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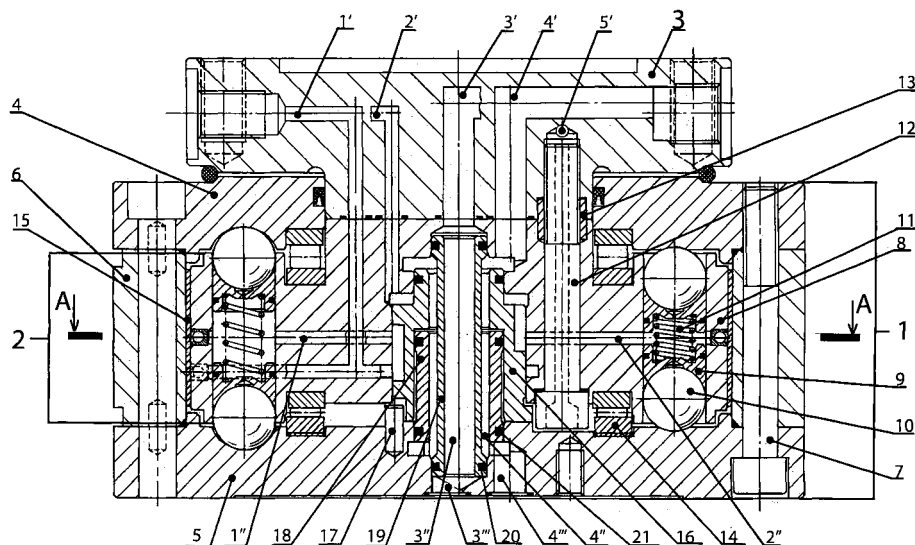
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Amended claims in accordance with Rule 137(2) EPC.

(54) **Piston-type rotator**

(57) The present invention relates to hydraulic rotators used in hydraulic cranes. The object is to develop a rotator with higher torque and minimised dimensions. The rotator includes an outer casing (1); cylinder assembly (2); flanged axle (3). The cylinder assembly (2) comprises an assembly of block (8) with milled cylindrical openings-cylinders wherein in each of the cylindrical opening two pistons (9) and springs (11) between them are inserted so that the pistons (9) can move in opposite from each other direction under the force of hydraulic pressure and actuate the unit revolving the outer casing

(1) interconnected with working appliances. On both sides of cylinder assembly (2), axial bearings (14) are mounted to take up axial loads from upper and bottom covers (4;5), the spacer (6) contains a pressed-in sliding bearing (15), enabling the rotation of outer casing (1) relatively to the cylinder assembly (2). Pressure is directed to the distribution valve (16) via channel (1'), then via channels on to the cylinders in cylinder assembly (2). Once the pressure reaches the cylinder, pistons (9) start moving in opposite directions and actuating the balls (10). Torque is generated, as a result of tangential force, causing the rotation of outer casing (1).

**Fig. 1**

Description

[0001] The present invention relates to the field of hydraulic devices, more specifically, to hydraulic rotators used in hydraulic cranes for actuation and rotation of working appliances, such as clamps, grab buckets, including multi-bucket grapples, excavator buckets, etc..

[0002] Rotators of prior art, including different models produced by BALTROTORS, SIA, LV and INDEXATOR, AB, SE, contain guided-vane hydraulic motors as rotation gears. For instance, rotator of prior art of company INDEXATOR, AB, is known from description to international patent application No. WO 03/082725, MKN⁷ B66C 13/08, 2003, rotator assembly of which contains a vane-type hydraulic motor with springloaded vanes that interact with the contoured inner surface of the stator. An inherent drawback of the rotator of the prior art is a lack of rigid stopping moment during the rotation process, a feature crucial at construction works. In the event of load unbalance at the inclined or horizontal position of rotor axle, a spontaneous swing movement of the load becomes possible, which is unacceptable in building and construction technology.

[0003] The rotators of prior art are also well-known BLACK BRUIN brand radial piston-type rotators made by Sampo Hydraulics Oy, FI. Information on the analogue is available at the web site: <http://www.sampo-hydraulics.com>. This type of rotator of prior art is mostly used in timber industry, and due to its specific design features the rotator is integrated with the suspension, therefore its connection to another suspension is impossible. A circular cross-section large-diameter piston is used as the key element of the radial piston-type hydraulic motor. Use of the large-diameter piston is necessary to achieve the torque required, but it results in the rotator's increased size.

[0004] Most widely known are the THUMM brand piston-type rotators with both radial and axial positioning of pistons. A rotator with radial piston positioning has considerable dimensions in terms of height. First and foremost it is needed to use a double-row piston assembly, so that required torque levels can be achieved. Consequently, the overall dimensions of rotator are enlarged by the collector array with two sets of taper bearings that serve to take up both radial and axial loads.

[0005] The axial-piston type rotator of prior art is known from description to international patent application No. WO9626326 (PCT/EP 96/00684), MKN⁷ B66C3/00, 1996, measures considerably less in height due to the specifically contoured parts of the rotator enabling to use their surfaces as radial and thrust bearings. However, this results in the mandatory replacement of all costly parts when the wearing of some part happens.

[0006] The object of the current invention is to develop a technologically improved embodiment of rotator with higher torque and minimised dimensions.

[0007] In conformity of invention a piston-type rotator including an axial piston hydraulic motor and a block with

axial openings for pistons, connecting elements for mounting it to the crane and to working appliances, a hydraulic system for actuation of working appliances and distribution of fluid within the rotator, wherein the hydraulic motor, producing rotary motion and torque, contains a static cylinder assembly with axial cylindrical openings that are provided with two pistons and springs between them and are positioned in each of the said cylindrical opening so that the pistons can move in opposite from each other direction under the force of hydraulic pressure and actuate by means of their working surface the unit revolving the outer casing interconnected with working appliances.

[0008] Each piston provided with the ball inserted into the ball socket of the piston, is made so that it can interact with the correspondingly contoured surfaces of the upper and bottom covers which are connected by means of the spacer for revolving the outer casing interconnected with working appliances.

[0009] The rotator is provided with the axial bearings positioned on two sides between the cylinder assembly and the upper cover and the bottom cover so that they are capable of taking up both upward and downward-directed axial loads, at that, the sliding bearing is pressed-in into the internal diameter of the spacer taking up radial loads.

[0010] A flanged axle is attached to the cylinder assembly provided with hydraulic channels connected to an external pressure source for applying pressure to the working appliances and to the system of fluid distribution within the rotator, whereas the flanged surface of the axle is performed as an assembly point for attachment components of the rotator and the crane.

[0011] The invention is further illustrated by the accompanying drawings, where on Fig. 1 is shown the length-wise section of the rotator; on Fig. 2 its cross section.

[0012] The piston-type rotator includes the following major components: outer casing 1; cylinder assembly 2; flanged axle 3.

[0013] Outer casing 1 in its turn contains: upper cover 4; bottom cover 5; spacer 6; held together by bolts 7. The internal walls of the upper and bottom covers have spheroid surfaces conforming to the shape of cylinder assembly 2.

[0014] The cylinder assembly 2 comprises an assembly of block 8 with milled cylindrical openings-cylinders wherein in each of the cylindrical opening two pistons 9 and springs 11 between them are inserted so that the pistons 9 can move in opposite from each other direction under the force of hydraulic pressure and actuate by means of their working surface the unit revolving the outer casing 1 interconnected with working appliances (not shown). The balls 10 are placed into the ball socket on the piston 9 surfaces opposite to the spring 11.

[0015] On both sides of cylinder assembly 2, axial bearings 14 are mounted to take up axial loads from the upper and bottom covers 4; 5, whereas the spacer 6 contains pressed-in sliding bearing 15, enabling the rotation

of outer casing 1 relatively to the cylinder assembly 2 and taking up radial loads. The distribution valve 16 is located in the central aperture of the cylinder assembly block 8 with a minimum gap clearance that enables thermal expansion of heat generated by the hydraulic fluid.

[0016] Distribution valve 16 is fixed to the bottom cover 5 with a pin 17 and rotates along with the cover during normal operation.

[0017] The static component, connecting rotator with the crane's arm (not shown) is a flanged axle 3, attached to the cylinder assembly block 8 with axial load-bearing screws 12, and with torque-responsive pins 13. One of bolts 12 has a through axial hole, connecting the inner space of casing 1 with channel 5', which serves as a drainage for outflow from the casing.

[0018] Flanged axle 3 also has hydraulic channels 1'; 2' bored through it, via which supply of hydraulic fluid is directed to distribution valve 16 and either pressure supply or drainage is carried out depending on the direction of movement; likewise, in assembly block 8, hydraulic channels 1' and 2' that lead from the distribution valve to the cylinders in the cylinder assembly, are provided for the same purpose.

[0019] With a view to conducting the hydraulic fluid from an external pressure source to the actuating devices, hydraulic channels 3' and 4' have been provided in the flanged axle 3 and they subsequently lead on to channels 3' and 4' formed by bushings 18 and 19, inserted accordingly into the central apertures of bottom cover 5, distribution valve 16 and into that of casing of block 8.

[0020] Seals 20 and 21 isolate the discharge ducts from the drain channels. At the end of the system there are outlets 3' and 4' to which the actuating devices' hydraulic system is connected.

[0021] The piston-type rotator operates as follows. Pressure is directed to the distribution valve 16 via channel 1', then via channels in compliance with the distribution valve's certain configuration, on to the cylinders in cylinder assembly 2. In this particular case, those are channels 1' (Fig. 2). Once the pressure reaches the cylinder, pistons 9 start moving in opposite directions and actuating the balls 10, inserted into each of them, the contoured surfaces of the upper and bottom covers 4, 5, and as a consequence of the resulting tangential force, torque is generated, causing the rotation of outer casing 1 (Fig. 1).

[0022] Technical features of the invented rotator are characterized by that there are two pistons operating concurrently, the resulting torque is twice that generated by a single piston.

[0023] The hydraulic fluid from the cylinders operating in drain mode travels via hydraulic channels 2" (Fig. 2) to the distribution valve 16 and then on via channels 2' (Fig. 2) to be drained (Fig. 1).

[0024] Upon the alteration of a 'discharge-drain' supply of hydraulic fluid to its opposite value, the process is reversed as is the direction in which the rotator rotates.

[0025] The suggested rotator offers improved perform-

ance in terms of a two-fold increase in torque output while having smaller dimensions than a double-row axial piston rotator.

[0026] The suggested hydraulic piston rotator can be used in hydraulic cranes for actuating and rotating attachments of various pieces of machinery, whereas all of its constituent parts can be produced by industrial methods of prior art.

Claims

1. A piston-type rotator including an axial piston hydraulic motor and a block with axial openings for pistons, connecting elements for mounting it to the crane and to working appliances, a hydraulic system for actuation of working appliances and distribution of fluid within the rotator, **characterised in that** the hydraulic motor, producing rotary motion and torque, contains a static cylinder assembly (2) with axial cylindrical openings that are provided with two pistons (9) and springs (11) between them and are positioned in each of the said cylindrical opening so that the pistons can move in opposite from each other direction under the force of hydraulic pressure and actuate by means of their working surface the unit revolving the outer casing (1) interconnected with working appliances.
2. A piston-type rotator according to Claim 1, **characterized in that** each piston (9), provided with the ball (10) inserted into the ball socket of the piston (9), is made so that it can interact with the correspondingly contoured surfaces of the upper and bottom covers (4, 5) which are connected by means of the spacer (6) for revolving the outer casing (1) interconnected with working appliances.
3. A piston-type rotator according to Claim 1 or 2, **characterized in that** the rotator is provided with the axial bearings (14) positioned on two sides between the cylinder assembly (2) and the upper cover (4) and the bottom cover (5) so that they are capable of taking up both upward and downward-directed axial loads, at that, the sliding bearing (15) is pressed-in into the internal diameter of the spacer (6) taking up radial loads.
4. A piston-type rotator according to any of preceding Claims, **characterized in that** a flanged axle (3) is attached to the cylinder assembly (2) provided with hydraulic channels (1', 2', 3', 4', 5') connected to an external pressure source for applying pressure to the working appliances and to the system of fluid distribution within the rotator, whereas the flanged surface of the axle (3) is performed as an assembly point for attachment components of the rotator and the crane.

**Amended claims in accordance with Rule 137(2)
EPC.**

1. A piston-type hydraulic rotator comprising: an outer casing unit; a hydraulic motor producing rotary motion and torque, including a relatively static cylinder block with a plurality of axial cylindrical openings with two pistons and springs between them positioned in each of the said cylindrical openings enabling the pistons to move in opposite from each other direction under the force of hydraulic pressure and to interact by means of their spheroid working surfaces with conforming surfaces of connecting elements enabling mounting the rotator to a crane and to working appliances; a hydraulic system for actuation of working appliances and distribution of fluid within a rotator, **characterised in that** the said cylinder block (2) is placed inside of hollow outer casing unit (1), wherein the said outer casing unit (1) is provided with an upper (4) and end covers (5) and spacer (6) between them so that the spheroid working surfaces of the upper and end covers (4, 5) of the said casing unit (1) are made interact able with the conforming surfaces of balls (10) of pistons (9) and to cause a rotary motion of outer casing unit (1) interconnect able with the said working appliances.

2. A piston-type rotator according to Claim 1, **characterized in that** the axial bearings (14) are placed on two sides between the said cylinder block (2) and the upper cover (4) and end cover (5) of casing unit (1) so that they are capable of taking up both upward and downward-directed axial loads, wherein the corresponding plain bearing (15) is pressed-in into the internal diameter of the said spacer (6) to take up the radial loads.

3. A piston-type rotator according to Claim 1 or 2, **characterized in that** the connecting elements for mounting rotator to crane are formed as an axle (3) with flange attached to the cylinder block (2) of hydraulic motor and provided with hydraulic channels (1¹, 2¹, 3¹, 4¹, 5¹) connectable to an external source of pressure applicable to the working appliances and to the system of fluid distribution within the rotator, wherein the flanged surface of the axle (3) is adapted to be a mechanical assembly point for attachment components of the rotator and the crane.

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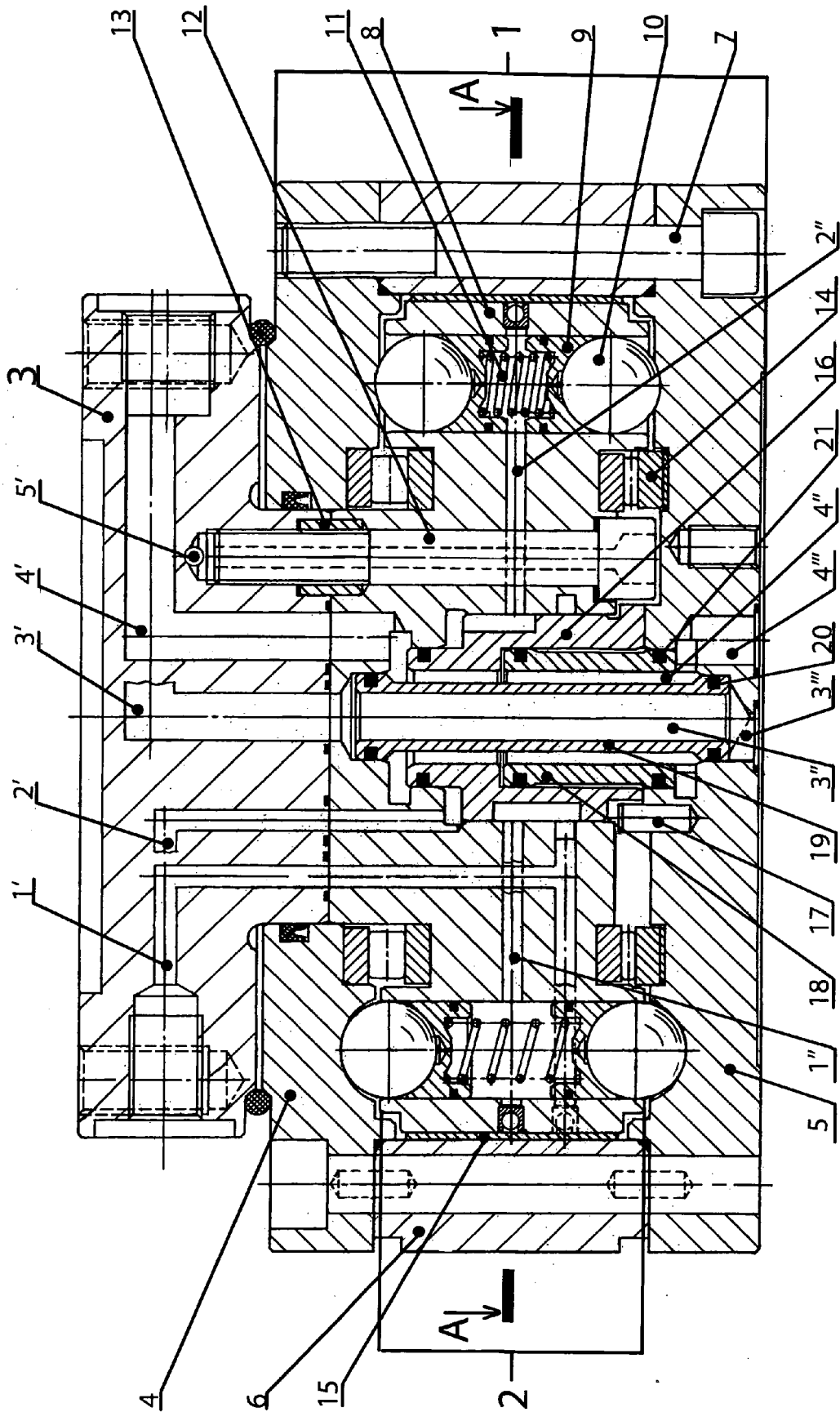


Fig. 1

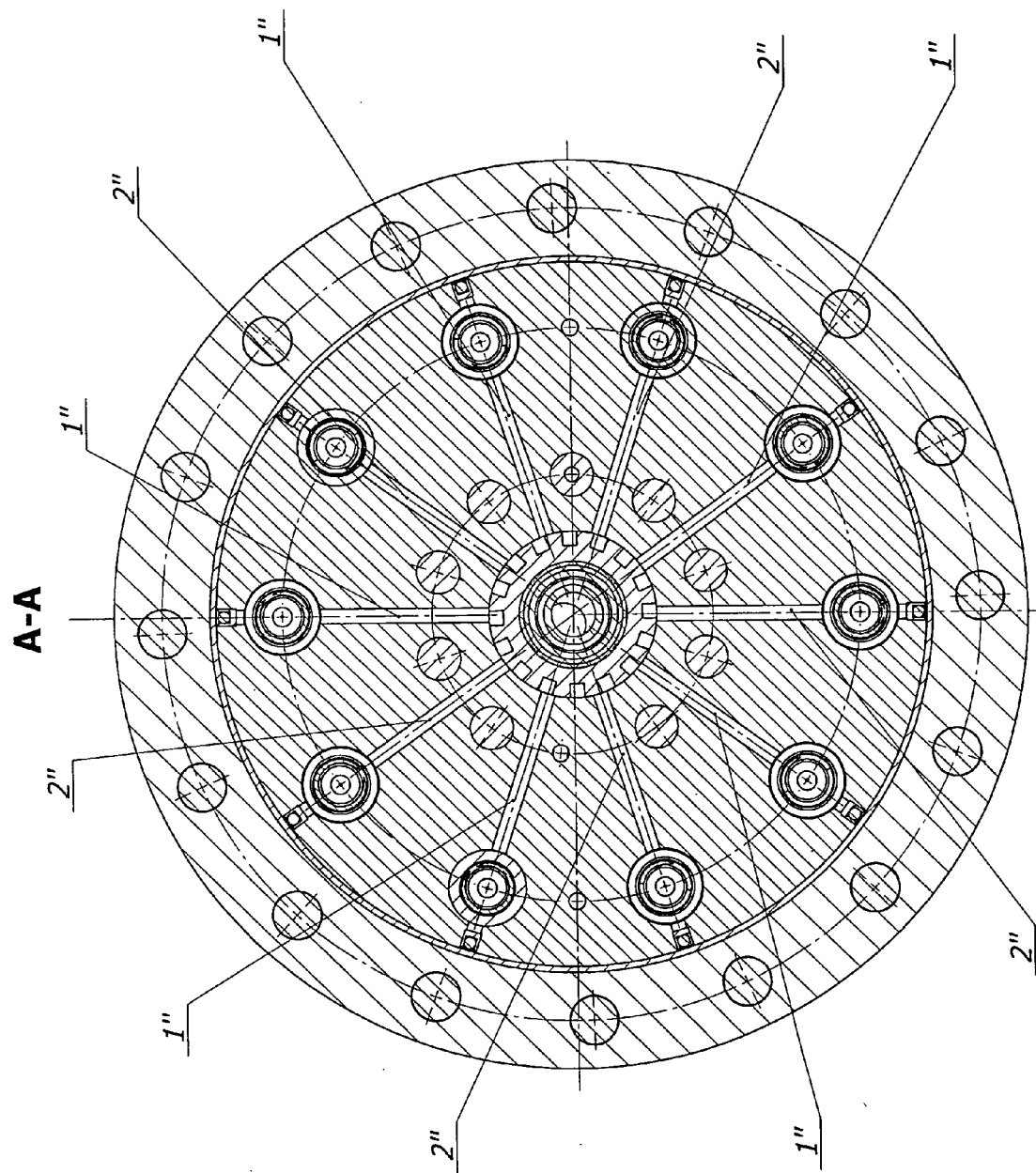


Fig. 2



EUROPEAN SEARCH REPORT

Application Number
EP 08 01 5251

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 3 435 774 A (PARRETT JOHN T) 1 April 1969 (1969-04-01) * column 2, lines 9-15; figures 1,4 * * column 2, line 53 - column 3, line 55 * * column 5, line 60 - column 6, line 49 * -----	1	INV. F03C1/06 B66C3/00 B66C13/08 E02F3/36
A	US 4 086 845 A (TAKAGI KINZO) 2 May 1978 (1978-05-02) * abstract; figures 2,7 * * column 2, line 30 - column 3, line 21 * -----	1,3,4	
A	US 2 617 360 A (BARKER VIRGIL D) 11 November 1952 (1952-11-11) * figures 1,4,11 * * column 3, line 45 - column 5, line 4 * -----	1,3,4	
A	US 4 333 676 A (THUMM HEINZ) 8 June 1982 (1982-06-08) * abstract; figure 1 * * column 4, line 58 - column 5, line 16 * -----	1	
A	US 2 712 794 A (HUMPHREYS MARION W) 12 July 1955 (1955-07-12) * figures 14,15,28 * * column 5, lines 42-58 * * column 9, lines 66-73 * -----	1	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC) F03C B66C E02F
Place of search Munich		Date of completion of the search 26 February 2009	Examiner Richmond, Robin
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 03.02 (P04C01)

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

EP 08 01 5251

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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26-02-2009

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3435774 A	01-04-1969	NONE	
US 4086845 A	02-05-1978	CA 1056263 A1 DE 2610448 A1 FR 2303970 A1 GB 1540282 A JP 51106203 A	12-06-1979 16-09-1976 08-10-1976 07-02-1979 21-09-1976
US 2617360 A	11-11-1952	NONE	
US 4333676 A	08-06-1982	DE 2838346 A1	20-03-1980
US 2712794 A	12-07-1955	NONE	

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 03082725 A [0002]
- WO 9626326 A [0005]
- EP 9600684 W [0005]