB IT SE**

(72) Inventor: **Nuotio, Esa**  
**61270 Luopajarvi (FI)**

(30) Priority: **24.04.1996 FI 961763**

(74) Representative: **Tanskanen, Jarmo Tapio et al**  
**Papula Rein Lahtela Oy,**  
**P.O. Box 981**  
**00101 Helsinki (FI)**

(71) Applicant: **Nuotio, Esa**  
**61270 Luopajarvi (FI)**

### (54) Device to be connected to the knuckle boom set of a working vehicle

(57) Device to be connected to a chuck (7) at the end of the knuckle boom set (1) of a working vehicle, said knuckle boom set comprising several boom arms (5, 6) successively connected to each other with joints permitting them to be turned in relation to each other by power means (2, 3, 4), said chuck being so pivoted on the outermost boom arm (6) of the knuckle boom set that it is able to turn about a horizontal pivoted axle (8),

which device comprises a mounting frame (9) provided with mounting elements (10) to allow it to be attached to the chuck (7). The device comprises an elongated telescopic jib (11) with an adjustable extension length, which is connected to the mounting frame (9); an implement (12) pivoted on the end of the jib; and a first power means (13), such as a hydraulic cylinder, arranged between the jib and the implement to turn the implement with respect to the jib.

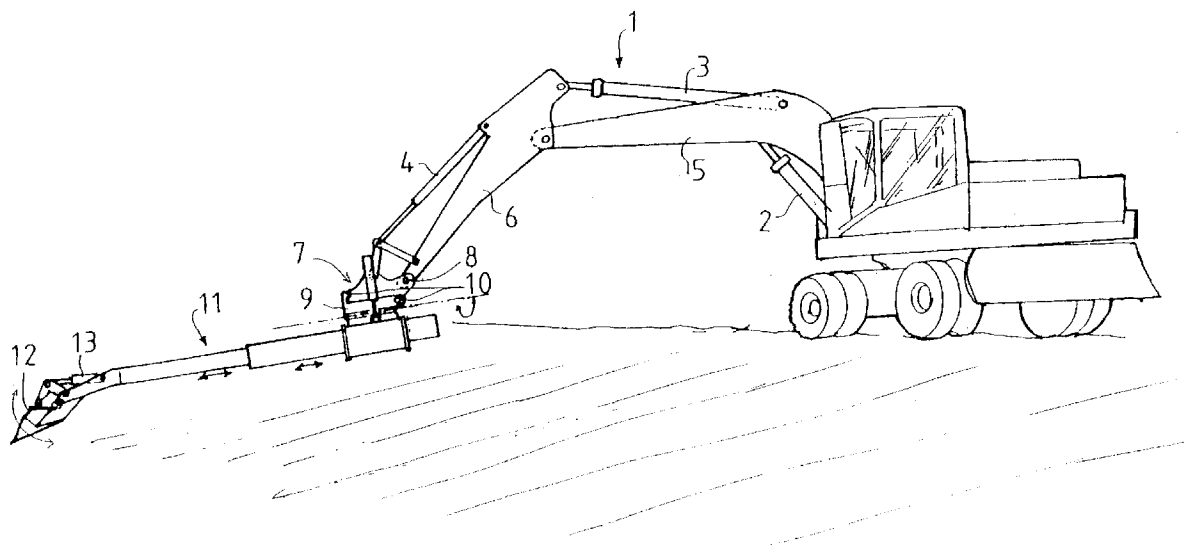


Fig 1

**EP 0 803 615 A2**

## Description

The invention relates to a device as defined in the preamble of claim 1.

Previously known is a device designed to be attached to a chuck at the end of the knuckle boom set of a working vehicle, which knuckle boom set comprises several boom arms connected to each other with joints permitting them to be turned with respect to each other with a suitable power means, said chuck being so pivoted on the outermost boom arm of the knuckle boom set that it is able to turn about a horizontal pivoted axle, and which device further comprises a mounting frame provided with mounting elements to allow it to be attached to the chuck. The knuckle boom set of an ordinary working vehicle, such as an excavator, usually has such a limited extension length that the vehicle is not applicable for use e.g. for the finishing and maintenance work on the inclined and relatively wide road side and side ditch area of a road under construction or maintenance, e.g. for smoothing and earth moving purposes. For instance, to allow fast smoothing of the sloping road sides, it would be an advantage if the working vehicle could additionally drive back and forth on the road while performing the smoothing and earth moving work. With prior-art devices, this is not possible.

The object of the present invention is to eliminate the drawbacks mentioned above.

A specific object of the invention is to produce a device for connection to the knuckle boom set of a working vehicle, a device which substantially increases the extension length of the knuckle boom set to enable the device to be used to carry out finishing work on the road sides while the working vehicle is able to move along a road. A further object of the invention is to produce an accessory to which it is possible to attach any known implements.

The device of the invention is characterized by what is presented in claim 1.

According to the invention, the device comprises an adjustable telescopic jib connected to a mounting frame; an implement pivoted on the end of the jib; and a first power means, such as a hydraulic cylinder, arranged between the jib and the implement to turn the implement relative to the jib.

The invention has the advantage that, by means of the telescopic jib, the extension length of the knuckle boom set of the working vehicle can be considerably increased, and that it is possible to attach any implement to the end of the jib. In combination with the possibilities of movement of the knuckle boom set, the jib considerably widens the potential area of application of the working vehicle for different types of work. The increased extension length allows it to be used e.g. for different kinds of lifting jobs: it is possible e.g. to attach a long object to the end of the jib and hang it in a vertical position. An example of such application is the handling of a so-called culvert opener, a task for which the lift height of

the knuckle boom set of a conventional excavator is insufficient without a suitable accessory.

An embodiment of the device comprises a pressure-medium operated second power means, such as a hydraulic cylinder, e.g. a double-acting hydraulic cylinder, used to extend and contract the telescopic jib.

In an embodiment of the device, the mounting frame of the device comprises a first frame part attached to the chuck by means of mounting elements, and a second frame part pivoted on the first frame part so that it can turn about a first pivot pin, said pivot pin being disposed in a direction perpendicular to the direction of a pivoted axle; and the device comprises a pressure-medium operated third power means, such as a hydraulic cylinder, e.g. a double-acting hydraulic cylinder, to turn the first frame part and the second frame part with respect to each other. With this arrangement, the jib together with the implement can be tilted into a desired angle, so that e.g. a smoothing device used as an implement at the end of the jib e.g. to smooth a road side slope can be tilted to a position corresponding to the inclination of the slope.

In an embodiment of the device, the jib comprises an elongated first jib beam connected to the second frame part, and an elongated second jib beam fitted to be movable within the first jib beam; and a second power means is arranged to act between the first jib beam and the second jib beam to contract and extend the jib in a telescopic manner. The jib beams are preferably box beams of a rectangular cross-section.

An embodiment of the device comprises a bush-like guide element in which the first jib beam is movably mounted; and the device comprises a pressure-medium operated fourth power means, such as a hydraulic cylinder, e.g. a double-acting hydraulic cylinder, to move the first jib beam with respect to the guide element in the longitudinal direction of the jib. This arrangement further increases the adjustment range of the extension length of the jib.

In an embodiment of the device, the implement is pivoted on the end of the second jib beam so as to allow it to be turned about a second pivot pin transverse to the longitudinal direction of the second jib beam.

In an embodiment of the device, the device has a four-link mechanism to control the turning of the implement about the second pivot pin.

In an embodiment of the device, the implement comprises a first implement frame, which is connected via joints to the end of the second jib beam so that it is able to turn about the second pivot pin; a second implement frame, to which a tool is attached; and a rotator arranged to rotate the second implement frame about a rotation axis perpendicular to the second pivot pin. The rotator allows the tool to be rotated to a desired working position.

In an embodiment of the device, the device is attached to the knuckle boom set of an excavator in the place of a bucket or other known implement; and the

mounting elements are elements known in themselves of a standard quick-grip adapter known in itself.

In an embodiment of the device, the tool attached to the implement is an earth moving tool, such as a bucket, ramming plate, smoothing plate or a combination of these. The implement may comprise a soil compacting device, such as a mechanical vibrator, e.g. a vibrating roller. The tool may also be a clearing device, such as a cutting device for the cutting of vegetation, e.g. brushwood, grass, etc., especially a brushwood cutter equipped with a power means.

In the following, the invention is described in detail by the aid of application examples by referring to the attached drawing, in which

Fig. 1 presents an embodiment of the device of the invention, mounted on the knuckle boom set of an excavator,

Fig. 2 presents the device of Fig. 1 in side view without an implement,

Fig. 3 presents section III-III of Fig. 2,

Fig. 4 presents a side view of a part of the device in Fig. 2, which has an implement attached to the end of the jib; the implement is a smoothing device, turned into its first extreme position,

Fig. 5 presents the device of Fig. 4 with the smoothing device turned into its second extreme position, and

Fig. 6 presents a part of the device in Fig. 2, corresponding to figures 4 and 5, in which the implement is a bucket.

Fig. 1 presents an excavator having a chassis provided with wheels and a rotatable boom carrier, comprising a knuckle boom set 1 composed of boom arms 5, 6 successively pivoted on each other and provided with power means 2, 3 for turning the boom arms in relation to each other. Pivoted on the end of the outer boom arm 6 is a standard quick-grip chuck 7, to which it is normally possible to attach e.g. an excavator bucket or other device provided with corresponding quick-grip mounting elements. The chuck 7 is provided with a joint permitting it to turn about a horizontal pivoted axle 8. The boom accessory attached to the standard quick-grip chuck 7 comprises a mounting frame 9 provided with mounting elements 10 for attachment to the chuck 7. The device has a hydraulically adjusted telescopic jib 11, which is connected to the mounting frame 9. The implement 12 is pivoted on the end of the jib 11. The first power means 13, a double-acting hydraulic cylinder, is arranged to act between the jib 11 and the implement 12 to turn the implement in relation to the jib.

The jib 11 increases the extension length of the machine in the example in Fig. 1 by about 3 - 5 metres. When mounted e.g. on an 18-ton excavator with a wheeled chassis, its extension length with the jib 11 is about 14 metres. When the machine is on level ground, its stability is sufficient without the use of digging sup-

ports, so it can be used by driving the machine along the road while working. This results in a considerably faster performance of e.g. the task of making a road side slope as illustrated by Fig. 1.

Referring now to Fig. 2, the device comprises a pressure-medium operated second power means 14, which is a double-acting hydraulic cylinder, used to contract and extend the telescopic jib 11.

As shown in Fig. 3, the mounting frame 9 used to attach the jib device to the knuckle boom set of a working vehicle comprises a first frame part 15, which is attached to the chuck 7 by means of mounting elements 10. Furthermore, the mounting frame 9 comprises a second frame part 16, which is pivoted on the first frame part 15 so that, using a third power means 18, a double-acting hydraulic cylinder, it can be turned about a first pivot pin 17. The pivot pin 17 is perpendicular to the direction of the pivoted axle 8 (see Fig. 1). Fig. 3 additionally illustrates different tilted positions of the jib 11, indicated with dotted broken lines. The second frame part 16 can preferably be tilted by about 40° - 45° with respect to the first frame part 15, so the machine can be used for the making or maintenance of even very steep road side slopes.

As shown in Fig. 2, the jib 11 comprises a first elongated jib beam 19, which is attached to the second frame part 16 of the mounting frame 9. A second elongated jib beam 20 is movably fitted inside the first jib beam. The second power means 14 is arranged to act between the first jib beam 19 and the second jib beam 20 to contract and extend the jib 11. Attached to the second frame part 16 is a bush-like guide element 21 in which the first jib beam 19 is movably mounted. A pressure-medium operated fourth power means 22, which is a double-acting hydraulic cylinder, moves the first jib beam with respect to the guide bushing 21 in the longitudinal direction of the jib 11.

Fig. 2 does not show an implement at the end of the second jib beam 20, whereas Fig. 4 and 5 present an example of an implement 12 in which the tool 27 is a smoothing device, which in Fig. 4 and 5 is shown in side view with the smoothing and ramming surfaces 31, 31', 32, and 33 in a position perpendicular to the longitudinal direction of the second jib beam 20 and to the plane of the figure. The implement 12 is connected via a four-link mechanism 24 to the end of the second jib beam 20 so that it can be turned about a second pivot pin 23 transverse to the longitudinal direction of the second jib beam. The four-link mechanism or quadrilateral link mechanism comprises the second pivot pin 23 placed at the end of the second jib beam 20 and a joint 34 at the end of the jib beam at a distance from the pivot pin 23. The part between joints 23 and 34 can be regarded as the fixed member or body of the mechanism, in relation to which the mechanism turns. Pivoted on this body via joint 34 is a tilting lever 35, which is actuated by hydraulic cylinder 13. Connected by one end via joint 36 to the end of the tilting lever 35 is an intermediate lever 37, whose other end is connected via joint 38 to a first

implement frame 25 of the implement. Joint 38 is located on the implement frame 25 at a distance from the pivot pin 23.

The implement 12 comprises a first implement frame 25, which is connected via joints to the end of the second jib beam 20 so that it is able to turn about the second pivot pin 23. Further, the implement comprises a second implement frame 26, to which a tool 27 is attached. A rotator 28 is arranged to rotate the second implement frame about an axis 29 of rotation. The rotation axis 29 is perpendicular to the second pivot pin 23. The dotted broken line in Fig. 4 represents a smoothing implement turned by the rotator 28, as an example, through 90° from the position depicted in solid lines. The implement 12 can preferably be rotated by the rotator 28 through full 360° and locked in any desired angular position by means of a locking device 39, which, due to weight considerations, is preferably implemented as a pneumatic device.

Fig. 6 presents a bucket used as a tool 27 attached to the implement 12. When equipped with a bucket, the device can be used e.g. for ditch dredging and earth moving purposes.

It is also possible to attach a soil compacting device, such as a mechanical vibrator, e.g. a vibrating roller, to the end of the jib 11. Similarly, a clearing device, such as a cutting device for the cutting of vegetation, e.g. brushwood, grass, etc., especially a brushwood cutter equipped with a power means, can be attached to the end of the jib 11.

The invention is not restricted to the examples of its embodiments described above, but many variations are possible within the framework of the inventive idea defined by the claims.

## Claims

1. Device to be connected to a chuck (7) at the end of the knuckle boom set (1) of a working vehicle, said knuckle boom set comprising several boom arms (5, 6) successively connected to each other with joints permitting them to be turned in relation to each other by suitable power means (2, 3, 4), said chuck being so pivoted on the outermost boom arm (6) of the knuckle boom set that it is able to turn about a horizontal pivoted axle (8), which device comprises a mounting frame (9) provided with mounting elements (10) to allow it to be attached to the chuck (7), **characterized** in that the device comprises an elongated telescopic jib (11) with an adjustable extension length, which is connected to the mounting frame (9); an implement (12) pivoted on the end of the jib; and a first power means (13), such as a hydraulic cylinder, arranged between the jib and the implement to turn the implement with respect to the jib.
2. Device as defined in claim 1, **characterized** in that the device comprises a pressure-medium operated second power means (14), such as a hydraulic cylinder, e.g. a double-acting hydraulic cylinder, to contract and extend the telescopic jib.
3. Device as defined in claim 1 or 2, **characterized** in that the mounting frame (9) comprises a first frame part (15) attached to the chuck (7) by means of the mounting elements (10), and a second frame part (16) pivoted on the first frame part so that it can turn about a first pivot pin (17), mounted in a direction perpendicular to the direction of the pivoted axle (8); and that the device comprises a pressure-medium operated third power means (18), such as a hydraulic cylinder, e.g. a double-acting hydraulic cylinder, to turn the first frame part and the second frame part with respect to each other.
4. Device as defined in claim 3, **characterized** in that the jib (11) comprises an elongated first jib beam (19) connected to the second frame part (16), and an elongated second jib beam (20) fitted to be movable within the first jib beam; and that the second power means (14) is arranged to act between the first jib beam and the second jib beam to contract and extend the jib in a telescopic manner.
5. Device as defined in claim 4, **characterized** in that it comprises a bush-like guide element (21) attached to the second frame part (16), the first jib beam being movably mounted in said guide element; and that the device comprises a pressure-medium operated fourth power means (22), such as a hydraulic cylinder, e.g. a double-acting hydraulic cylinder, to move the first jib beam with respect to the guide element in the longitudinal direction of the jib.
6. Device as defined in any one of claims 1 - 6, **characterized** in that the implement is pivoted on the end of the second jib beam (20) so as to allow it to be turned about the second pivot pin (23), transverse to the longitudinal direction of the second jib beam.
7. Device as defined in claim 6, **characterized** in that the device has a four-link mechanism to control the turning of the implement about the second pivot pin (23).
8. Device as defined in any one of claims 1 - 7, **characterized** in that the implement (12) comprises a first implement frame (25), which is connected via joints to the end of the second jib beam (20) so that it is able to turn about the second pivot pin; a second implement frame (26), to which a tool (27) is attached; and a rotator (28) arranged to rotate the

second implement frame about a rotation axis (29) perpendicular to the second pivot pin (23).

9. Device as defined in any one of claims 1 - 8, **characterized** in that the device is attached to the knuckle boom set (1) of an excavator in the place of a bucket or other known implement; and that the mounting elements (10) are elements known in themselves of a standard quick-grip adapter known in itself. 5 10
10. Device as defined in any one of claims 1 - 9, **characterized** in that the tool (27) attached to the implement (12) is an earth moving tool, such as a bucket, ramming plate, smoothing plate or a combination of these; and/or that the implement (12) comprises a soil compacting device, such as a mechanical vibrator, e.g. a vibrating roller; and/or that the tool (27) is a clearing device, such as a cutting device for the cutting of vegetation, e.g. brushwood, grass, etc., especially a brushwood cutter equipped with a power means. 15 20

25

30

35

40

45

50

55

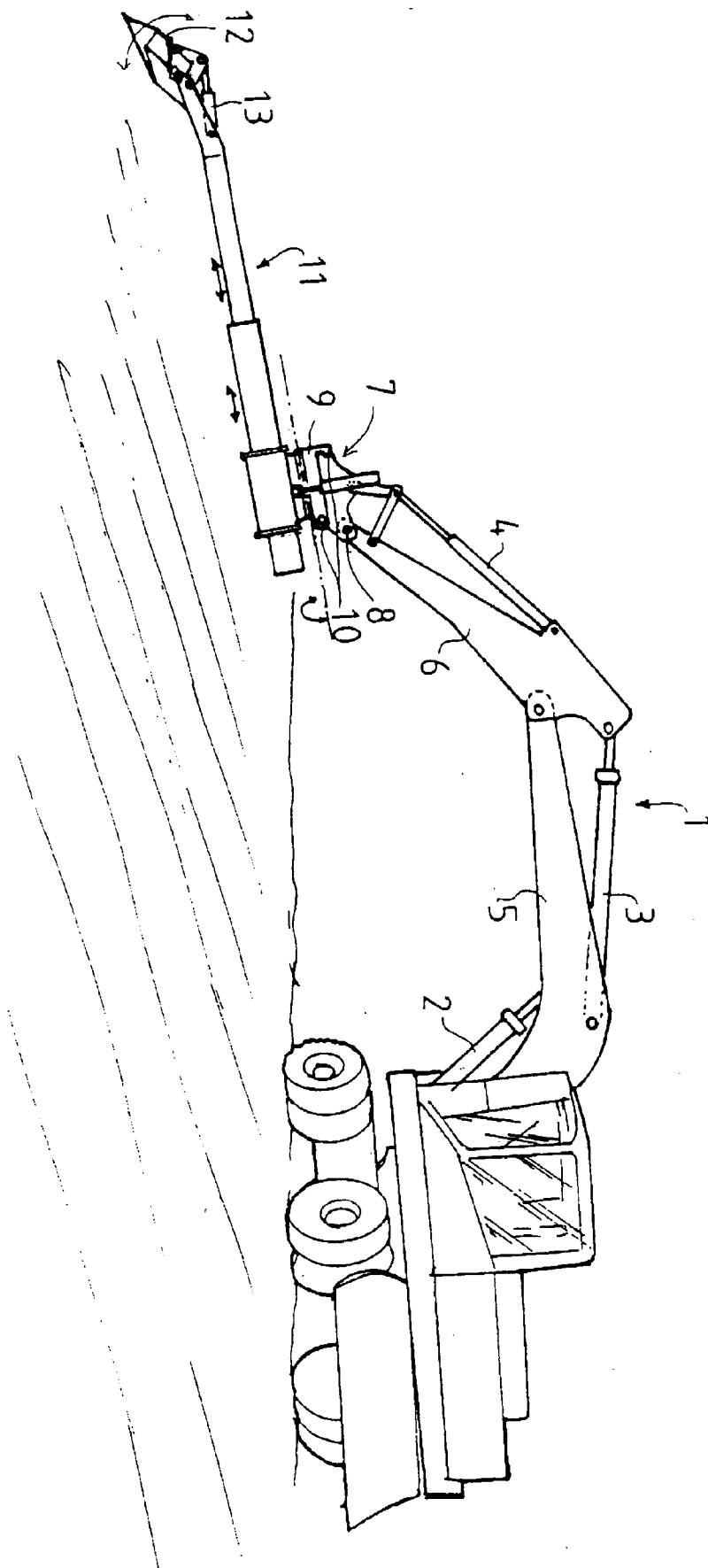
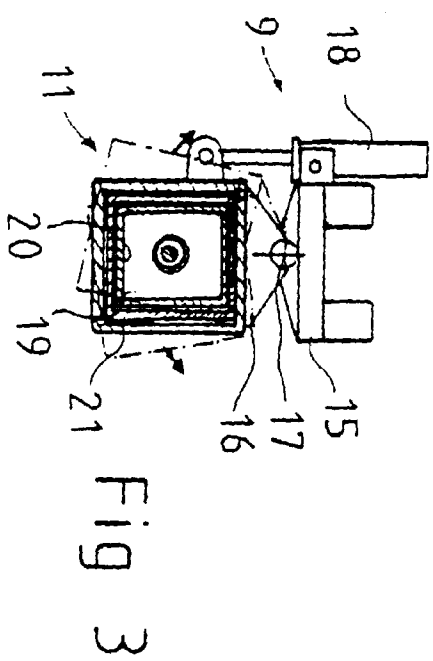
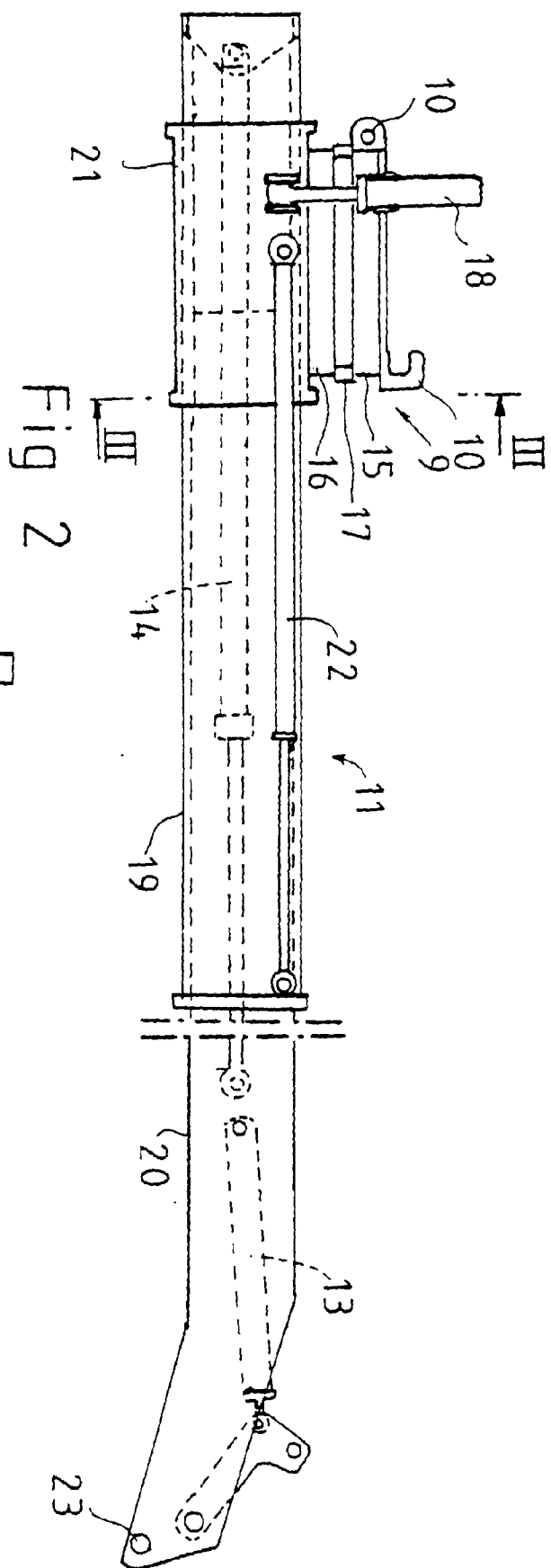


Fig 1



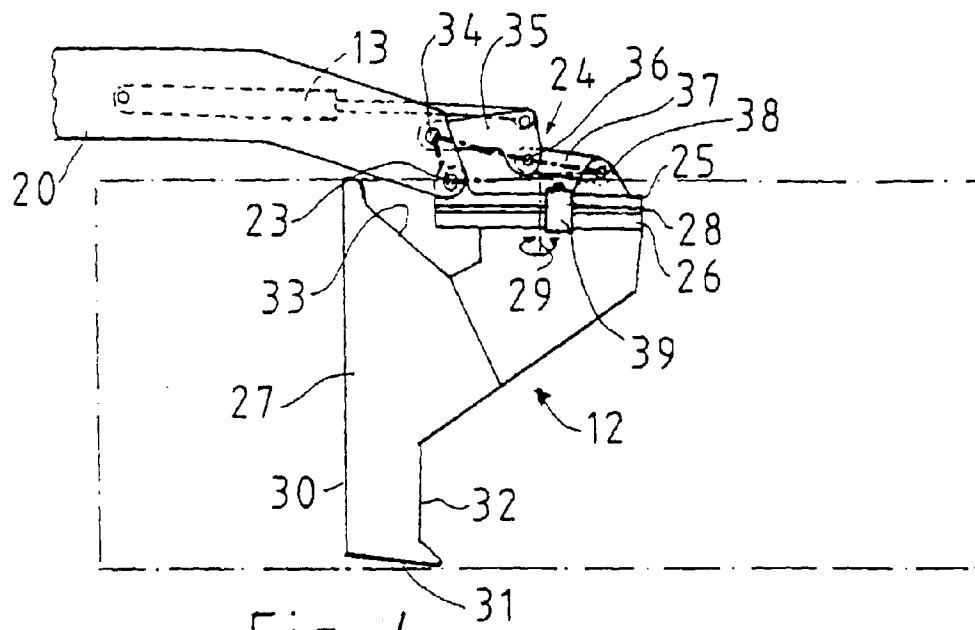


Fig 4

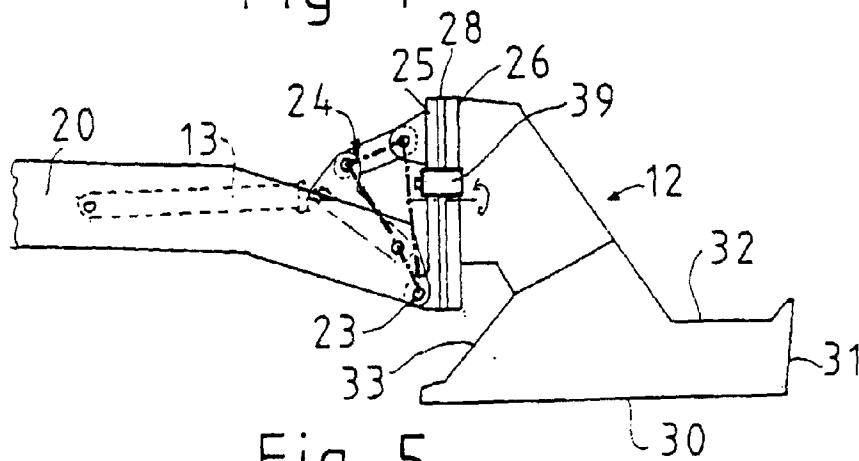


Fig 5

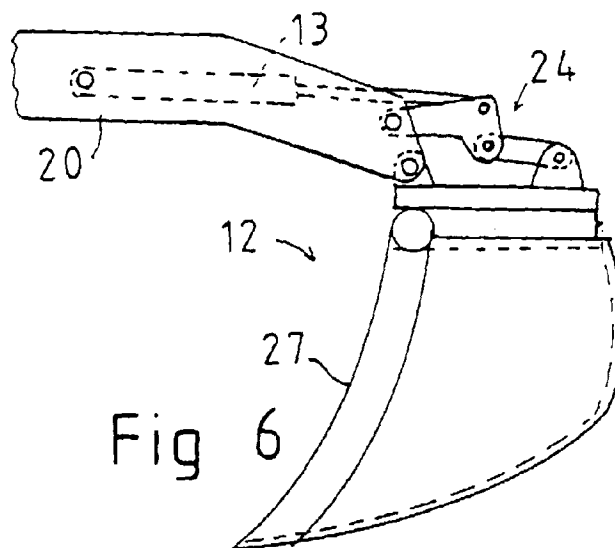


Fig 6