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Remarks:
Amended claims in accordance with Rule 86 (2) EPC.

(54) Crapple assembly for a hydraulic arm of an working vehicle

(57) A clamping device for an hydraulic arm of a working vehicle to seize and manipulate an object, of the type connectable to the end of an articulated arm of a working vehicle by means of connecting means through a hydraulic oil supply and electrical current.
characterized in that said clamping device includes:

a) an arm (B);
b) a forearm (AB) articulated to the first arm by means of lateral hinging (12), said forearm being inclinable up to 90° by means of an internal oleodynamic cylinder (49);
c) a clamping jaw unit (GP) articulated outside the end of said forearm (AB) and involving three jaws (20a,20b,20c) with respective operating oleodynamic cylinders (14);
d) said arm (B) involving a first rotational device (DR1) with first fluid motor (9) that transmits the external tangential continuous screw motion (7) geared on the crown gear (56) of said arm (B), in order to rotate said rotating internal box (46) with respect to the respective connecting means to the articulated arm of the working vehicle;
e) said forearm (AB) comprising a second rotational means (DR2) to rotate said clamping jaw unit (GP) with respect to said forearm (AB) by means of a second internal fluid motor (42) and an axial reducer (15);
f) a first and a second electrovalve (11,17) to operate the respective double two way oleodynamic movement members of said arm (B).
the first fluid motor (9), the internal angulation hydraulic cylinder (49) and the three hydraulic cylinders (14) to operate the clamping jaws (20a,20b,20c), said hydraulic cylinders (14) being operated by a second fluid motor (42) in connection with a third electrovalve (43), and
g) first and second brush electric switches for a rotating contact (SW1,SW2) for said second electrovalve (17) and the third electrovalve (43).

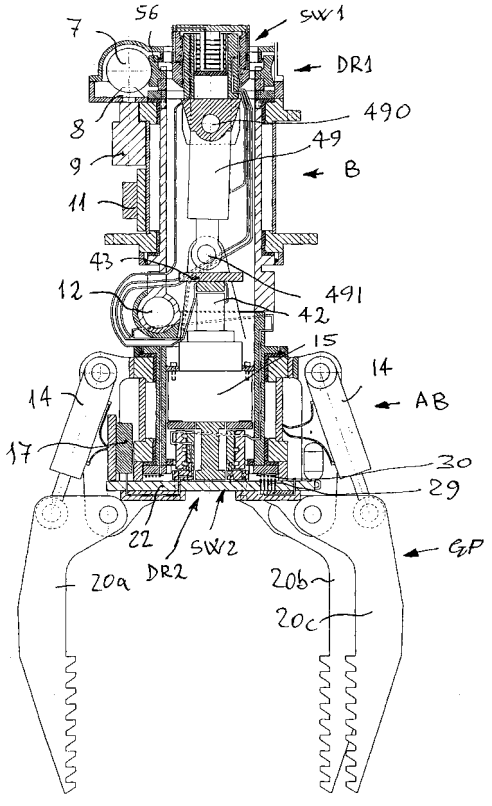


FIG.1

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Description

Object

[0001] This invention refers to a movable clamping device for a hydraulic arm of a working vehicle as in the characteristics of the pre-characterizing part of the main claim.

[0002] The working vehicle with said movable clamping unit is also part of the present invention.

Technical Field

[0003] The technical field refers to the manipulation of large blocks or heavy objects.

Background Art

[0004] In the prior art the need to manipulate very heavy objects, such as for example large stone blocks, or any other object is known.

[0005] At present this is carried out by means of traditional lifting, manipulation and positioning machines that, however, do not generally dispose of suitable and versatile means for the complete movement of the block.

[0006] The use of moving means is complex and implies high manufacturing costs.

[0007] Moreover, the moving means that can be attached to the end of an arm, for example, of a self-propelled machine are not usually autonomous or equipped with all possible movement to manipulate an object.

Aim of the Present Invention

[0008] The aim of the present invention is to avoid the above-mentioned drawbacks and allow the production of a universal hydraulic clamping unit capable of being readily connected to the end of an arm of a self-propelled machine, such as an excavator, for example by simply removing its end bucket and replacing it with said clamping unit by means of rapid hydraulic connections prearranged for automatic coupling and electric current connection supplied by the excavator.

Disclosure of the Invention

[0009] The problem is solved with the characteristics of claim 1.

[0010] The dependent claims refer to the preferred solutions.

Advantages

[0011] In this way the advantage of having a universal clamping device is obtained:

readily attachable and detachable from the end of the hydraulic arm of the self-propelled working vehicle;

can be oriented like a hand both in 360° rotation as well as flexible like a hand and also rotary when folded up to 90°, disposing of two rotation systems, one for the respective support and one for the respective clamping unit independent of its angular position.

[0012] The arm movement is possible thanks to the cylinder that before allowed till 180° prior rotational movement.

In this way, it is therefore possible to seize, raise, rotate, incline and further rotate the gripper allowing any form of manipulation of the heavy block seized between the jaws of the gripper.

Description of a Preferred Embodiment

[0013] The clamping device according to the present invention will be better understood in its structure with the aid of the enclosed figures reporting a preferred embodiment, wherein:

- Fig. 1 represents schematically in axial section the clamping unit of the present invention;
- Fig.2 represents the same section as in Fig.1 but with all the numeral references detailing constructive details;

Fig.3 represents the schematic view of the support carrying the clamping unit that allows the connection and mechanical locking to the arm of the self-propelled machine, not illustrated.

Fig.4 represents a stirrup connected to pa device (2) for moving, being supported 63 that does not allow rotation of part 4 and part 61.

Fig. 5 represents the stirrup applied to hydraulic stator 36 and with the elongated part supported by 40, having the possibility to move and do not allowing rotation of the hydraulic stator.

Detailed Description of the Clamping Device as in the Figures

[0014] As disclosed in Figure 1, the clamping device essentially includes mechanical attaching means of its bearing structure (not illustrated) at the end of an articulated arm of a working vehicle (not illustrated) and attaching means of the respective hydraulic pipes for sending hydraulic oil to the clamping unit and electrical attaching means for the control of the respective electro-valves that actuate the hydraulic circuits of said clamping unit.

Main structure of the Clamping Device

[0015] The clamping unit includes a bearing structure that includes a connection with a first fluid motor (9) with conical pinion gear (8) for a gear wheel with worm screw (7) that gears on a crown gear (56) forming a rotational

device (DR1) to rotate the whole main arm (46) that includes the clamping unit (at least for 360°), the assembly being covered with a support flange (51) and external protection cover with protection box containing an internal box (47) within which an internal double-acting oleodynamic cylinder (49) is housed, whose shaft end is hinged (491) to a forearm (AB) that rotates with it.

[0016] Said forearm (AB) is hinged laterally (12) at the end of the arm (B) and therefore the cylinder (49), hinged internally to the arm (490), can rotate said forearm (AB) angularly by at least 90°.

[0017] The hinging end of the shaft of the hydraulic cylinder (491) is hinged to the top of the internal support (40) of said forearm (AB), in this way making it rotate angularly.

[0018] Under the pivoting plate and support (40) of the forearm (AB) there is a second fluid motor (42) that transmits the motion by means of an axial reducer (15)
to the clamping unit (GP) that includes three opposing jaws (20a-20b-20c).

[0019] In this way the clamping unit (GP) can rotate at least for 360° and beyond, with respect to the forearm (AB), also when said forearm (AB) is rotated at an angular incline with respect to the arm (B).by means of said hydraulic piston (49).

[0020] Furthermore, the jaws (20a-20b-20c) of the clamping unit (GP) can be operated independently on said forearm (AB) by means of the activation of three respective oleodynamic cylinders (14).

[0021] The upper electric rotary switch system (1, 62, ...) allows the control of the respective two way electro-valve by electric rotating switch (43) which electric connections arrive also at the lower valve (17).

[0022] The end electric rotary switch system (24-30) similarly allows the control of the respective second electro-valve (43) that in turn controls the flow of the oil to the different devices of the second fluid motor (42), (said fluid motor acting on 22, 23, 24, 25, 26, 27, 28, 29, 34,38). The operation of the hydraulic cylinder (14) is allowed by electromagnetic valve (17).

[0023] It is understood in this way that the clamping unit of this invention is perfectly orientable in all directions in order to manipulate a heavy block as desired.

[0024] The constructive details are not shown, as they are adoptable by any individual skilled in this area.

[0025] In the following, the numeral references of the most important features of the structure of the clamping unit are reported in detail.

[0026] Advantageously, said arm (B) is covered with an external box (47) and an internal box (46) in which the external box is not rotary while on the contrary the internal box (46) is rotary and includes said internal angulation hydraulic cylinder (49).

[0027] With the help of the cylinder (49) supported by (40) with the intermediation of bearing (491), it is allowed the 90° rotation of the AB structure on the bearing (12). Reducer (15) is fixed into the internal structure (40), in which are mounted the second hydraulic motor (42) and the hydraulic valve (43) that allow 360° rotation of GP structure and the hydraulic cylinder support.

REFERENCE

[0028]

1 Electric rotating brushes
2 Cover
3 First electric cable
4 Hydraulic stator
5 Hydraulic oil channel
6 Hydraulic cylinder base
7 Worm
8 conical gear
9 First fluid motor
10 Second electric cable for hydraulic valve activation
11 Two way electro-valve for hydraulic motor 9 and hydraulic cylinder 49
12 Pivot for jaw rotation
13 Support for two reducers
14 Hydraulic cylinder
15 Second fixed reducer
16 Rotating reducer
17 Third hydraulic valve
18 Hydraulic channel that carries to the electro-hydraulic valves 17
19 Hydraulic duct support
20a Jaw 1
20b Jaw 2
20c Jaw 3
21 Support connecting 23 with 22
22 Rotating clamp unit support
23 Rotating axle shaft
24 Hidraulic rotor
25 Screw M12 for fixing the hydraulic oil dispenser
26 Lubrication O'ring seal-gasket
27 Screw M14 for hydraulic oil dispenser fixing
28 Electric cable support
29 Arcuate electric contacts for brushes
30 Plate for electric contacts
31 Lubrication sealing-gasket
32 Hydraulic accumulator (with the locking valve, operates on cylinder (14) and consequeently operates the clamping device (20a)).
33 Lubrication sealing-gasket
34 Bronze bearing
34a Bronze bearing
35 Hydraulic-oil sealing gasket
36 Dispenser stator
37 Reducer fixing screw
38 Support for hydraulic cylinder and jaw unit
39 Lubrication sealing-gasket
40 Non-rotating static bushing
41 Hose-pipe
42 Second fluid motor
43 Bi-directional hydraulic valve for 42

44 Lubrication sealing-gasket
45 Bronze bearing
46 Rotating internal box
47 Fixed external box
48 Flexible hydraulic pipes to the dispenser 24-26-21
49 Internal hydraulic cylinder
50 Hydraulic ram hydraulic support
51 External flange to support the internal arm unit
52 Bronze bearing
53 Steel support of bronze bearing
54 Gasket for tightness against water and dust
55 Screw M16 to fix rotating group
56 Gearing crown
57 Lubricating seal
58 Hydraulic rotor
59 Seal for 58
60 Hydraulic oil channel
61 Rotating part of electric rotating switch
62 Fixed part of electric rotating switch
63 Support for external box 47 (on the support (51) and bearing support (45) is screwed the support structure (63). The support structure (63) allows fixing the arm in movbable way by the operating machine in which was previously applied a bucket: the cylinder that previously operate the bucklet, now allows to move the arm of the present device for the movement of the pieces to be moved till 180°).
64 Lower fork
65 Upper fork

Claims

1. Movable clamping device for the hydraulic arm of a working vehicle to seize and manipulate an object, of the type connectable to the end of an articulated arm of a working vehicle by means of connecting means through a hydraulic oil supply and electrical current,
characterized in that said clamping device includes:

a) an arm (B);
b) a forearm (AB) articulated to the first arm by means of lateral hinging (12), said forearm being inclinable up to 90° by means of an internal oleodynamic cylinder (49);
c) a clamping jaw unit (GP) articulated outside the end of said forearm (AB) and involving three jaws (20a,20b,20c) with respective operating oleodynamic cylinders (14);
d) said arm (B) involving a first rotational device (DR1)) with first fluid motor (9) that transmits the external tangential continuous screw motion (7) geared on the crown gear (56) of said arm (B), in order to rotate said rotating internal box (46) with respect to the respective connecting means to the articulated arm of the working vehicle;
e) said forearm (AB) comprising second rotational means (DR2) to rotate said clamping jaw unit (GP) with respect to said forearm (AB) by means of a second internal fluid motor (42) and axial reducer (15);
f) first and second electro-valve means (11,17) to operate the respective double two way oleodynamic movement members of said arm:

- first fluid motor (9) and internal angulation hydraulic cylinder (49) and

hydraulic cylinders (14) to operate clamping jaws (20a,20b.20c), said hydraulic cylinders being operated by a second fluid motor (42) in connection with electrovalve (43).
g) first and second brush electric switches for rotating contact (SW1, SW2) for said second electro-valve means (17) and electro valve (43).

2. Clamping device according to claim 1, **characterized in that** said arm (B) is covered with an external box (47) and an internal box (46) in which the external box is not rotary while its internal box (46) is rotary and includes said internal angulation hydraulic cylinder (49).

3. Clamping device according to claim 1, **characterized in that** in a similar way said forearm includes an external box (38) articulating said clamping jaw unit (14, 20a,20b,20c) that rotates with bearings (34, 34a) on an internal box (40) that internally supports at the end of the piston rod (491) of said internal hydraulic cylinder (49) that downwardly supports the axial reducer (15) to provide the rotation to said clamping jaw unit (GP) with external connection (22).

Amended claims in accordance with Rule 86(2) EPC.

1. Clamping device for an hydraulic arm of a working vehicle to seize and manipulate an object, of the type connectable to the end of an articulated arm of a working vehicle by connecting means through a hydraulic oil supply and electrical current, of the type having a rotational hydraulic clamping jaw, **characterized in that** said clamping device includes:

a) an arm (B);
b) a forearm (AB) articulated to the first arm by means of lateral hinging (12), said forearm being inclinable up to 90° by means of an internal oleodynamic cylinder (49);
c) a clamping jaw unit (GP) articulated outside the end of said forearm (AB) and involving three jaws (20a,20b,20c) each jaw having respectively an operating oleodynamic cylinder (14);
d) said arm (B) involving a first rotational device

(DR1)) with first fluid motor (9) that transmits the external tangential continuous screw motion (7) geared on the crown gear (56) of said arm (B), in order to rotate said rotating internal box (46) with respect to the respective connecting means to the articulated arm of the working vehicle;
e) said forearm (AB) comprising second rotational means (DR2) to rotate said clamping jaw unit (GP) with respect to said forearm (AB) by means of a second internal fluid motor (42) and axial reducer (15);
f) a first and a second electro-valve (11,17) to operate the respective double two way oleodynamic movement members of said arm (B):

i) the first fluid motor (9),
ii) the internal angulation hydraulic cylinder (49) and
iii) the three hydraulic cylinders (14) to operate the clamping jaws (20a,20b.20c), said hydraulic cylinders being operated by a second fluid motor (42) in connection with a third electrovalve (43), and

g) first and second brush electric switches for a rotating contact (SW1, SW2) for the second electro-valve (17) and the third electro valve (43).

2. Clamping device according to claim 1, **characterized in that** said arm (B) is covered with an external box (47) and an internal box (46) in which the external box is not rotary while its internal box (46) is rotary and includes said internal angulation hydraulic cylinder (49).

3. Clamping device according to claim 1, **characterized in that** said forearm includes an external box (38) articulating said clamping jaw unit (14, 20a,20b,20c) that rotates with bearings (34, 34a) on an internal box (40) that internally supports at the end of the piston rod (491) of said internal hydraulic cylinder (49) that downwardly supports the axial reducer (15) to provide the rotation to said clamping jaw unit (GP) with external connection (22).

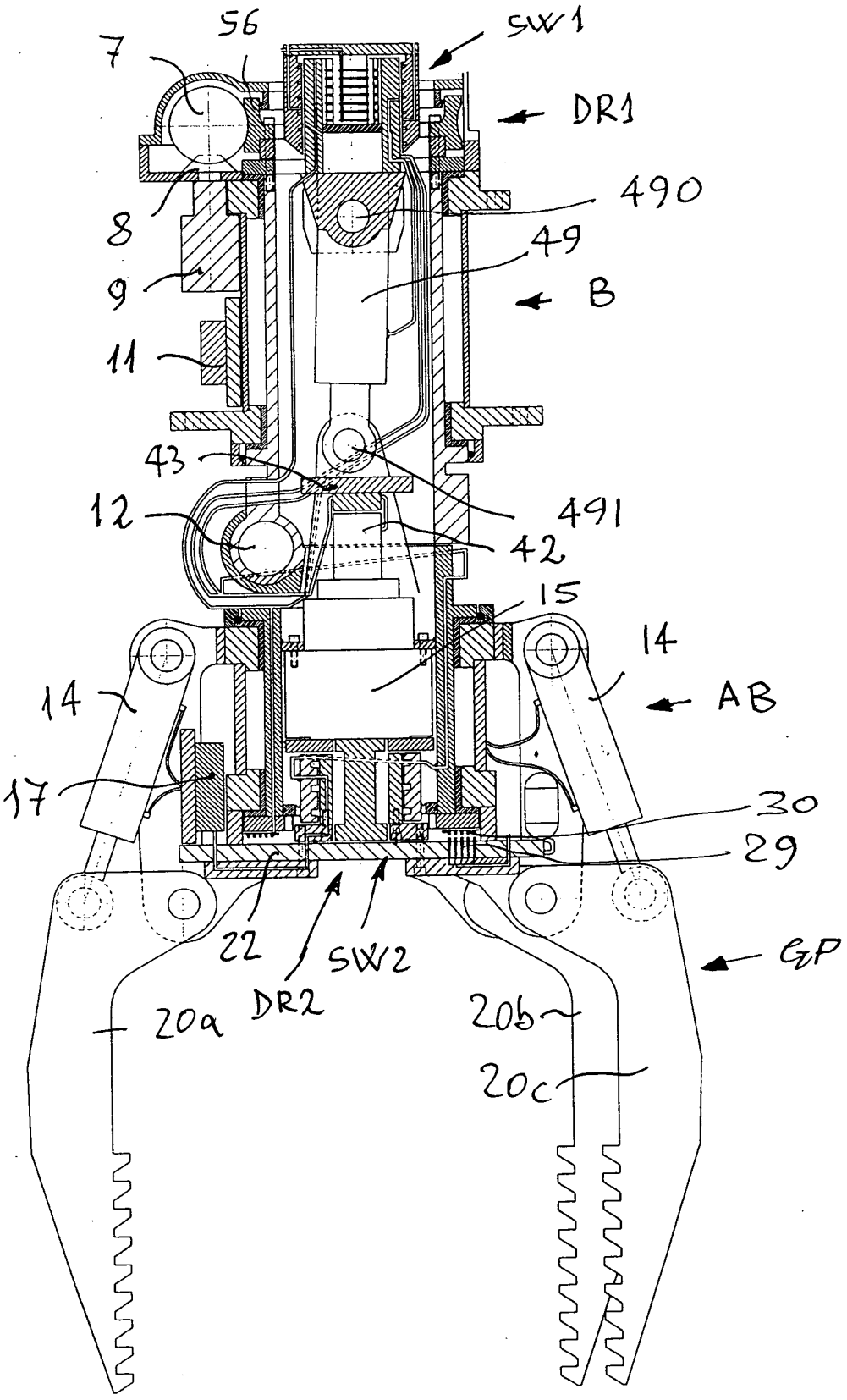

56
SW1
7
DR1
490
8
49
9
B
11
43
491
12
42
15
14
14
AB
17
30
29
22
SW2
GP
DR2
20a
20b
20c

FIG.1

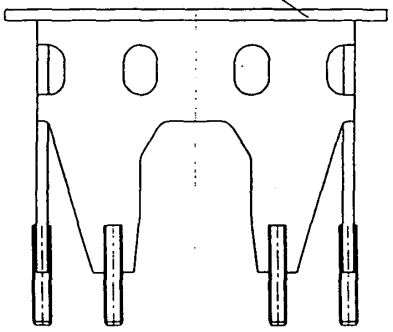


FIG.3

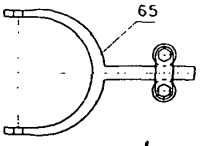


Fig.4

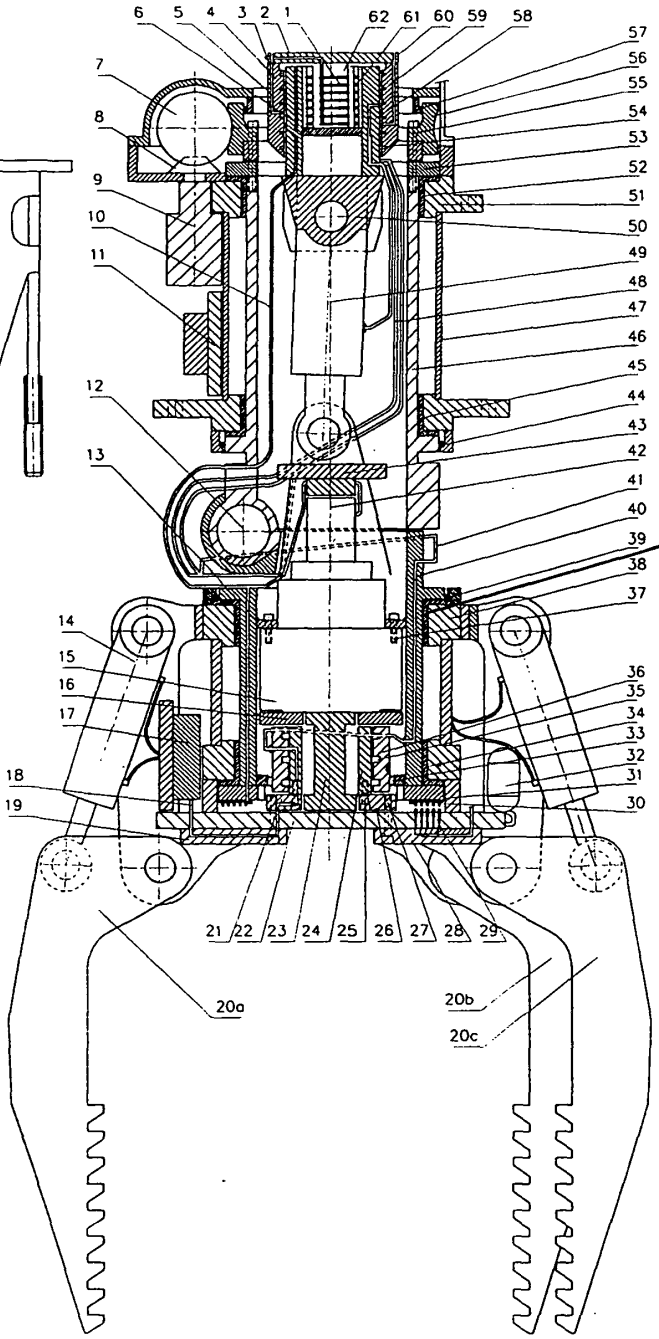


FIG.2

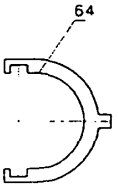


Fig.5

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 04 01 8326

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)
A	US 4 426 110 A (MITCHELL JOHNNY D ET AL) 17 January 1984 (1984-01-17) * figures *	1	B66C1/44 B66C3/00 E02F3/96
A	US 4 005 895 A (CULLINGS HAROLD L) 1 February 1977 (1977-02-01) * figures 1,3 *	1	
A	US 4 542 929 A (POSSINGER WARREN K) 24 September 1985 (1985-09-24) * figures 1,5 *	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.7)

B66C
E02F
E04G

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	5 October 2004	Masset, M

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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05-10-2004

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