(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 232 555**
**A1**

# (12) EUROPEAN PATENT APPLICATION

(21) Application number: **86201079.0**

(51) Int. Cl.⁴: **B66F 11/04**

(22) Date of filing: **20.06.86**

(30) Priority: **14.02.86 NL 8600371**

(43) Date of publication of application:
**19.08.87 Bulletin 87/34**

(84) Designated Contracting States:
**AT BE CH DE FR GB IT LI LU NL SE**

(71) Applicant: **Custers Hydraulica B.V.**
**Maasheseweg 79**
**NL-5804 AB Venray(NL)**

(72) Inventor: **de Groot, Joachim**
**Kerkeind 42**
**NL-5763 BD Milheeze(NL)**

(74) Representative: **Lips, Hendrik Jan George, Ir. et al**
**HAAGSCH OCTROOIBUREAU Breitnerlaan 146**
**NL-2596 HG Den Haag(NL)**

## (54) A device for keeping a working platform of an access equipment in the desired position.

(57) A device for keeping a working platform (18) of an access equipment in the desired position, said device comprising a hydraulical extendable boom (6, 29) one end of which is pivotally supported directly or by means of a second hydraulical extendable boom (6) by a fixed support structure (1), the other end (14, 36) pivotally carrying said working platform (18); in the vicinity of each pivoting shaft (5, 16, 39) a gear wheel or gear wheel segment (3, 15, 37) being mounted fixedly connected to one of the two parts rotatable with respect to each other, each gear wheel (3, 15, 37) engaging a gear rack (12, 22, 35) extending in the elongation of the piston-rod (11, 21, 34) of a double acting hydraulic motor (9, 19, 32) which is fixedly connected to the other part, the cylinder spaces (23, 24, 27, 28, 43, 44) of the hydraulic motors (9, 19, 32) being interconnected by conduits (25, 26, 41, 42) for hydraulic medium.

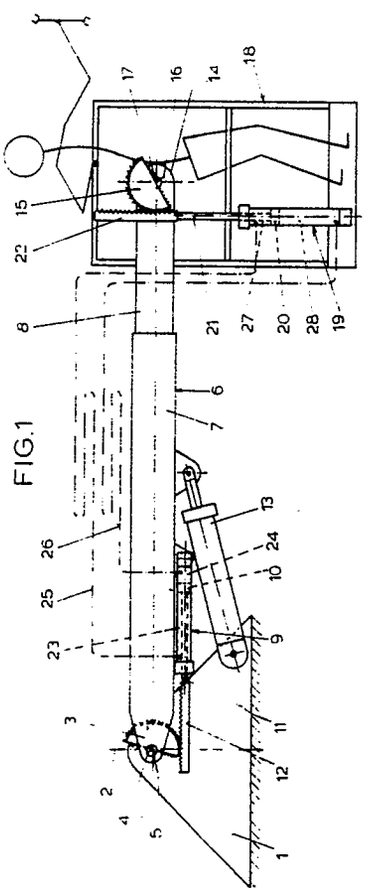


FIG.1

EP 0 232 555 A1

# A device for keeping a working platform of an access equipment in the desired position.

The invention relates to a device for keeping a working platform in the desired position, said platform being pivotally mounted on a horizontal shaft connected to the free end of a boom, the other end of which is pivotally mounted on a shaft extending parallel to the first mentioned shaft and being supported by a fixed or non-fixed support structure.

Such a device is applied in particular in so-called "high workers" or access equipment, which e.g. are used in the replacements of light-bulbs in lamp-posts and to that end then are mounted on a vehicle. After stationairy positioning the vehicle a worker may occupy his position on the working platform and the boom then is rotated upwards until the worker is in the vicinity of the upper end of the lamppost. Of course the working platform should then be turnable with respect to the boom, so that the working platform may stay in the desired horizontal position.

A device of the type described above e.g. is known from the published European Patent Application Nr. 0 117 120.

In this known device a parallel guidance is applied, so that a rod is present extending parallel and outside the support boom by which the working platform is kept in the correct position when rotating the boom.

A disadvantage of this known construction is not only the necessity of the long connecting rod, but also that no telescopically extendable boom can be applied so that when erecting the installation one is tied to a specific location or at least is forced to use a dual boom.

The invention has as an object to eliminate these dis advantages and provides to that extend a device of the type described above, which is characterized in that in the vicinity of each shaft a gear wheel or gear wheel segment with the same effective diameter is mounted, the centre-line of which is in line with the centre-line of the relevant shaft, said gear wheel being fixedly connected to one of the two parts rotatable with respect to each other, each gear wheel engaging a gear rack extending in the elongation of the piston-rod of a double acting hydraulic motor, which is fixedly connected to the other of the two mentioned parts, the cylinder spaces of the various hydraulic motors, located at both sides of a piston, being interconnected by conduits in such a way, that when rotating that part being pivotally connected to a fixedly mounted shaft, the resulting displacement of the piston in the motor present near this fixedly mounted shaft, causes a conveyance of hydraulic medium resulting in displacement of the piston or pistons in the other motor or motors by which the working platform is kept in the desired position.

Thus only hydraulic conduits have to extend between the hinge-points. Of these hydraulic conduits at least a part may be flexible, so that the use of a telescopically extendible arm does not present any objection.

While use can be made of a single pivotally mounted boom one end of which is supported by a fixedly mounted shaft, two mutually pivotally booms may also be present such as is the case in the equipment according to the already mentioned European Patent Application Nr. 0 117 120. When applying the invention both booms may be telescopically extendable, so that an installation is obtained, capable of covering a large working area.

According to a preferred embodiment of the invention the fixed support structure is connected to a gear wheel segment and the boom being pivotally supported by it is carrying a hydraulic motor extending substantially parallel to said boom, the free end of the boom being provided with a gear wheel segment and the working platform with the hydraulic motor cooperating therewith.

This provides a simple installation of the boom which may be telescopically extendable so that a substantial working area can be covered.

In order to be able to reach a still greater height, it can be provided that the fixed support structure is connected to a gear wheel segment and that the first boom, pivotally supported by it, is carrying a hydraulic motor extending substantially parallel to said boom, the other end of the first boom having a gear wheel segment and being pivotally connected to a second boom carrying a hydraulic motor, extending substantially parallel to said boom, for cooperation with the gear wheel segment, the free end of the second boom being provided with a gear wheel segment and the working platform of the hydraulic motor cooperating with it.

By application of the hydraulic motors and gear wheel segments in this way it can be achieved, that the hydraulic motors occupy only little space and that the conduits thereof extend closely along the booms, thus warranting an as good as possible protection of the conduits.

The invention will now be further elucidated by means of two embodiments, schematically shown in Figs. 1 and 2 of the drawing.

The installation shown in Fig. 1 comprises a support structure 1, which possibly may be mounted on a vehicle and can be pivotally as well with respect to said vehicle around a vertical axis 2. The support structure 1 is fixedly connected to a gear wheel segment 3, the centre-line 4 of which coincides with the centre-line of a shaft 5, on which a boom 6 is pivotally mounted. The boom 6 consists of the two boom sections 7 and 8 which can be telescopically moved into each other, but cannot rotate mutually during this moving. The extension of the boom sections can be effected by hydraulic means.

The boom section 7 is fixedly connected to a hydraulic motor 9 in which the piston 10 is located, the piston-rod 11 of which is fixedly connected to the gear rack 12, which is in engagement with the gear wheel segment 3. Rotation of the boom 6 can take place in a known manner by means of the hydraulic motor 13 as does not have to be elucidated further.

The free end 14 of the boom 6 carries a gear wheel segment 15, the centre-line 16 of which coincides with that of a shaft 17, by which a working platform 18 is pivotally supported. A hydraulic motor 19 is connected to the working platform 18, in said motor the piston 20 being located, which is connected to the piston-rod 21, carrying the gear rack 22.

The hydraulic motor 9 comprises the spaces 23 and 24 at either side of the piston 10, which by means of conduits 25 and 26 are connected to the spaces 27 and 28 respectively in the hydraulic motor 19.

If now the boom 6 is rotated counter-clockwise, as seen in Fig. 1, by means of the hydraulic motor 13, the gear rack 12 will be pulled away from the hydraulic motor 9, because the gear wheel segment 3 remains in its place, so that the piston 10 will move towards the left as seen in Fig. 1. By this time the space 23 left of the piston 10 will become smaller and hydraulic medium will be pressed into the space 27 of the hydraulic motor 19 via the conduit 25, so that the piston 20 will move downward and the gear rack will be pulled towards the hydraulic motor 19. Because the gear wheel segments 3 and 15 have the same effective diameter the displacement of the gear rack 22 will be as large as that of the gear rack 12, because of which the working platform 18 will be rotated over a same angle with respect to the boom 6 as the boom 6 with respect to the support structure 1. The working platform 18 thus remains in the desired position as this is shown in Fig. 1.

In case of the embodiment shown in Fig. 2 use is made again of a support structure 1 and a boom 6 pivotally mounted on it and being actuated by means of the hydraulic motor 13 and carrying the hydraulic motor 9, the piston-rod 11 of which is connected to the gear rack 12 cooperating with the gear wheel segment 3.

All these parts correspond with those of the embodiment according to Fig. 1, so that the same reference numbers have been used for them.

The end 14 of the boom 6 again is provided with a gear wheel segment 15, the centre-line of which is identified with 16, said centre-line coinciding with the centre-line of the shaft 17 now pivotally supporting the boom 29 consisting of two sections 30 and 31 which are telescopically movable into each other.

The boom section 30 is connected to a hydraulic motor 32, the piston 33 of which is connected to the piston-rod 34 which in turn is connected to the gear rack 35. The gear rack 35 cooperates in turn with the gear wheel segment 15. The free end 36 of the boom 29 again is provided with a gear wheel segment 37 the centre-line 38 of which coincides with the centre-line of the shaft 39 on which the working platform 18 is pivotally mounted.

Just like in the embodiment according to Fig. 1 the hydraulic motor 19 is connected to the working platform 18, the piston 20 of said motor being connected to the piston rod 21, carrying the gear rack 22. The gear rack 22 cooperates with the gear wheel segment 37.

The boom 29 is rotated with respect to the boom 6 by means of the hydraulic motor 40.

The spaces 27 and 28, located at either side of the piston 20 of the motor 19 are not only connected by means of the conduits 41 and 42 respectively with the spaces 23 and 24 respectively of the hydraulic motor 9, but simultaneously also with the spaces 43 and 44 respectively of the hydraulic motor 32.

In this way it is achieved that also in this case the working platform 18 can be maintained always in the desired vertical position. If for example the hydraulic motor 40 is not operated but only the hydraulic motor 13, the piston 33 of the hydraulic motor 32 will not be displaced, so that in the way as described in the case of Fig. 1, the working platform is kept in the proper position by rotating the boom 6 by means of the hydraulic motor 13. In the same way the working platform 18 will maintain its proper position if the hydraulic motor 13 is not operated but the hydraulic motor 40, because the hydraulic medium, displaced by the piston 33 of the hydraulic motor 32, will cause a corresponding

displacement of the piston 20 in the hydraulic motor 19. Also if both hydraulic motors 13 and 40 are operated simultaneously the working platform 18 will maintain its proper position.

It does not require further elucidation that the hydraulic motors 9, 19 and 32 should have the same diameter for obtaining the desired effect.

However, it would be possible to make the gear wheel segments with a different effective diameter and to adapt the internal diameter of the cylinders thereon. This is, however, less desirable from the viewpoint of manufacture, mounting, keeping in store of parts, and the like.

## Claims

1. Device for keeping a working platform in the desired position, said platform being pivotally mounted on a horizontal shaft connected to the free end of a boom, the other end of which is pivotally mounted on a shaft extending parallel to the first mentioned shaft and being supported by a fixed or non-fixed support structure, characterized in that in the vicinity of each shaft (5; 16; 39) a gear wheel or gear wheel segment (3, 15, 37) with the same effective diameter is mounted, the centre-line (4, 16, 38) of which is in line with the centre-line of the relevant shaft (5, 16, 39), said gear wheel (3, 15, 37) being fixedly connected to one of the two parts rotatable with respect to each other, each gear wheel (3, 15, 37) engaging a gear rack (12, 22, 35) extending in the elongation of the piston-rod (11, 21, 34) of a double acting hydraulic motor (9, 19, 32), which is fixedly connected to the other of the two mentioned parts, the cylinder spaces (23, 24, 27, 28, 43, 44) of the various hydraulic motors (9, 19, 32), located at both sides of a piston (10, 20, 33) being interconnected by conduits (25, 26, 41, 42) in such a way, that when rotating that part (6) being pivotally connected to a fixedly mounted shaft (5), the resulting displacement of the piston (10) in the motor (9) present near this fixedly mounted shaft (5), causes a conveyance of hydraulic medium resulting in displacement of the piston or pistons (20, 33) in the other motor or motors (19, 32) by which the working platform (18) is kept in the desired position.

2. Device according to claim 1, characterized in that the fixed support structure (1) is connected to a gear wheel segment (3) and the boom (6) being pivotally supported by it is carrying a hydraulic motor (9) extending substantially parallel to said boom (6), the free end (14) of the boom (6) being provided with a gear wheel segment (15) and the working platform (18) with the hydraulic motor (19) cooperating therewith.

3. Device according to claim 1, characterized in that the fixed support structure (1) is connected to a gear wheel segment (3) and that the first boom - (6), pivotally supported by it, is carrying a hydraulic motor (9) extending substantially parallel to said boom (6), the other end (14) of the first boom (6) having a gear wheel segment (15) and being pivotally connected to a second boom (29) carrying a hydraulic motor (32), extending substantially parallel to the second boom (29), for cooperating with the gear wheel segment (15), the free end (36) of the second boom (29) being provided with the working platform (18).

I.

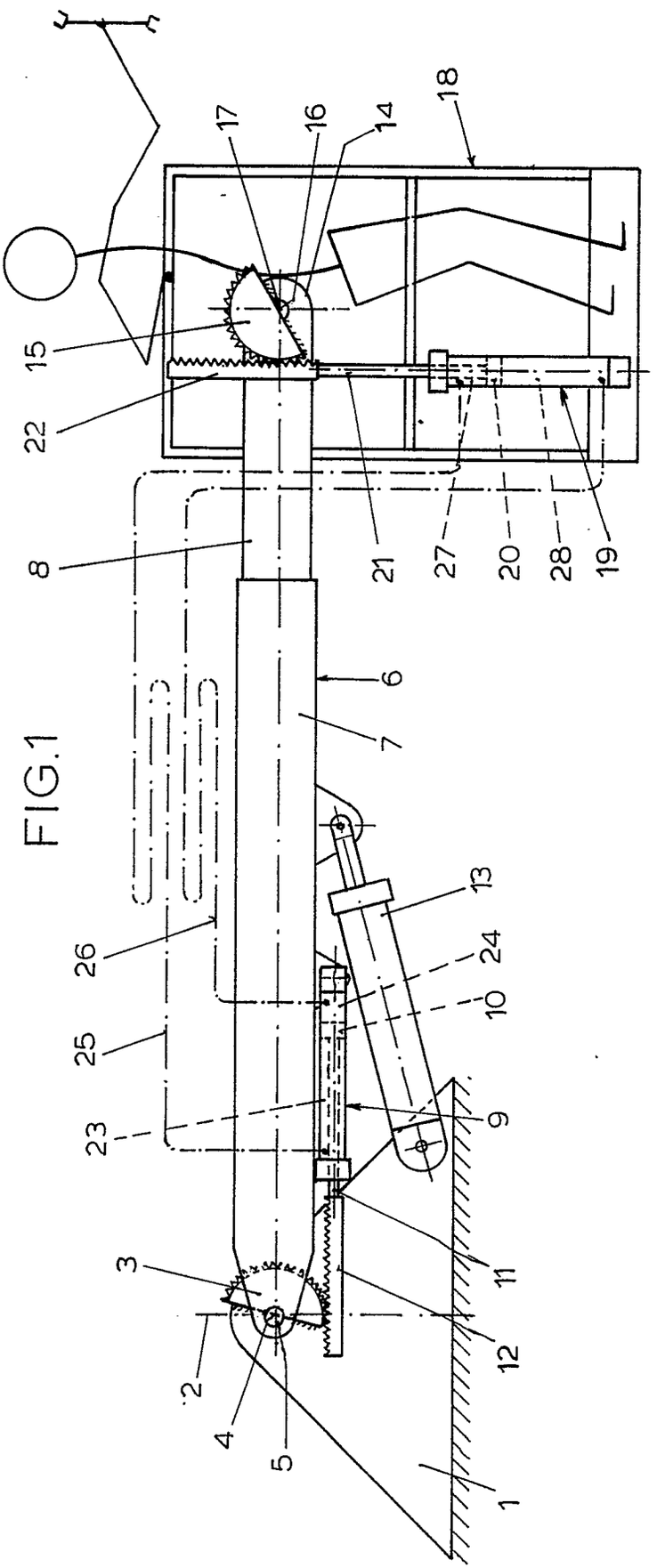


FIG.1

Custers Hydraulica B.V., VENRAY.

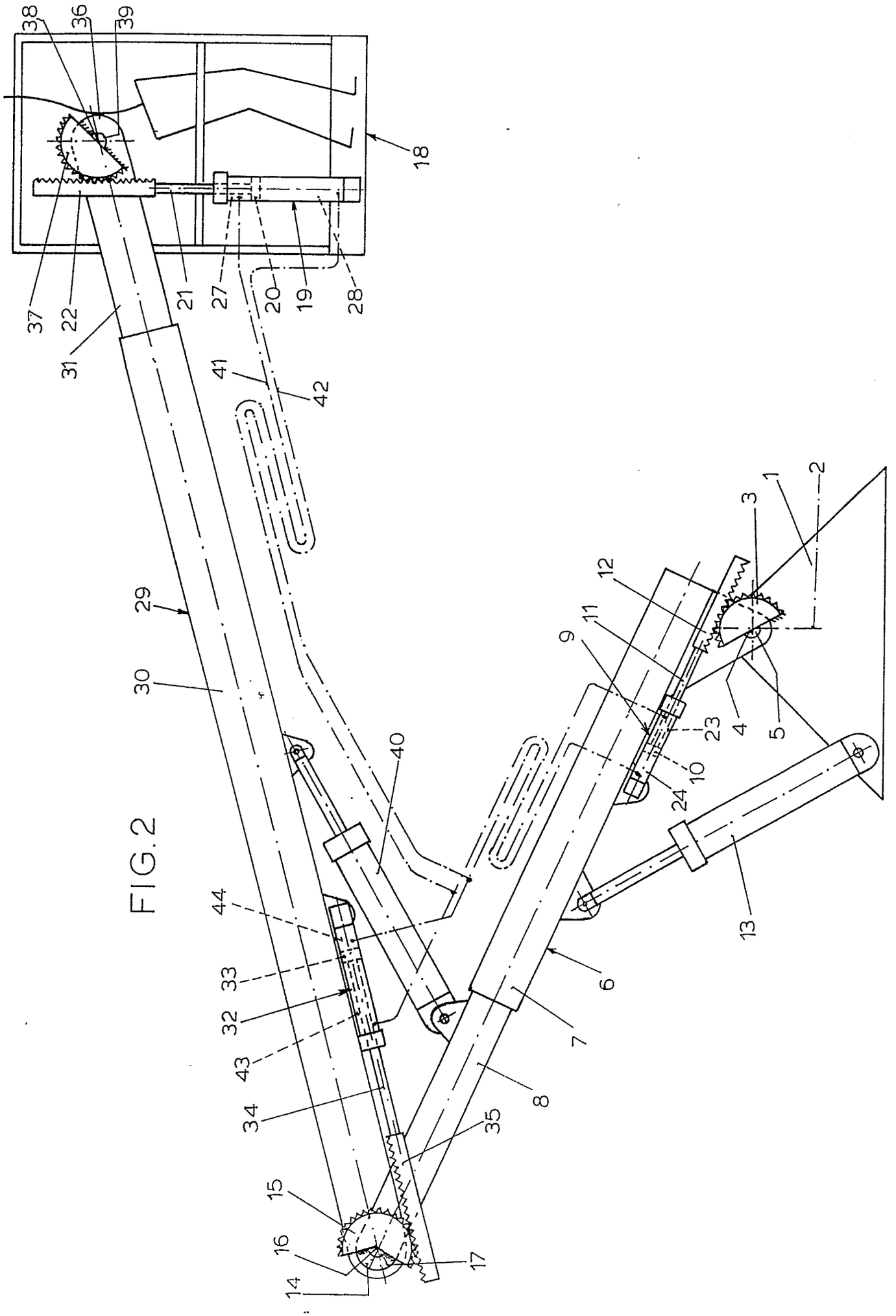
38
36
39
18
37
22
21
27
20
19
28
31
41
42
29
30
40
44
33
32
43
34
35
15
16
14
17
8
7
6
13
12
11
9
10
24
23
4
5
3
1
2

FIG.2

European Patent Office

# EUROPEAN SEARCH REPORT

Application number

EP 86 20 1079

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (Int. Cl.4) |
|---|---|---|---|
| X | US-A-3 645 359 (RAYMOND) * Abstract; column 6, lines 47-56; figures 1-3 * | 1-3 | B 66 F 11/04 |
| A | GB-A-1 544 415 (ARMFIELD ENGINEERING) | | |
| A | WO-A-8 300 037 (CARTER) | | |
| A | US-A-3 467 217 (ZWIGHT) | | |
| A | FR-A-1 479 017 (CENTRALNE BIURO KONSTRUKCYJNE URZADZEN BUDOWLANYCH) | | |
| A | FR-A-1 101 852 (GENEVE) | | TECHNICAL FIELDS SEARCHED (Int. Cl.4) B 66 F E 01 D B 60 P |
| A,D | EP-A-0 117 120 (AERIAL ACCESS EQUIPMENT) | | |

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| THE HAGUE | 15-10-1986 | VAN DEN BERGHE E.J.J |

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO Form 1503 03.82