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(54) Lever-type control device for transmitting electrical signals

(57) A lever-type control device for transmitting electrical signals, comprising a spherical element (2) for emitting at least one magnetic field that is connected to the end of a rod (3) actuated at the other end and contained within a seat that comprises means suitable to allow the rotation thereof about at least one axis that is perpendicular to the axis of the rod and passes through the center of the spherical element, the seat further comprising at least one sensor (10a, 10b) for sensing variations in the at least one magnetic field emitted by the spherical element, sending electrical signals that are proportional to the variations to an electronic board for processing.

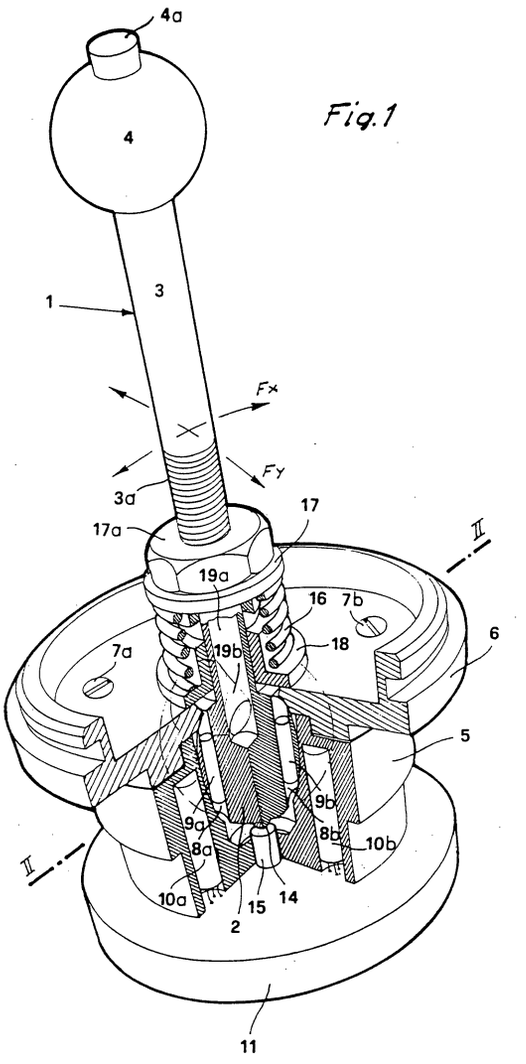

Fig.1

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Description

[0001] The present invention relates to a lever-type control device for transmitting electrical signals.

[0002] The presence is known of control devices that are used commonly in self-propelled machines, such as for example overhead platforms, and comprise a lever that is meant to be actuated rotationally by the operator in order to vary the position of permanent magnets with respect to one or more fixed sensors.

[0003] The electrical signals emitted by said sensors are consequently influenced thereby in proportion to the movements of the lever, and therefore an appropriate processing of said signals, performed by an electronic board, allows to transmit to the actuators and servo systems that are present on the machine provided with the device, such as for example motors or actuation cylinders, commands that are also proportional to said movements.

[0004] Currently commercially available devices that operate in the described manner are constructively rather complicated, and it is therefore the aim of the present invention to provide a device that has, by way of particularly simple production methods, a low cost and highly reliable operation.

[0005] This aim is achieved by a lever-type control device for transmitting electrical signals, according to the invention, characterized in that it comprises, in order to form said lever, a spherical element for emitting at least one magnetic field that is connected to the end of a radial rod meant to be actuated at the other end, said spherical element being contained within a seat that comprises means suitable to allow the rotation of said spherical element about at least one axis that is perpendicular to the axis of the rod and passes through the center of the spherical element, said seat further comprising at least one sensor suitable to sense variations in the at least one magnetic field emitted by the spherical element, consequently sending electrical signals that are proportional to said variations to an electronic board for signal processing.

[0006] Further characteristics and advantages will become better apparent from the description of some preferred but not exclusive embodiments of the invention, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

Figure 1 is a perspective view of the invention, with a portion removed for the sake of clarity of illustration;
Figure 2 is a sectional view, taken along the line II-II of Figure 1;
Figure 3 is a view of a portion of the control lever;
Figures 4 and 5 are views of further embodiments of portions of the control lever.

[0007] With reference to Figures 1, 2 and 3, the reference numeral 1 generally designates a lever of the device, which comprises, in a monolithic assembly, a spherical element 2 made of non-ferromagnetic material and a rod 3, which protrudes radially from the spherical element at one end; at the other end of the rod 3 there is a knob 4, which is meant to be gripped by the operator.

[0008] The spherical element 2 is contained within a seat formed partly in a base 5 and partly in a cover 6, which is fixed to said base by means of screws 7a and 7b, and comprises two permanent magnets 9a and 9b, which are inserted in suitable seating holes 8a and 8b, which are shaped like cylindrical blocks with axes that are parallel to the axis of the rod 3 and lie on planes that pass through said axis and are perpendicular to each other.

[0009] The permanent magnets 9a and 9b are arranged so as to face respectively sensors 10a and 10b comprised within the base 5, which are suitable to sense variations in the magnetic fields emitted by said magnets, consequently emitting electrical signals, which are sent to an electronic board comprised within a container 11.

[0010] The base 5 comprises means that allow the rotation of the spherical element 2 about two axes that are perpendicular to the axis of the rod 3, designated by the reference letter z, and pass through the center of said spherical element: the axis x, which is perpendicular to the plane that contains the permanent magnet 9a with the corresponding sensor 10a, and the axis y, which is perpendicular to the plane that contains the permanent magnet 9b with the corresponding sensor 10b.

[0011] Said means comprise a pivot 12, which protrudes from the base 5 in a radial direction and so that its axis passes through the center of the spherical element 2; said pivot is inserted in a slot 13, which is formed in the spherical element and is delimited by planes that are parallel and equidistant with respect to the diametrical plane that passes through the axis z and through the axis of the pivot 12.

[0012] When the operator, after gripping the knob 4, causes the rotation of the lever 1 about the axis x along the arrows Fx of Figure 1, the position of the magnet 9a changes with respect to the corresponding sensor 10a and accordingly the signal emitted by said sensor undergoes variations that are proportional to the extent of the movements of the lever: a suitable processing of said signal performed by the electronic board inserted in the container 11 determines the sending of commands, likewise proportional to the extent of said movements, to one or more selected actuators that are present on the machine provided with the device.

[0013] The same applies if the operator turns the lever 1 about the axis y along the arrows Fy, changing the position of the magnet 9b with respect to the corresponding sensor 10b and consequently varying the signal emitted by said sensor.

[0014] The rotations of the lever 1 about the two axes x and y can also occur simultaneously; in this case, by combining said rotations simultaneously, it is possible

to send signals simultaneously from the two sensors to the corresponding actuators.

[0015] However, it is also possible to provide for the presence of means suitable to allow only one rotation at a time to occur.

[0016] Before proceeding with the description of the invention, it should be noted that the sensors 10a and 10b can each be replaced with a pair of sensors suitable for example to send signals respectively of the analog and digital type.

[0017] Figure 1 shows that the spherical element 2 is provided with a pin 14, which is suitable to press a button 15 connected to the electronic board comprised in the container 11 when the lever 1 is in the zero position, i. e., inactive, which is the position shown in the figure, and to release it when the lever is actuated; accordingly, the electronic control management system is allowed to reset the signals to the zero position at each transition through this position.

[0018] Regarding said zero position, it should be noted that the lever 1 has means that are suitable to make it return automatically to said position; said means comprise the spring 16, which acts between the bushes associated with the rod 3, i.e., the bush 17 in contact with the adjustment nut 17a engaged on the thread 3a of said rod and the bush 18 rested on the upper surface of the cover 6.

[0019] The description of the embodiment considered so far ends by considering the presence, within the lever 1, of a duct that is formed by the axial cavity 19a connected to the conical cavity 19b at the hole 19c that is present in the base 5 and ends externally, said duct being such as to allow the passage of wires, not shown in the figure, that extend from the button 4a comprised within the knob 4.

[0020] In a second embodiment of the invention, the spherical element of the lever can comprise a single block-shaped permanent magnet that faces at least one sensor, and there are means suitable to allow the rotation of the spherical element about the axis that is perpendicular to the plane that contains said magnet with the corresponding sensor.

[0021] In further embodiments of the invention, the permanent magnets may be provided in the form of prism-like blocks, and the axes of said magnets may also have any inclination with respect to the axis of the rod comprised within the lever, for example an inclination equal to a right angle.

[0022] Figure 4 illustrates a lever 20 according to a further embodiment, which comprises the rod 21 connected to the spherical element 22 provided by means of a single permanent magnet.

[0023] Figure 5 is another view of a lever 23 according to another embodiment that comprises the rod 24 connected to the spherical element 25 made of nonferromagnetic material and provided with the annular permanent magnet 26 contained in a diametrical slot that lies on the plane that is perpendicular to the axis of the rod 24.

[0024] The described invention is susceptible of numerous other modifications and variations, all of which are within the scope of the inventive concept; all the details may furthermore be replaced with other technically equivalent elements.

[0025] The disclosures in Italian Patent Application No. MN2001A000045, from which this application claims priority, are incorporated herein by reference.

[0026] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the scope of each element identified by way of example by such reference signs.

Claims

1. A lever-type control device for transmitting electrical signals, **characterized in that** it comprises, in order to form said lever, a spherical element for emitting at least one magnetic field that is connected to the end of a radial rod meant to be actuated at the other end, said spherical element being contained within a seat that comprises means suitable to allow the rotation of said spherical element about at least one axis that is perpendicular to the axis of the rod and passes through the center of the spherical element, said seat further comprising at least one sensor suitable to sense variations in the at least one magnetic field emitted by the spherical element, consequently sending electrical signals that are proportional to said variations to an electronic board for signal processing.

2. The device according to claim 1, **characterized in that** the spherical element is made of nonferromagnetic material and comprises internally at least one block-shaped permanent magnet that faces at least one corresponding sensor accommodated within the seat of the spherical element, means being provided which allow the rotation of the spherical element about each axis substantially at right angles to the plane that contains each magnet with the corresponding sensor.

3. The device according to one or more of the preceding claims, **characterized in that** the spherical element comprises internally two block-shaped permanent magnets that face corresponding sensors accommodated within the seat of the spherical element, means being provided which allow the rotation of the spherical element about the two axes that are substantially perpendicular to the planes that contain each one of the two magnets with the corresponding at least one sensor.

4. The device according to one or more of the preceding claims, **characterized in that** the spherical element comprises internally two block-shaped permanent magnets with axes that are contained within planes that pass through the axis of the rod connected to the spherical element and are substantially perpendicular to each other.

5. The device according to one or more of the preceding claims, **characterized in that** the spherical element is made of nonferromagnetic material and comprises two cylindrical block-shaped permanent magnets, which are inserted in suitable seating holes and have axes that are parallel to the axis of the rod connected to the spherical element and are contained within planes that pass through said axis and are perpendicular to each other, each magnet facing a corresponding sensor that is accommodated within the seat of the spherical element, means being provided which allow the simultaneous rotation of the spherical element about two axes that are perpendicular to the axis of said rod, pass through the center of the spherical element and are perpendicular to the planes that contain each one of the two magnets with the corresponding sensor, said means comprising a pivot that protrudes from said seat in a radial direction with respect to said spherical element and whose axis passes through the center of said spherical element, said pivot being inserted in a slot that is formed in the spherical element and is delimited by planes that are parallel and equidistant with respect to the diametrical plane that passes through the axis of the rod connected to the spherical element and through the axis of said pivot.

6. The device according to one or more of the preceding claims, **characterized in that** the spherical element is made of nonferromagnetic material and comprises, inserted in a suitable seating hole, a permanent magnet shaped like a block, which faces at least one sensor that is accommodated within the seat of the spherical element, means being provided which are suitable to allow the rotation of the spherical element about an axis that is perpendicular to the plane that contains said magnet with the corresponding sensor.

7. The device according to claim 1, **characterized in that** the spherical element is provided by means of a single permanent magnet.

8. The device according to claim 1, **characterized in that** the spherical element is made of nonferromagnetic material and comprises internally an annular permanent magnet that is contained in a diametrical slot that is contained within the plane that is perpendicular to the axis of the rod connected to the spherical element.

9. The device according to one or more of the preceding claims, **characterized in that** the spherical element of the lever comprises a pin for the actuation of a button that is connected to the electronic board and is suitable to act on said button in the zero position of the lever.

10. The device according to one or more of the preceding claims, **characterized in that** the rod of the lever comprises an axial cavity that is connected to a conical cavity that is present in the spherical element at a hole provided in the seat of said spherical element and leads outside, so as to allow the passage of wires that extend from a button comprised within a knob for the actuation of the rod.

11. The device according to one or more of the preceding claims, **characterized by** the presence of means suitable to determine the automatic return of the lever to the zero position, said means comprising a spring that acts between two bushes that are associated with the rod of the lever, one of said bushes being in contact with an adjustment nut, the other bush resting on a plane that is present in the seat of the spherical element of said lever.

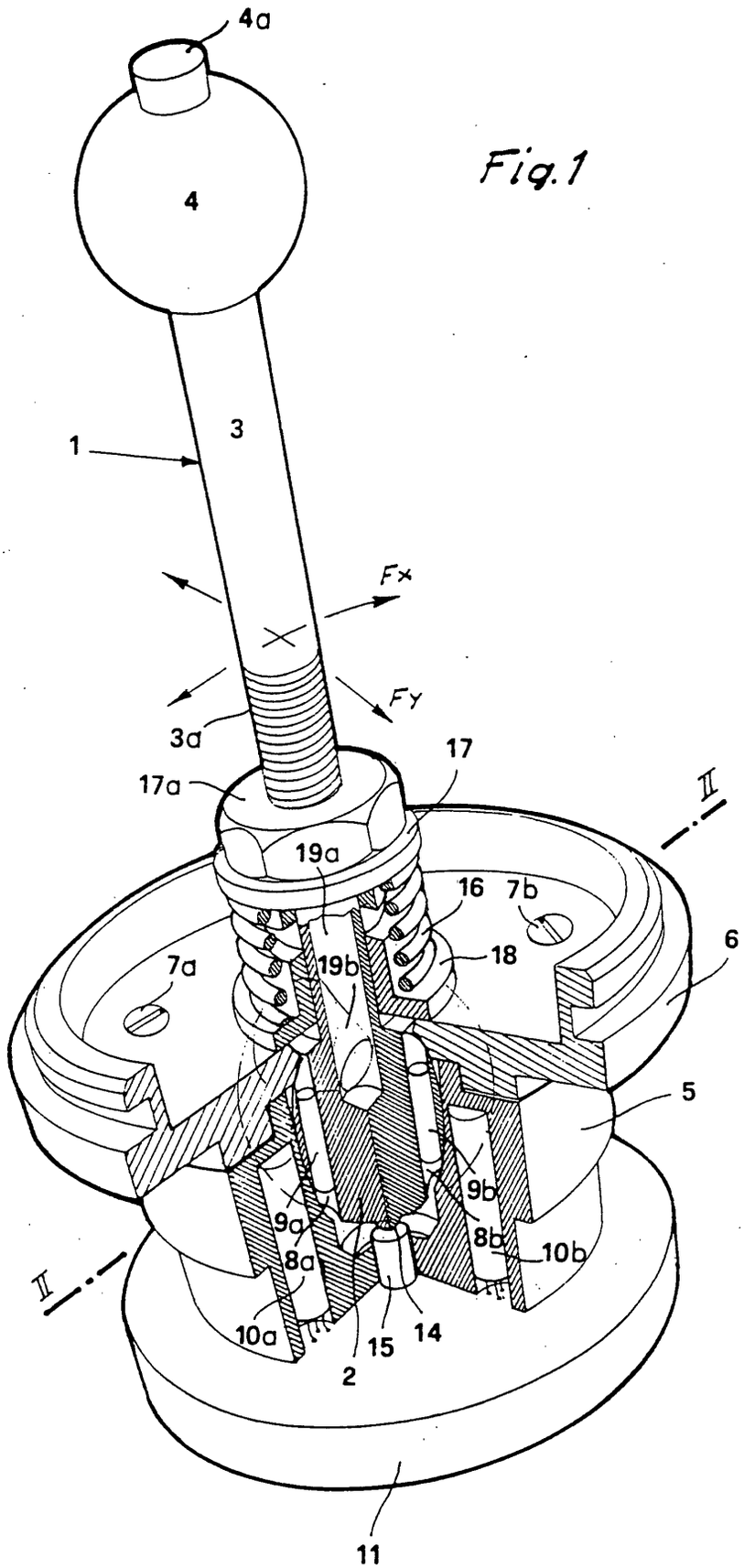

4a
4
3
1
Fx
Fy
3a
17
17a
II
19a
16
7b
18
6
7a
19b
5
9b
9a
8b
10b
8a
II
10a
15
14
2
11

Fig.1

Fig.3

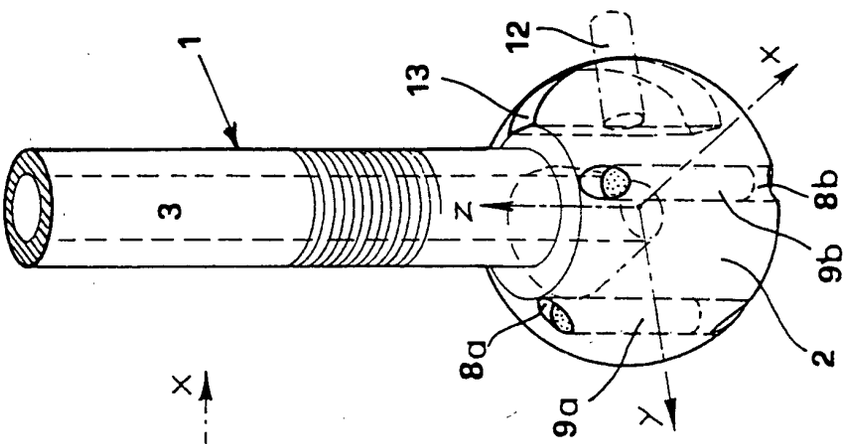
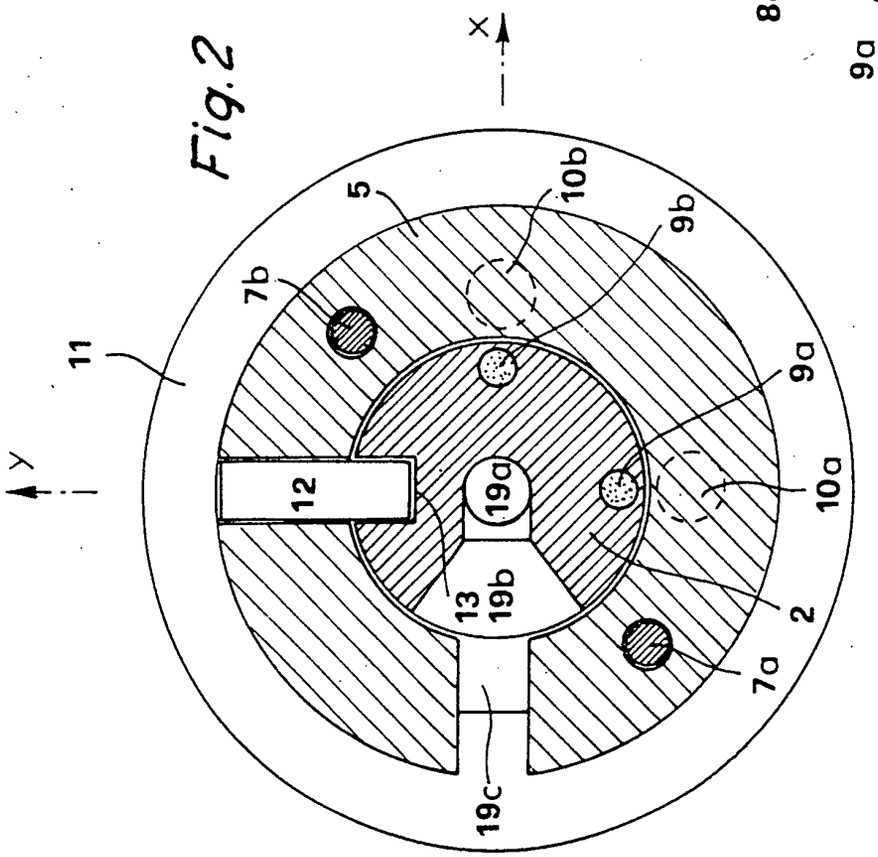

1
3
Z
12
13
X
8b
9b
2
8a
9a
Y

Fig.2


X
Y
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5
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9b
7b
9a
10a
12
19a
13
19b
2
7a
19c

Fig. 4

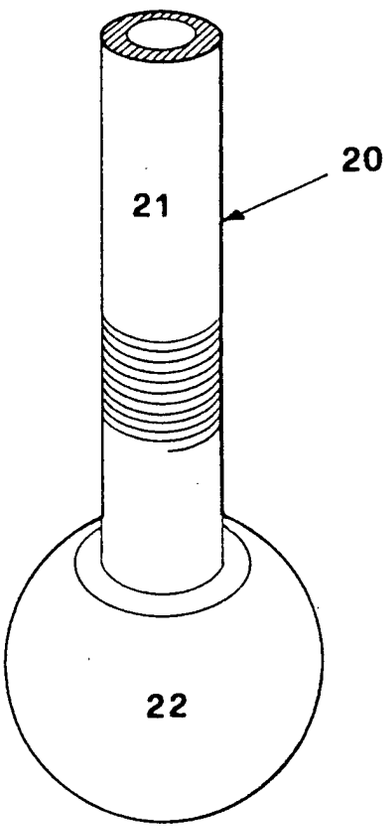
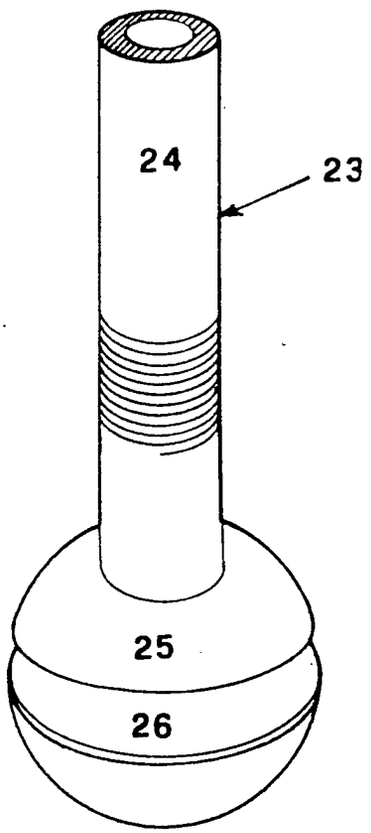


Fig. 5



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EUROPEAN SEARCH REPORT

Application Number
EP 02 02 4903

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 Y A	US 4 639 667 A (ANDRESEN HERMAN J) 27 January 1987 (1987-01-27) * column 2, line 10 - line 29 * * column 5, line 49 - column 6, line 21 * * column 9, line 62 - column 10, line 22 * * figures 5,6,11,12 *	1,3,4,7 8 2,5,6,10	G05G9/047 G05G5/05
X Y	US 4 500 867 A (ISHITOBI YOSHIMITSU ET AL) 19 February 1985 (1985-02-19) * column 3, line 13 - line 33 * * column 7, line 8 - column 8, line 10 * * figures 1,2,11 *	1,2,6,7 8	
A	US 4 492 128 A (HEIDELBERGER WALTER ET AL) 8 January 1985 (1985-01-08) * column 2, line 47 - line 54 * * figure 2 *	11	

TECHNICAL FIELDS SEARCHED (Int.Cl.7)
G05G

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	21 January 2003	J. Giráldez Sánchez

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4639667 A	27-01-1987	US 4733214 A	22-03-1988
US 4500867 A	19-02-1985	JP 58122424 A	21-07-1983
		CA 1184624 A1	26-03-1985
US 4492128 A	08-01-1985	DE 3117414 A1	18-11-1982
		FR 2505064 A1	05-11-1982
		JP 57191921 A	25-11-1982

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