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(54) **A device for moving an implement**

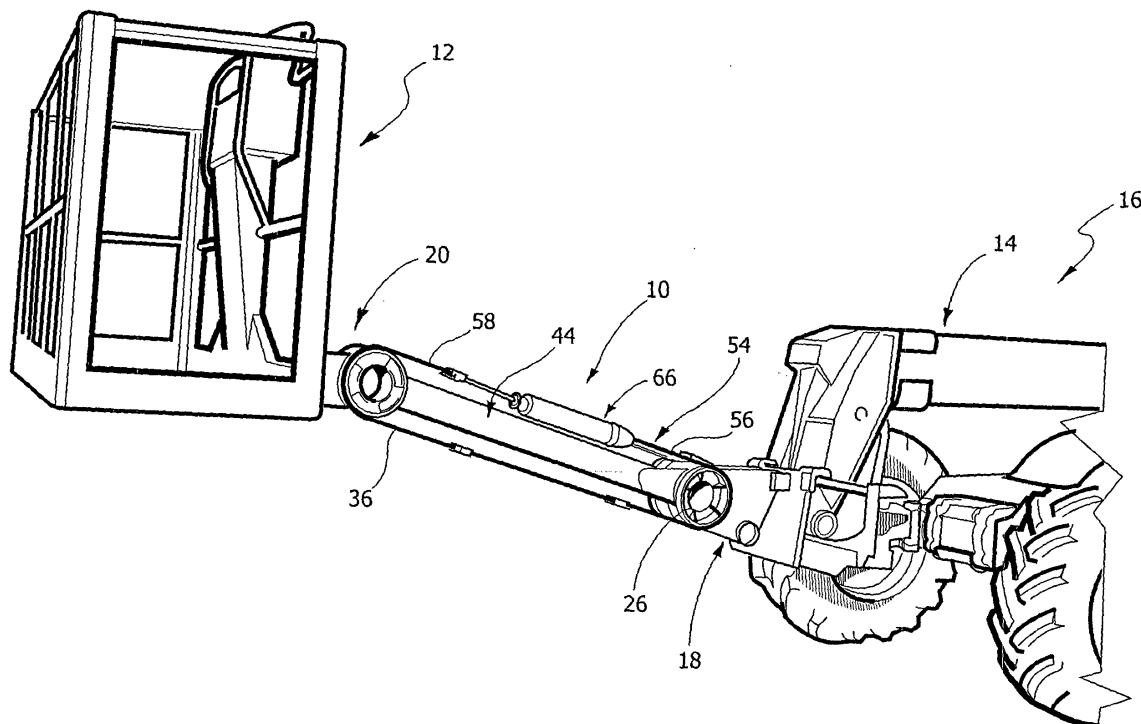
(57) A device for moving an implement, comprising:

- a first and a second support (18, 20),
- an arm (44) mounted rotatable relative to the first support (18) around a first axis (30) and rotatable relative to the second support (20) around a second axis (40) parallel to the first axis (30),
- at least one flexible element (54) fastened to the first

and to the second support (18, 20) and cooperating with a first and with a second winding surface (28, 38) integral respectively with the first and with the second support (18, 20), and

- an actuator (66) positioned to command a rotation of the arm (44) relative to one of said supports (18, 20).

FIG. 1



Description

[0001] The present invention relates to a device for moving an implement, applicable for example to the end of a telescopic lifting arm.

[0002] The present invention was developed in particular for the purpose of providing a moving device for an aerial platform. Aerial platforms are connected to the end of a lifting device, constituted for example by a telescopic lifting arm borne by a vehicle. Sometimes, between the aerial platform and the end of the telescopic lifting arm a moving device is provided which allows to displace the aerial platform within a work area without moving the telescopic lifting arm.

[0003] Although the present invention was developed in particular in view of its application to an aerial platform, the device according to the present invention can be used to move implements of any kind.

[0004] The object of the present invention is to provide a device that allows to move an implement along a wide action arc, even greater than 180°, and with high manoeuvring sensitivity in any point of the field of action.

[0005] According to the present invention, said object is achieved by a device having the characteristics set out in the claims.

[0006] The present invention shall now be described in detail with reference to the accompanying drawings, provided purely by way of non limiting example, in which:

- Figure 1 is an exploded perspective view showing a device according to the present invention used for moving an aerial platform;
- Figures 2, 3 and 4 show various operative positions of the device according to the present invention,
- Figure 5 is a plan view of the device according to the invention,
- Figure 6 is a section along the line VI-VI of Figure 5, and
- Figure 7 is an exploded perspective view of a part of the device according to the invention.

[0007] With reference to Figures 1 through 4, the reference number 10 designates a device according to the present invention for moving an implement. In the example illustrated in the figures, the device 10 is used to move locally an aerial platform 12 which is connected through the device 10 to the end of a telescopic lifting arm 14 borne by a vehicle 16 illustrated only partially in Figure 1.

[0008] Although Figures 1 through 4 illustrate the specific case of the application of the device 10 for moving an aerial platform 12, this application does not limit the field of use of the device according to the invention. The device 10 can be used to move any kind of implement, in combination with a telescopic lifting arm or with a different, fixed or movable support.

[0009] With reference in particular to Figure 7, the device 10 comprises a first support 18 and a second support 20. In the application illustrated by way of example in

Figures 1 through 4, the first support 18 is fastened to the end of the telescopic arm 14 whilst the second support 20 is fastened to the aerial platform 12.

[0010] The first support 18 comprises a cylindrical hub 22 which extends between two parallel walls 24 and two drums 26 fixed relative to the walls 24 and to the hub 22 and positioned externally relative to the walls 24. The drums 26 are provided with respective cylindrical winding surfaces 28 each of which is formed by a cylindrical race, coaxial relative to the axis 30 of the hub 22.

[0011] The second support 20 is similar to the first support 18 and comprises a hub 32 positioned between two parallel walls 34 and two drums 36 fixed relative to the walls 34 and to the hub 32 and having respective cylindrical winding surfaces 38, coaxial relative to the axis 40 of the hub 32. The second support 20 further comprises a cylindrical body 42 fixed between the walls 34, serving to fasten the support 20 to the implement to be moved, constituted by the aerial platform 12 in the example of Figures 1 through 4.

[0012] The device 10 comprises an arm 44 with fixed length constituted for example by a metallic tubular element with quadrangular section. The arm 44 is rotatably connected to the first support 18 around the axis 30 and to the second support 20 around the axis 40. The arm 44 has at its two ends two semi-cylindrical seats 46, 48 coupled respectively with the hub 22 and with the hub 32. To the second end of the arm 44 is fastened a respective arched flange 50, 52 with a semi-cylindrical seat complementary to the seat 46, 48. Preferably, between the hubs 22, 32 and the surfaces 46, 48 of the arm 44 and of the flanges 50, 52 are interposed bushings (not illustrated) made of bronze or similar material with low friction coefficient.

[0013] With reference to Figures 2, 5 and 6, the device 10 according to the present invention comprises two flexible elements 54 each of which is wound on a segment of the cylindrical winding surfaces 28, 38 of the drums 26, 36, integral with the respective supports 18, 20. In the example illustrated in the figures, each flexible element 54 comprises a first chain segment 56 co-operating with the winding surface 28 and a second chain segment 58 co-operating with the winding surface 38. One point of the chain segment 56 is fastened to a point of the winding surface 28 by means of a fastening block designated with the number 50 in Figure 7. In the same way, one point of the chain segment 58 is fastened to a point of the unwinding surface 38 by means of a block designated by the number 62 in Figures 5 and 7. The fastening of the two points of the chain segments 56, 58 to the respective winding surfaces 28, 38 leaves freedom of winding and unwinding of the chain segments 56, 58 on the winding surfaces 28, 38 in all other points.

[0014] The two chain segments 56, 58 of each flexible element 54 are mutually connected in such a way that each flexible element 54 is closed in a loop. The connection of the chain segments 56, 58 can be achieved by means of non flexible elements along a part of the two

rectilinear branches which extend between the drums 26, 36. In the illustrated example, the lower branch of each flexible element 54 comprises a non flexible metallic rod 64 at whose ends are fastened respective ends of the chain segments 54, 56. The upper branch of each flexible element 54 comprises a non flexible and non extensible connection between the corresponding ends of the chain segments 56, 58 obtained in the way which shall be described below.

[0015] The device 10 according to the present invention comprises an actuator positioned in such a way as to actuate the rotation of the arm 44 relative to one of the two supports 18, 20 around the axis of rotation 30 or 40. An advantageous arrangement of said actuator shall be described below. However, the present invention is not limited to the use of an actuator arranged as described below. The invention may use any actuator able to command a rotation movement of the arm 44 around the axis 30 and 40, such as a rotating actuator positioned coaxially to one of the hubs 22 or 32.

[0016] According to a preferred embodiment of the present invention, the actuator which commands the rotation of the arm 44 is a linear actuator 66, preferably constituted by a telescopic hydraulic cylinder, positioned with its own axis parallel to the axis of the arm 44. The actuator 66 comprises a body 68 and a stem 70, one of which is fastened to the arm 44 and the other one is fastened to the flexible elements 54. In the illustrated example, one end of the stem 70 is fastened to a block 72 fastened on an external surface of the arm 44. To the body 68 of the hydraulic cylinder 66 are fastened two flanges 74, 76. One end of each chain segment 56 is fastened to the first flange 74 and one end of each chain segment 58 is fastened to the second flange 76. The distance between the flanges 74, 76 is fixed and invariable so that from the operative viewpoint it is as if the ends of the two chain segments 56, 58 were fastened directly to each other and to the body 68.

[0017] With reference to Figures 1 through 4, the illustrated arrangement is such that, by varying the extension of the hydraulic cylinder 66, a rotation of the arm 44 around the axis 30 of the support 18 is commanded. During the rotation of the arm 44 around the axis 30 of the first support 18, a rotation of the second support 20 relative to the arm 44 around the axis 40 is simultaneously obtained. The rotation of the second support 20 relative to the arm 44 has an equal amplitude and an opposite direction to the rotation of the arm 44 relative to the first support 18.

[0018] Therefore, the device 10 allows to move the implement fastened to the second support 20 maintaining said implement constantly parallel to itself. This characteristic is particularly advantageous in the case of an aerial platform 12. The device 10 allows to move the platform as shown schematically in Figures 1 through 4 without moving the telescopic arm 14 and maintaining the platform with its own base surface constantly horizontal.

[0019] The device 10 according to the present inven-

tion allows to obtain angles of rotation of the arm 44 even exceeding 180°. A great advantage is the linearity of manoeuvre due to the fact that the torque applied by the cylinder 10 to the arm 44 is constant, regardless of the angular position of the arm 44. This allows to obtain an extreme manoeuvrability and considerable sensitivity of displacement in any position of the arm, even when the arm operates in the vicinity of its end of travel positions. Moreover, the ratio between the angular velocity of the arm 44 and the linear velocity of the actuator 66 remains constant in every operative position.

[0020] An additional advantageous aspect of the present invention consists of the possibility of anchoring the flexible hoses for carrying oil, water, electrical signals, etc. to the implement 12 directly to the transmission members 54. More specifically, the flexible hoses can be fastened to brackets directly connected to the two adjustable tie rods 64 constituted by steel round rods. This arrangement enables to solve a considerable problem present on all machines provided with flexible hoses, which in the presence of relative motions between different parts of the structures typically generate disorder and critical points for the emergence of wear phenomena or of localised ruptures. If the flexible hoses are anchored in the points in which the chains 58 are anchored to the support drums 26, 36, a path with constant length to pass from the machine to the basket will be obtained. Moreover, the movement of the flexible hoses will be a simple winding-unwinding on "ideal" drums with a diameter equal to that of the support drums 26, 36 of the chains 58.

Claims

1. A device for moving an implement, **characterised in that** it comprises:

- a first and a second support (18, 20),
- an arm (44) mounted rotatable relative to a first support (18) around a first axis (30) and rotatable relative to the second support (20) around a second axis (40) parallel to the first axis (30),
- at least one flexible element (54) fastened to the first and to the second support (18, 20) and co-operating with a first and with a second winding surface (28, 38) integral respectively with the first and with the second support (18, 20), and
- an actuator (66) positioned to command a rotation of the arm (44) relative to one of said supports (18, 20).

2. Device as claimed in claim 1, **characterised in that** each of said supports (18, 20) comprises two drums (26, 36) provided with respective winding surfaces (28, 38) co-operating with respective flexible elements (54).

3. Device as claimed in claim 2, **characterised in that**

each of said flexible elements (54) comprises two chain segments (56, 58) each of which is fastened in one point to a respective winding surface (28, 38).

4. Device as claimed in claim 1, **characterised in that** 5
each of said supports (18, 20) comprises a respective cylindrical hub (22, 32) coaxial to the respective winding surface (28, 38).
5. Device as claimed in claim 1, **characterised in that** 10
said actuator (66) is a telescopic linear actuator including two elements (68, 70) telescopically slidable relative to one another, a first of which (70) is fastened to the arm (44) and a second of which (68) is fastened to said flexible element (54). 15
6. Vehicle with telescopic lifting arm (14) bearing an aerial platform (12), **characterised in that** it comprises a device as claimed in one or more of the previous claims interposed between the telescopic lifting arm (14) and the aerial platform (12). 20
7. Vehicle as claimed in claim 6, **characterised in that** it comprises flexible hoses for feeding the implement (12), anchored directly to said transmission members (54). 25

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FIG. 1

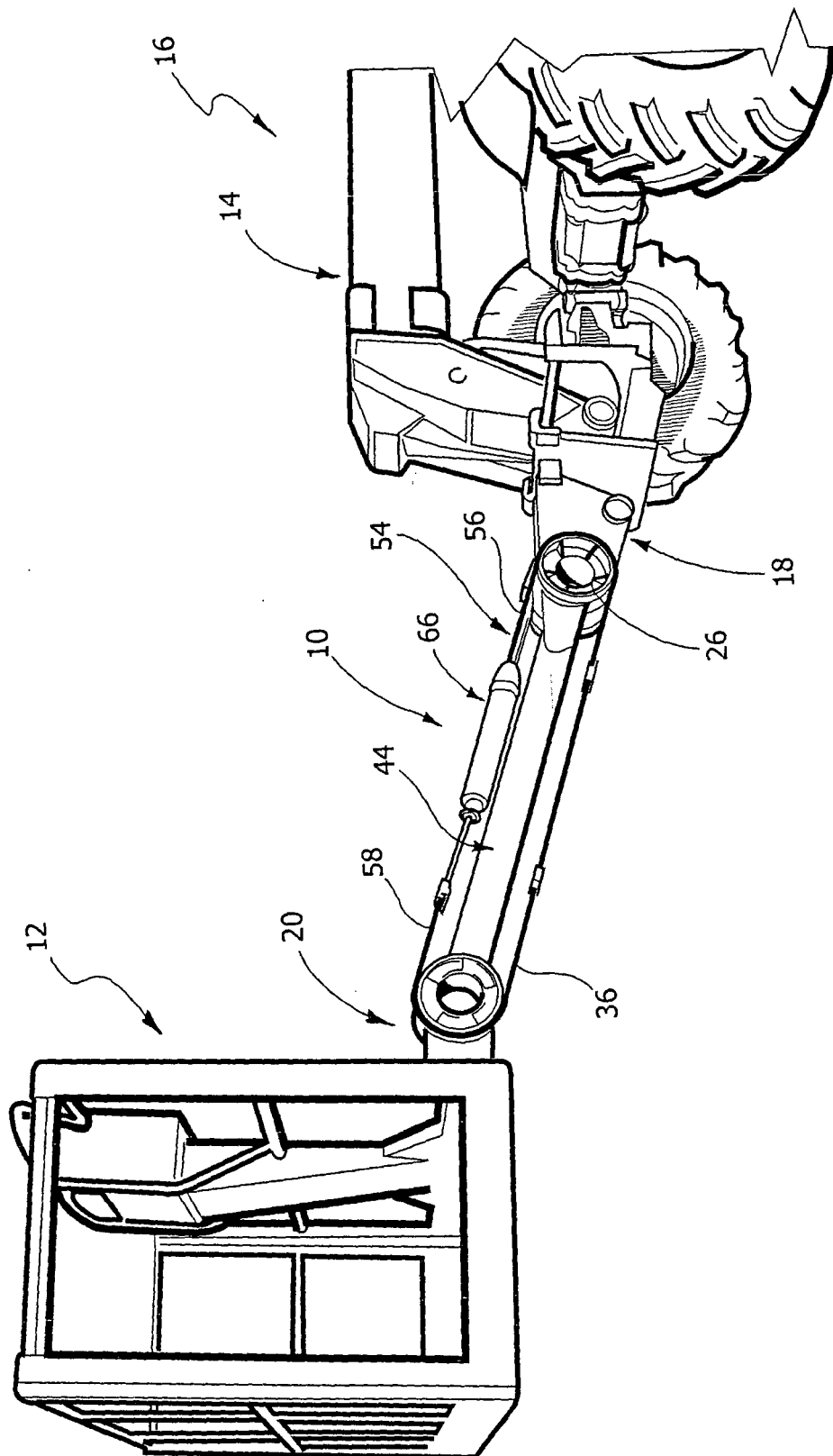


FIG. 2

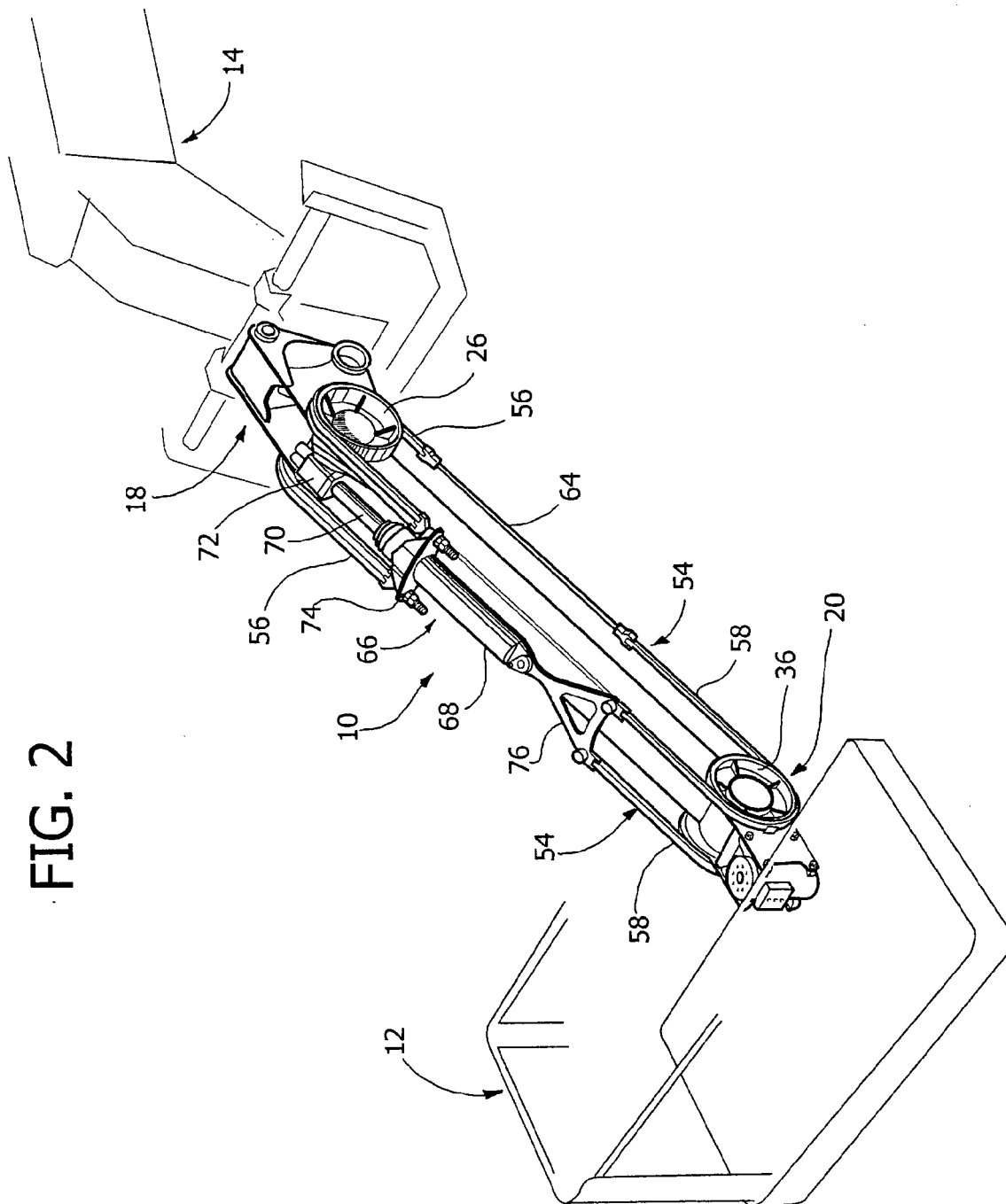


FIG. 3

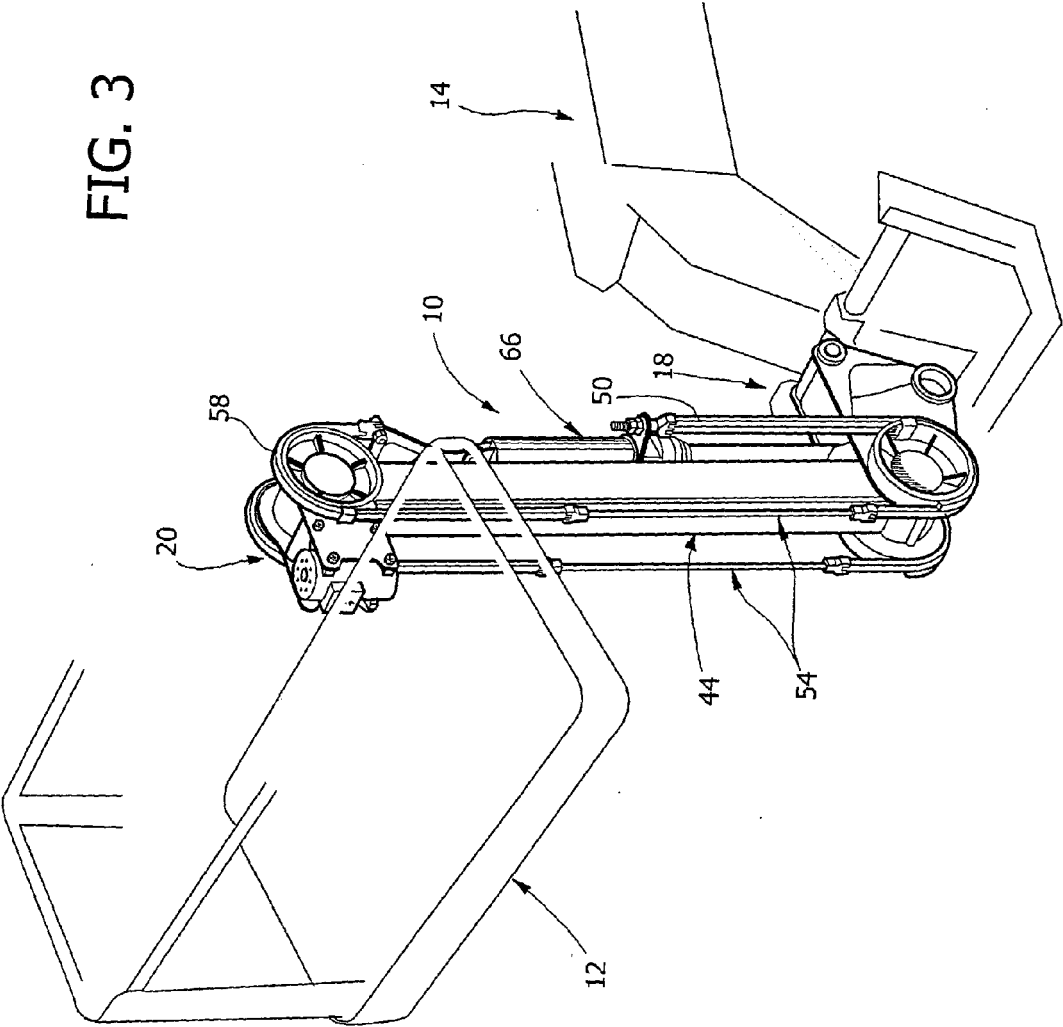


FIG. 4

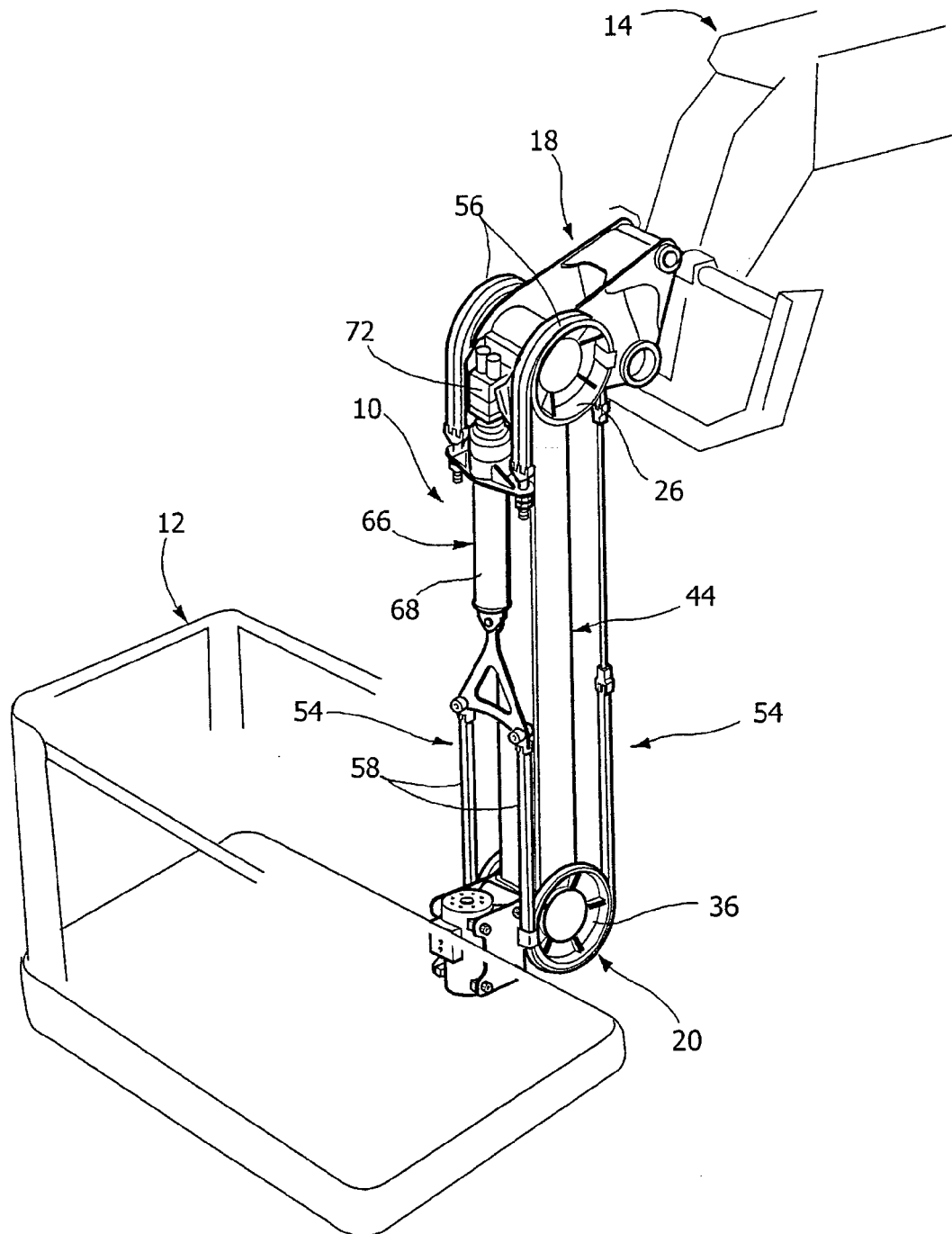
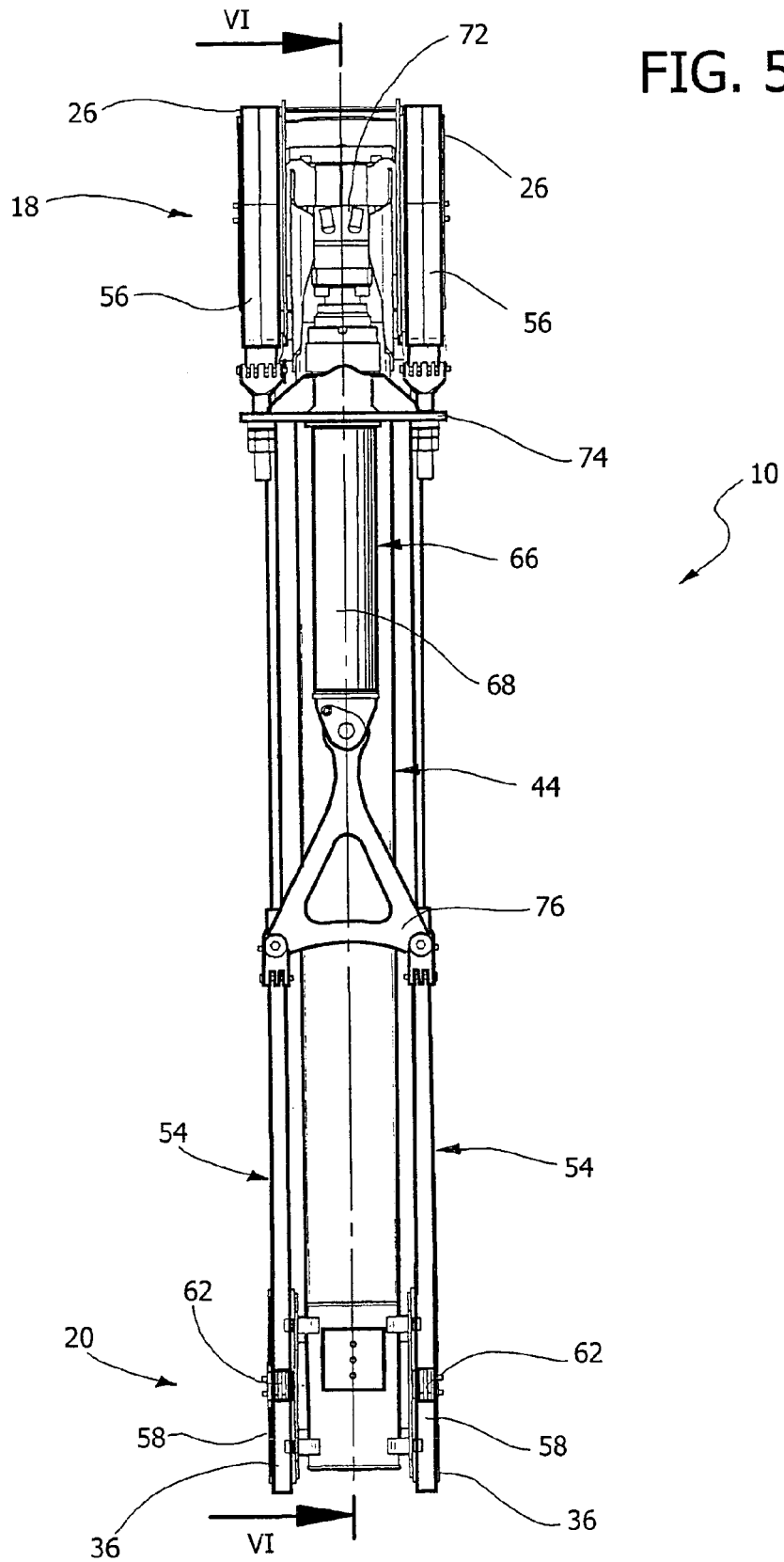


FIG. 5



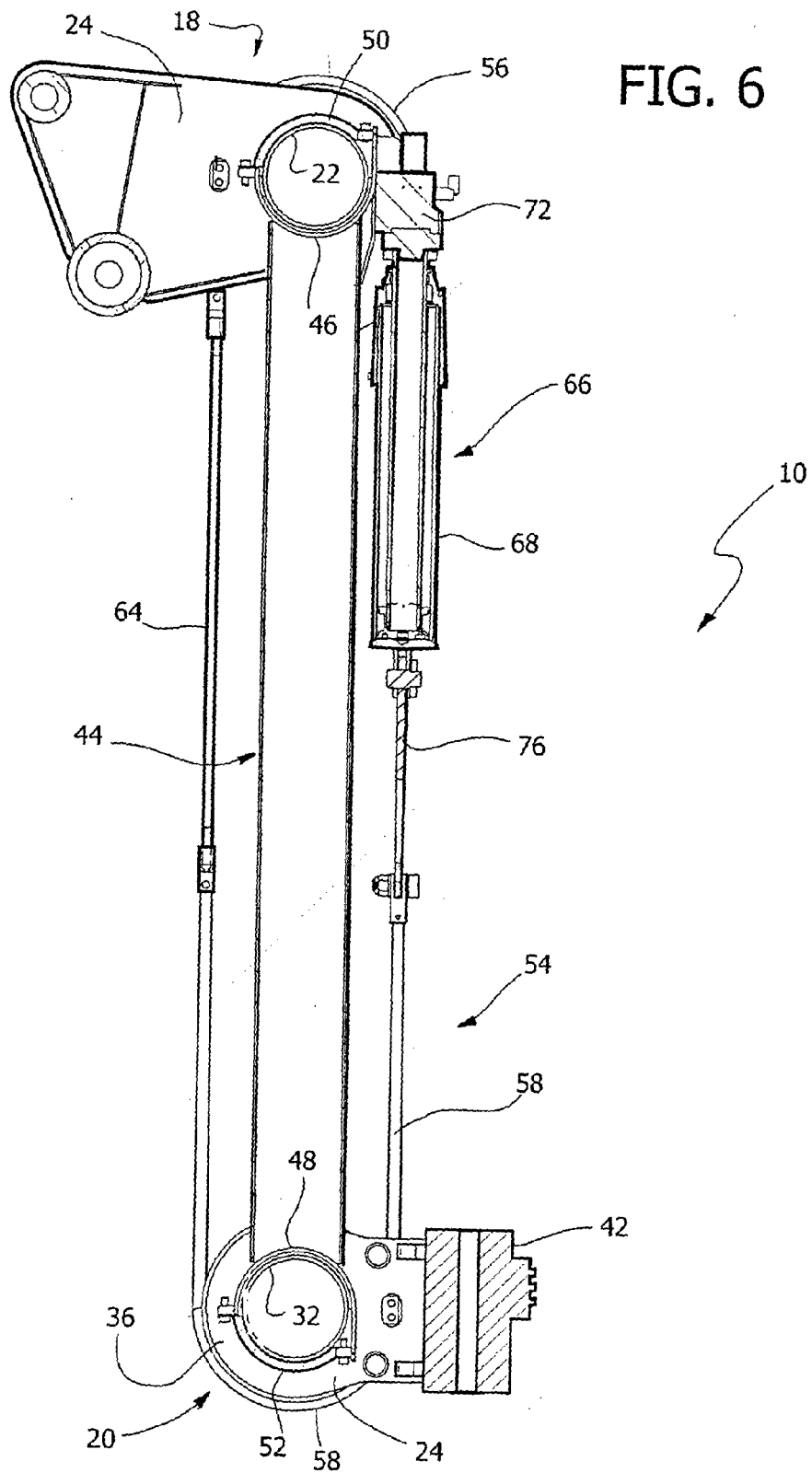
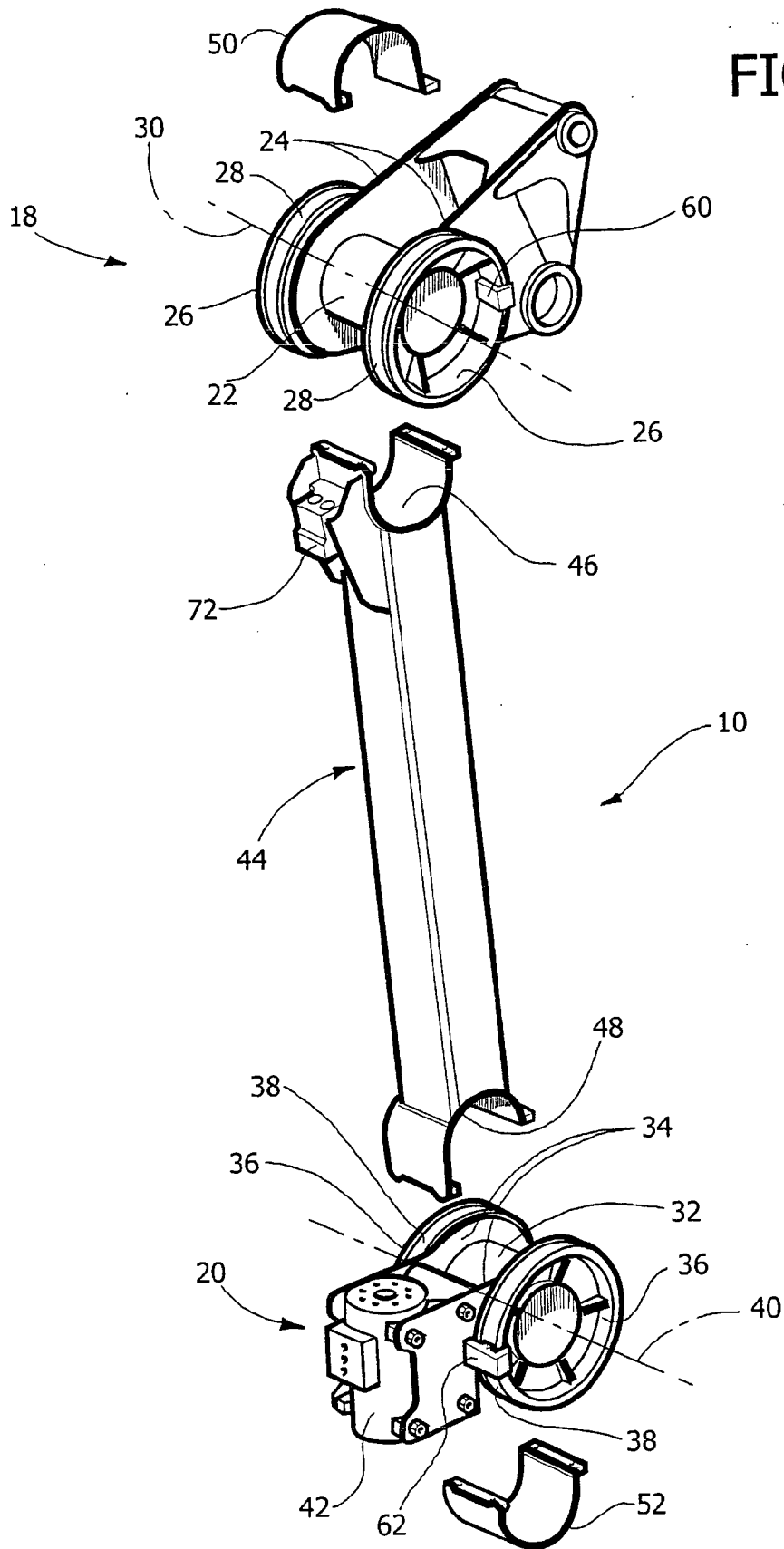


FIG. 6

FIG. 7





European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 04 42 5939

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.7)
X	US 6 547 217 B1 (DYGERT OLEN DEAN) 15 April 2003 (2003-04-15) * column 2, line 65 - column 4, line 24; figure 2 *	1,3,4,6,7	B66F11/04 B66F9/065
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			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			B66F E02F
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 13 May 2005	Examiner Blumenberg, C
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	

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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13-05-2005

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