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(71) Applicant: **He, Qinghua**
Changsha
Hunan (CN)

(72) Inventor: **He, Qinghua**
Changsha
Hunan (CN)

(74) Representative: **Hudy, Ludwik**
Kancelaria Patentowa Patelha
Czernichow 4
32-070 Czernichow, Krakow (PL)

(54) **Hydraulic lock**

(57) A hydraulically-controlled lock apparatus for a hydraulic excavator is disclosed. The apparatus includes a first main pump (6), a second main pump (5), a main control valve (8), a first travel motor (1), a second travel motor (2), and a hydraulic fluid reservoir (4). The hydraulic circuits from the first main pump (6) and the said second main pump (5) to the main control valve (8) are connected respectively to the two entrances of a hydraulic unloading valve. The exit of the hydraulic unloading valve is connected to the hydraulic fluid reservoir (4). The hydraulic unloading valve is a logic unloading valve (3), or a 2/2 way unloading valve (9), or a pilot hydraulically-controlled unloading valve (10). The hydraulically-controlled lock apparatus disclosed by the present invention while effectively reducing the loss of fluid return pressure of the hydraulically manipulating valve, features simple structure, easy manipulation, reliable operation, and a high price to performance ratio.

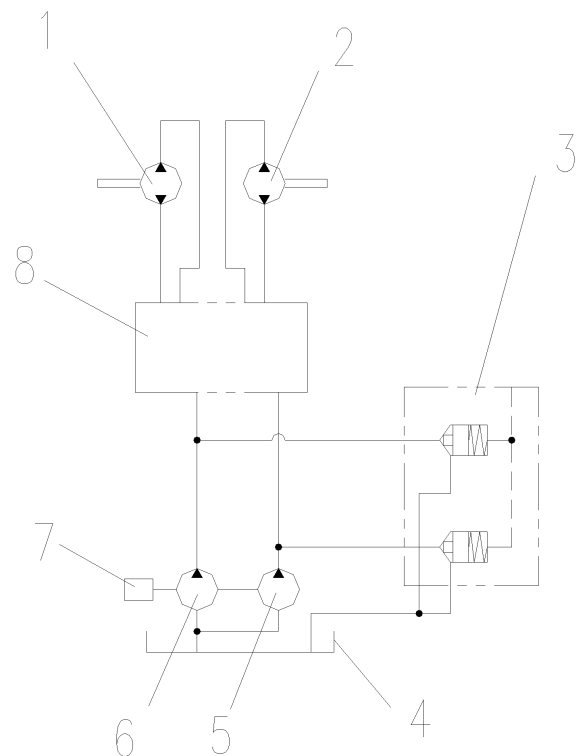


Fig. 1

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Description

[0001] This invention relates to a hydraulic excavator, and more particularly, to a hydraulically-controlled lock apparatus for a hydraulic excavator.

[0002] The travel of a hydraulic excavator is driven by a main pump that supplies power to a travel motor through a main control valve. As to the two work modes, the travel and stop of a hydraulic excavator are controlled by manipulating the main control valve through a mechanical lever. When the excavator is to be operated, the main control valve needs to be manipulated so as to connect the main pump with the travel motor, which supplies power to the travel motor, so as to realize a travel mode. When the excavator is to be stopped, the main control valve needs to be manipulated so as to disconnect the main pump with the travel motor to lose its power, and thus to realize a stop mode.

[0003] While the hydraulic excavator is in a stop mode, the travel mechanism must be locked to prevent the main pump from connecting to the travel motor, and thus to avoid any accidents. In conventional solutions, the lock of a travel mechanism is achieved by a mechanical lock apparatus to lock the mechanical lever, which then locks the main control valve, and finally locks the travel mechanism. However, this type of mechanical apparatus causes the loss of fluid return pressure of the hydraulic manipulating valve, and has the disadvantages of complicated configuration, difficult manufacture and maintenance, and overall high cost.

[0004] The objective of the present invention is to provide a hydraulically-controlled lock apparatus for the travel of a hydraulic excavator having the features of simple structure, easy manipulation, reliable operation, and high price to performance ratio, one which reduces effectively the loss of fluid return pressure of a hydraulic manipulating valve.

[0005] In accordance with one aspect of the present invention, a hydraulically-controlled lock apparatus for the travel of a hydraulic excavator is disclosed. The apparatus includes a first main pump, a second main pump, a main control valve, a first travel motor, a second travel motor, and a hydraulic fluid reservoir.

[0006] In one embodiment of the invention, the hydraulic circuits of said first and said second main pumps to said main control valve are connected to the entrances of the hydraulically-controlled unloading valve, and the exit of said unloading valve is connected to said hydraulic fluid reservoir.

[0007] In certain embodiments of the invention, said hydraulically-controlled unloading valve is a logic hydraulically-controlled unloading valve.

[0008] In certain embodiments of the invention, said hydraulically-controlled unloading valve is a 2/2 way hydraulically-controlled unloading valve.

[0009] In certain embodiments of the invention, said hydraulically-controlled unloading valve is a pilot hydraulically-controlled unloading valve.

[0010] For the hydraulically-controlled lock apparatus according to the present invention, when the travel mechanism is to be locked, a hydraulically-controlled unloading valve needs to be operated to unload the flow of the main pump to a hydraulic fluid reservoir, which enables a zero travel pressure, and thus a lock function. When the lock of the travel is to be disabled, said unloading valve needs to be operated to close the unloading path from the main pump to the hydraulic fluid reservoir to realize a normal travel.

[0011] One advantage of the present invention is that it provides a control apparatus having a simple structure and a reliable operation with fewer mounted components and a low malfunction rate.

[0012] The other advantage of the present invention is that it reduces the loss of fluid return pressure of the main pump when the travel of a hydraulic excavator is locked.

[0013] As a result, the hydraulically-controlled lock apparatus of the present invention is an apparatus with the features of simple structure, easy manipulation, reliable operation, and high price to performance ratio, which effectively reduces the loss of fluid return pressure of a hydraulic manipulating valve.

[0014] Many of the attendant advantages of the present invention will become more readily apparent and better understood as the following detailed description is considered in connection with the accompanying drawings in which:

FIG. 1 is a diagrammatic view of the hydraulically-controlled lock apparatus for the travel of a hydraulic excavator with a logic hydraulically-controlled unloading valve;

FIG. 2 is a diagrammatic view of the hydraulically-controlled lock apparatus for the travel of a hydraulic excavator with a 2/2 way hydraulically-controlled unloading valve; and

FIG. 3 is a diagrammatic view of the hydraulically-controlled lock apparatus for the travel of a hydraulic excavator with a pilot hydraulically-controlled unloading valve.

[0015] With reference to FIG. 1, a first main pump 6 and a second main pump 5 are driven by an engine 7. The main pumps 6 and 5 are connected respectively to a first travel motor 1 and a second travel motor 2 through a main control valve 8; the hydraulic circuits from the first and second main pumps 6 and 5 are also connected to entrance passages of a first logic unloading valve and a second logic unloading valve, 3, respectively. The exit passages of the first and the second unloading valves 3 are connected to a hydraulic fluid supply tank or a hydraulic fluid reservoir 4.

[0016] As shown in FIG. 1, when the hydraulic excavator is in motion, said logic hydraulically-controlled unloading valve 3 is turned off to close the unloading paths of said first and said second main pumps 6 and 5 to the

hydraulic fluid reservoir 4, and thus the hydraulic fluid passes from said main pumps 6 and 5 to the main control valve 8 to the first and the second travel motors 1 and 2 to realize normal travel. When the travel mechanism is to be locked, the logic hydraulically-controlled unloading valve 3 is turned on to unload the flow of the said first and second main pumps 6 and 5 through the logic hydraulically-controlled unloading valve 3 to the hydraulic fluid reservoir 4, which results in a zero hydraulic pressure to the said travel motors 1 and 2, and causing their stop, and thus a lock function.

[0017] The term "unloading valve" as used herein, refers to a pressure control valve used to unload a pump and save energy when hydraulic fluid flow is not required. Unloading valves direct pump output flow directly to the hydraulic fluid reservoir at low pressure after system pressure has been reached. When the hydraulic system requires full fluid flow, fluid under pressure passes through the valve for discharge to the hydraulic system. When the system does not require full fluid flow, the excess fluid is automatically discharged from the unloading valve to the hydraulic fluid reservoir.

[0018] In certain embodiments of the invention described herein, the unloading valve is a logic valve or a 2/2-way valve or a pilot valve. Logic valves or 2/2-way valves, also known as cartridge valves, have two functional ports. A pilot pressure hydraulically controls the flow path between the two connections. The logic valve has a poppet sleeve which remains in closed position with the help of a spring. A well seated cone of the poppet valve provides nearly zero leakage state across two ports of the valve. The control cover provides pilot connections, and it also encloses the cartridge valve. A direct control can be provided to the cartridge valve by mounting different types of pilot controls to the adjacent manifold face or to the control cover. The direct control of the cartridge valve's switching function can be achieved by using a pilot valve. This control is either between open or closed positions, two extreme positions or intermediate positions.

[0019] With reference to FIG. 2, a first main pump 6 and a second main pump 5 are driven by an engine 7. The main pumps 6 and 5 are connected respectively to a first travel motor 1 and a second travel motor 2 through a main control valve 8; the hydraulic circuits from the first and second main pumps 6 and 5 are also connected to entrance passages of a first 2/2-way unloading valve and a second 2/2-way unloading valve, 9, respectively. The exit passages of the first and the second unloading valves 9 are connected to a hydraulic fluid reservoir 4.

[0020] Similarly, with reference to FIG. 3, a first main pump 6 and a second main pump 5 are driven by an engine 7. The main pumps 6 and 5 are connected respectively to a first travel motor 1 and a second travel motor 2 through a main control valve 8; the hydraulic circuits from the first and second main pumps 6 and 5 are also connected to entrance passages of a first pilot unloading valve and a second pilot unloading valve, 10,

respectively. The exit passages of the first and the second unloading valves 10 are connected to a hydraulic fluid reservoir 4.

[0021] As shown in FIG. 2 or FIG. 3, when the travel mechanism is to be locked, the 2/2-way hydraulic unloading valve 9 or the pilot hydraulically-controlled unloading valve 10, respectively, are operated to unload the flow of said first and second main pumps 6 and 5 to the hydraulic fluid reservoir, which enables a zero travel pressure and thus allows to realize a lock function. When the lock of the travel manipulation is to be disabled, said unloading valves 9 or 10 are operated to close the unloading paths from the first and second main pumps 6 and 5, and thus to realize normal travel.

[0022] The invention has been described with reference to the preferred embodiments. It is intended that the invention be construed as including all the applications of the hydraulically-controlled unloading valve to unload the flow of a main pump to a hydraulic fluid reservoir to realize a lock function insofar as it comes within the scope of the appended claims or the equivalents thereof.

Claims

1. A hydraulically-controlled lock apparatus for the travel of a hydraulic excavator comprising:

- a first main pump (6);
- a second main pump (5);
- a main control valve (8);
- a first travel motor (1);
- a second travel motor (2);
- one or more hydraulically-controlled unloading valves (3, 9, 10); and
- a hydraulic fluid reservoir (4),

wherein

said first and second main pumps (6) and (5) are connected to said one or more hydraulically-controlled unloading valves (3, 9, 10); and said one or more hydraulically-controlled unloading valves (3, 9, 10) are connected to said hydraulic fluid reservoir (4).

2. The hydraulically-controlled lock apparatus as claimed in claim 1, wherein said hydraulically-controlled unloading valves are logic unloading valves (3).

3. The hydraulically-controlled lock apparatus as claimed in claim 1, wherein said hydraulically-controlled unloading valves are 2/2-way unloading valves (9).

4. The hydraulically-controlled lock apparatus as claimed in claim 1, wherein said hydraulically-con-

trolled unloading valves are pilot unloading valves
(10).

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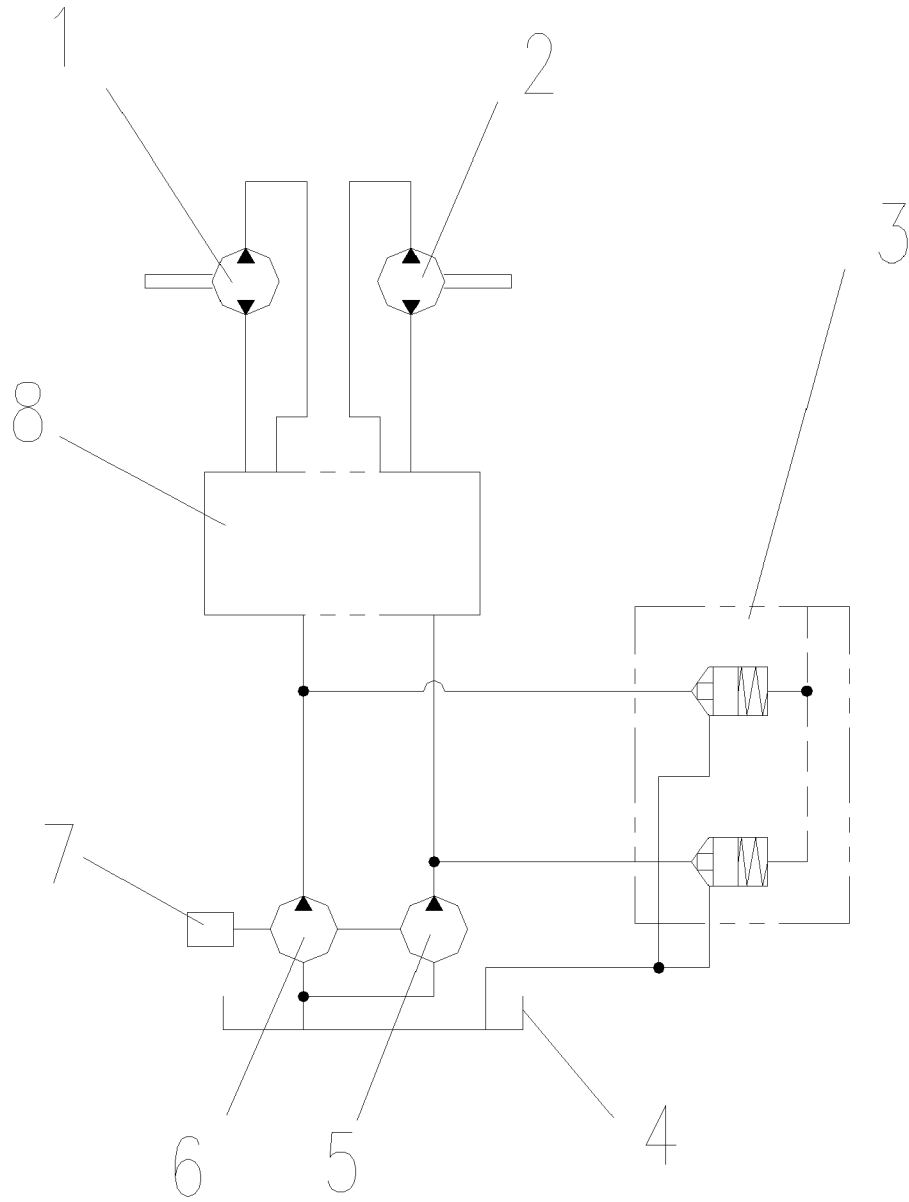


Fig. 1

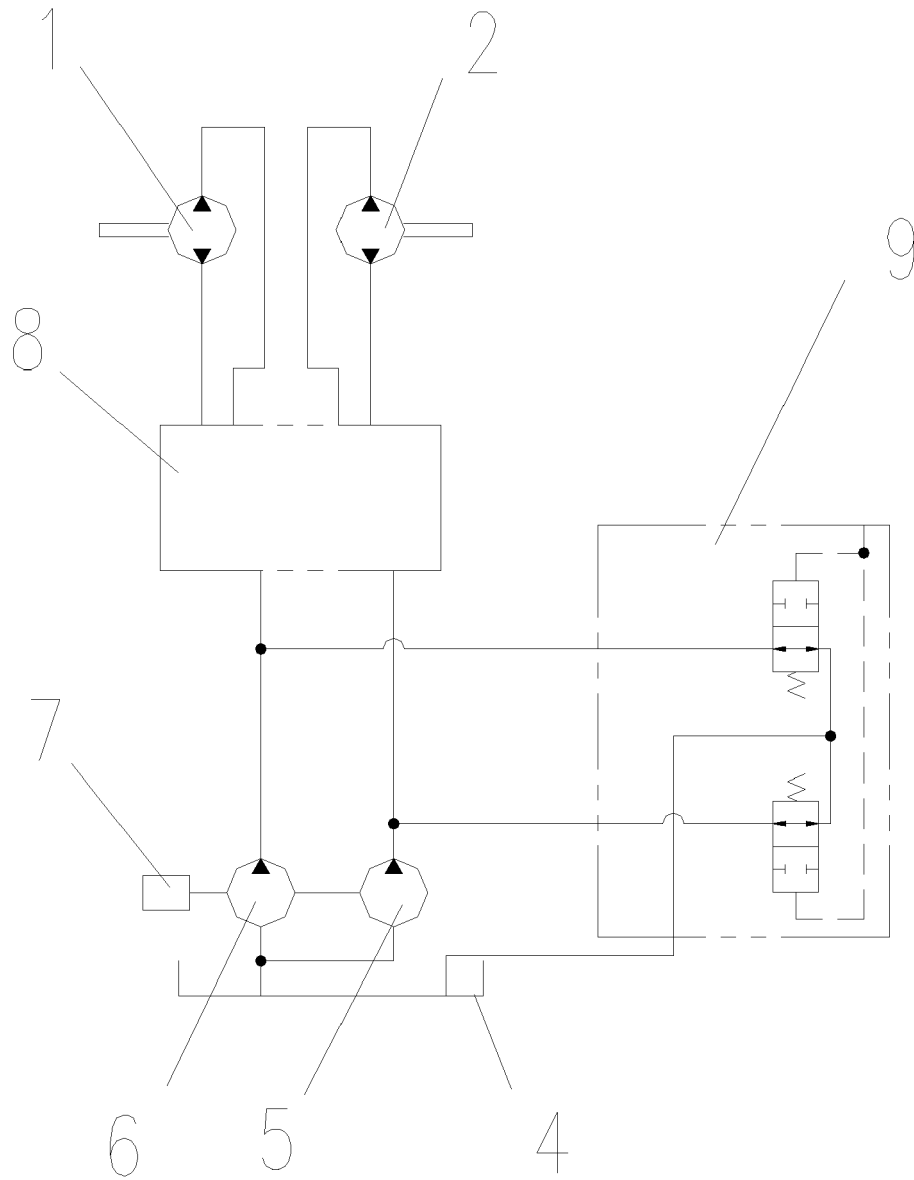


Fig. 2

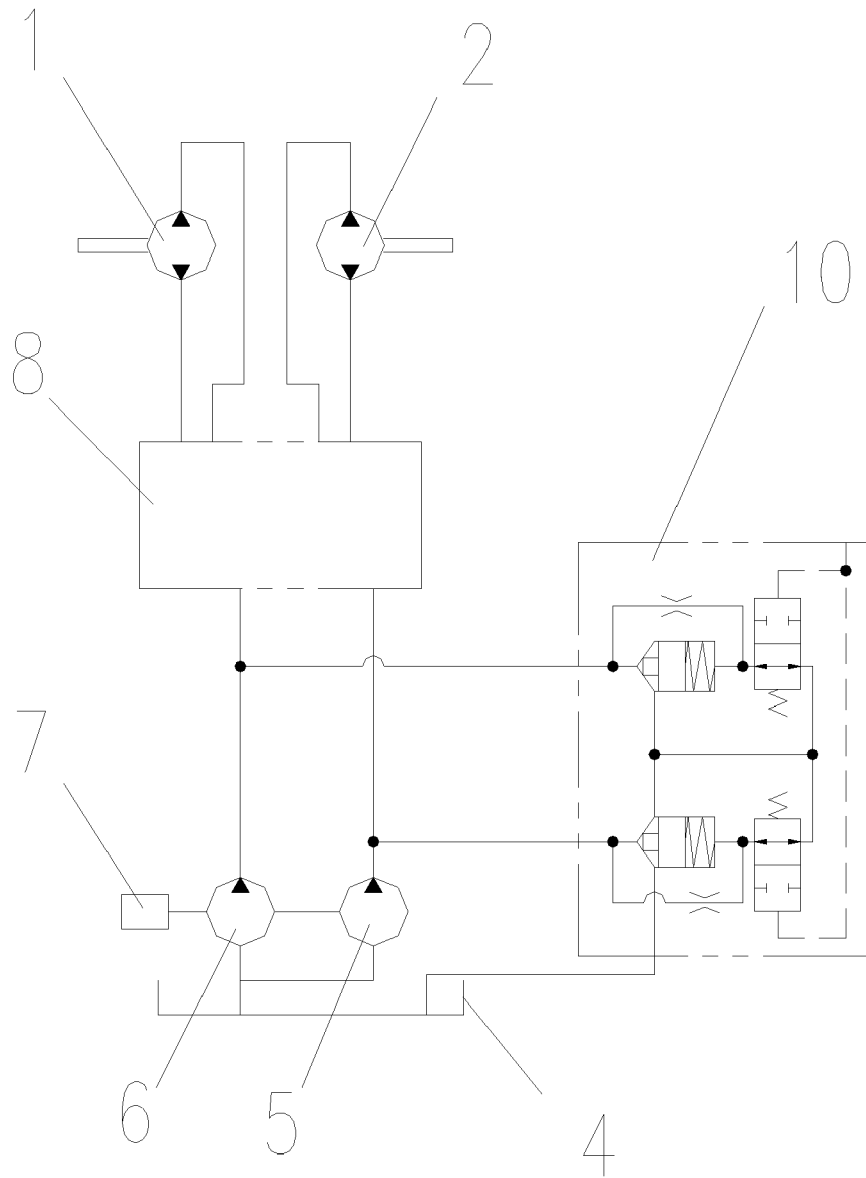


Fig. 3



| DOCUMENTS CONSIDERED TO BE RELEVANT | | | |
|---|--|---|---|
| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (IPC) |
| X | US 2001/036413 A1 (MCFADDEN DAN C ET AL) 1 November 2001 (2001-11-01) * figure 1 * * paragraph [0024] - paragraph [0028] * | 1-4 | INV. E02F9/22 |
| Y | US 2003/037465 A1 (TOJI YUTAKA ET AL) 27 February 2003 (2003-02-27) * figure 12 * * paragraph [0137] - paragraph [0138] * | 1-4 | |
| Y | US 5 251 440 A (BONG-DONG ET AL) 12 October 1993 (1993-10-12) * figures 1A,1B * * column 8, line 22 - line 25 * * column 8, line 62 - line 66 * * column 9, line 45 - line 52 * | 1-4 | |
| A | PATENT ABSTRACTS OF JAPAN vol. 014, no. 514 (M-1046), 13 November 1990 (1990-11-13) -& JP 02 213529 A (YUTANI HEAVY IND LTD), 24 August 1990 (1990-08-24) * abstract; figures 1,2,4 * | 1 | |
| A | EP 0 928 849 A (HITACHI CONSTRUCTION MACHINERY CO., LTD) 14 July 1999 (1999-07-14) * figures 1,5 * * paragraph [0044] * * paragraph [0048] * * paragraph [0055] - paragraph [0056] * | 1-4 | |
| A | US 6 038 859 A (MANGANO ET AL) 21 March 2000 (2000-03-21) * figure 1 * | 1 | |
| The present search report has been drawn up for all claims | | | TECHNICAL FIELDS SEARCHED (IPC) F15B E02F |
| Place of search The Hague | | Date of completion of the search 13 September 2006 | Examiner Guthmuller, Jacques |
| <p>CATEGORY OF CITED DOCUMENTS</p> <p>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</p> <p>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</p> <p>& : member of the same patent family, corresponding document</p> | | | |

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| DOCUMENTS CONSIDERED TO BE RELEVANT | | | |
|---|---|---|---|
| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (IPC) |
| A | PATENT ABSTRACTS OF JAPAN vol. 2000, no. 23, 10 February 2001 (2001-02-10) -& JP 2001 165109 A (KUBOTA CORP), 19 June 2001 (2001-06-19) * abstract; figures 1,3 * ----- | 1 | |
| | | | TECHNICAL FIELDS SEARCHED (IPC) |
| | | | |
| The present search report has been drawn up for all claims | | | |
| Place of search The Hague | | Date of completion of the search 13 September 2006 | Examiner Guthmuller, Jacques |
| 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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EPO FORM 1503 03.82 (P/4C01)

ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.

EP 06 11 8421

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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13-09-2006

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|--|------------------|--|--|
| US 2001036413 A1 | 01-11-2001 | NONE | |
| US 2003037465 A1 | 27-02-2003 | EP 1316650 A2 JP 3614121 B2 JP 2003056505 A | 04-06-2003 26-01-2005 26-02-2003 |
| US 5251440 A | 12-10-1993 | DE 4137879 A1 FR 2669055 A1 GB 2251962 A IT 1252380 B | 14-05-1992 15-05-1992 22-07-1992 12-06-1995 |
| JP 02213529 A | 24-08-1990 | NONE | |
| EP 0928849 A | 14-07-1999 | JP 3413092 B2 JP 11200423 A US 6087945 A | 03-06-2003 27-07-1999 11-07-2000 |
| US 6038859 A | 21-03-2000 | EP 0957210 A1 FR 2778703 A1 JP 2000002201 A | 17-11-1999 19-11-1999 07-01-2000 |
| JP 2001165109 A | 19-06-2001 | NONE | |

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82