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(71) Applicant: **Pearson Engineering Limited**
Newcastle upon Tyne NE6 3QS (GB)

(72) Inventor: **The designation of the inventor has not yet been filed**

(74) Representative: **Vinsome, Rex Martin**
Urquhart-Dykes & Lord LLP
12th Floor, Cale Cross House
Pilgrim Street 156
Newcastle-upon-Tyne NE1 6SU (GB)

(54) **Mine detonating apparatus**

(57) A mine detonating apparatus (1) to be mounted to an armoured personnel carrier (4) is disclosed. A frame (2) is pivotally mounted to the front of a vehicle body (3) of the armoured personnel carrier (4), for pivoting about a first axis (5). At least one roller (6) is pivotally mounted to the frame (2) for pivoting about a respective second axis (7), such that the angle (α) between a longitudinal axis (9) of the roller (6) and the frame (2) can vary. In use, the roller (6) applies pressure to the ground in front of the vehicle (4). A control means receives an input signal dependent upon the angle (α) between the longitudinal axis (9) of the roller (6) and the frame (2), and controls the angle (γ) of the frame (2) relative to the vehicle body (3) to maintain the path (18) of the roller (6) along the path (15) of at least one wheel (12) of the vehicle (4).

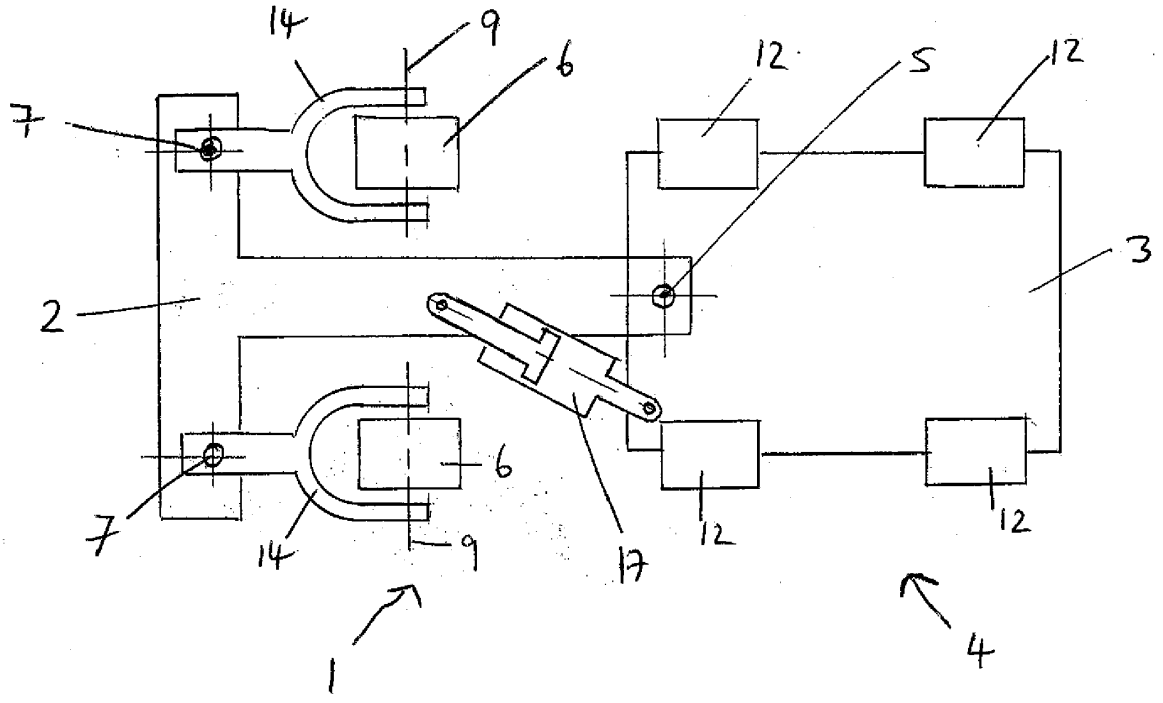

FIGURE 1

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Description

[0001] The present invention relates to a mine detonating apparatus and vehicles including such apparatus. The invention relates particularly, but not exclusively, to mine detonating apparatus for use with armoured personnel carriers.

[0002] In many situations, such as peacekeeping operations and low intensity conflicts, there is a requirement for military or peacekeeping personnel to be able to travel along roads which may be mined.

[0003] A mine detonating apparatus for use with battle tanks is known. The apparatus includes a pair of heavy rollers (known as mine rollers), each of which is located in front of a track of the tank. As the tracks of the tank approach a mine, the weight of the rollers detonates the mine. These rollers are made of steel and are sufficiently strong that they are able to withstand the blast.

[0004] Mine detonating apparatus of this type suffers from the drawback that while the heavy sacrificial mine rollers can readily be fitted to battle tanks (weighing approximately 40 to 60 tonne), they are too heavy to be carried on armoured personnel carriers, which generally weigh only approximately 10 to 20 tonne.

[0005] A known mine detonating apparatus for use on armoured personnel carriers which seeks to overcome this drawback uses hydraulic force to exert a force of about 2 tonnes on the rollers (which, together with the one tonne weight of the roller applies a force of 3 tonne on the ground) to compensate for the smaller weight of the rollers compared with the rollers used with tanks. However, this arrangement suffers from the drawback that they are only effective when the vehicle is travelling in a relatively straight line, where the wheels or tracks of the vehicle follow the route traced by the rollers.

[0006] A mine detonating apparatus for an armoured personnel carrier is described in WO 02/03007 A1. The mine detonating apparatus includes a front roller assembly, supported by a support frame connected to the vehicle body by means of a front pair of hydraulic cylinders, and a rear roller assembly connected to the vehicle body by means of a rear pair of hydraulic cylinders. As the vehicle turns, this trailing rear roller assembly swings to the inside of the turn, thereby compressing and extending respectively the rear hydraulic cylinders. These cylinders are connected via hydraulic hoses to the front cylinders. The hydraulic forces thus generated in the front cylinders steer the support frame to the inside of the turn. However, this arrangement suffers from the drawback that the rear roller assembly, rear hydraulic cylinders and front to rear hydraulic hoses are complex, expensive and vulnerable to damage.

[0007] Preferred embodiments of the present invention seek to overcome the above disadvantages of the prior art.

[0008] According to an aspect of the present invention, there is provided a mine detonating apparatus comprising:-

a body adapted to be pivotally mounted to a vehicle body about a first axis;

at least one roller pivotally mounted to the body about a respective second axis, for varying the angle between a longitudinal axis of at least one said roller and the body, such that, in use, at least one said roller applies pressure to the ground in front of the vehicle; and

control means for

(i) receiving at least one input signal dependent upon the angle between the longitudinal axis of at least one said roller and the body, and

(ii) controlling the angle of the body relative to the vehicle body to maintain the path of at least one said roller along the path of at least one wheel and/or track of the vehicle.

[0009] By providing control means for receiving at least one input signal dependent upon the angle between the longitudinal axis of at least one said roller and the body, and controlling the angle of the body relative to the vehicle body to maintain the path of at least one said roller along the path of at least one wheel and/or track of the vehicle, the apparatus is effective even when the vehicle is travelling around a curved path. Advantageously, the apparatus does not require an additional rear roller and interconnection thereto, and is therefore more robust. A further advantage is that the control means senses the actual route followed by the rollers, enabling the apparatus to position the mine rollers to accurately precede the path of the vehicle's wheels.

[0010] Preferably, at least one said roller is castored to said body.

[0011] The advantage of this feature is that the rollers can pivot freely to follow the desired path of the vehicle when the vehicle is steered around a corner, the angle of the longitudinal axis of the rollers with respect to the body indicating the turning radius of the apparatus.

[0012] The input signal may be generated by a rotational potentiometer.

[0013] The control means may further comprise calculating means for calculating a required angle of the body relative to the vehicle body to maintain the path of at least one said roller along the path of at least one wheel and/or track of the vehicle, based on said input signal.

[0014] The control means may include at least one hydraulic piston for controlling the angle of the body relative to the vehicle body.

[0015] The first axis may be substantially vertical when the apparatus is in use.

[0016] The second axis may be substantially vertical when the apparatus is in use.

[0017] The mine detonating apparatus may comprise at least two rollers pivotally mounted to the body about at least one second axis, arranged such that each wheel of the vehicle is preceded by at least one roller.

[0018] The mine detonating apparatus may comprise

two or more roller assemblies pivotally mounted to the body about a respective second axis, each roller assembly comprising a plurality of rollers and arranged to precede a respective wheel of the vehicle.

[0019] According to another aspect of the present invention, there is provided a vehicle comprising a mine detonating apparatus as defined above.

[0020] The vehicle may be an armoured personnel carrier.

[0021] A preferred embodiment of the present invention will now be described, by way of example only and not in any limitative sense, with reference to the accompanying drawings, in which:

Figure 1 is a plan view of a vehicle including a mine detonating apparatus embodying the present invention;

Figure 2 is a side elevation view of the vehicle of Figure 1; and

Figure 3 is a schematic illustration of the operation of the mine detonating apparatus of the present invention.

Figure 4 is a schematic illustration of a problem associated with the prior art;

[0022] Referring to Figures 1, 2 and 3, a mine detonating apparatus 1 comprises a body or frame 2 adapted to be pivotally mounted to a vehicle body 3 of vehicle 4 about a first axis 5. Two rollers 6 are pivotally mounted to the frame 2 about respective second axes 7. The rollers 6 can pivot about the respective second axes 7 in order to vary an angle α between a longitudinal or rotational axis 9 of each roller 6 and the frame 2. The rollers 6 are arranged to apply pressure to the ground in front of the vehicle 4.

[0023] The mine detonating apparatus 1 also includes control means for receiving at least one input signal dependent upon the angle α between the rotational axis 9 of at least one roller 6 and the frame 2, and for controlling the angle γ of the frame 2 relative to the vehicle body 3 to maintain the path of the rollers 6 along the path 15 of at least one wheel 12 of the vehicle 4.

[0024] The frame 2 is pivotally mounted to the vehicle 4 for rotation about a substantially vertical axis 5 relative to the vehicle body 3. The frame 2 may also be pivotable about a horizontal axis (not shown) to accommodate unevenness in the ground.

[0025] Each roller 6 is mounted to a castor bracket 14 for rotation about a substantially horizontal axis 9. The castor bracket 14 is pivotally mounted to the frame 2 for rotation about axis 15 relative to the frame 2. The castor brackets 14 may also be pivotable about a horizontal axis (not shown) to accommodate unevenness in the ground.

[0026] The rollers 6 are arranged such that, when the vehicle 4 is driven in a straight line, the rollers 6 precede the front and rear wheels 12 of the vehicle 4. At least one roller and castor bracket assembly is provided for each of the vehicle tracks. In an alternative embodiment (not shown) each roller 6 may be replaced by a roller assembly comprising a plurality of rollers. The rollers of each roller assembly may be suspended independently of each other to accommodate variations in the height of the ground.

[0027] In one embodiment, the input signal received by the control means is provided by a rotational potentiometer 16 arranged between one of the castor brackets 14 and the frame 2. The rotational potentiometer 16 outputs a signal representative of the angle α between the rotational axis 9 of the roller 6 and the frame 2. However, the skilled person will appreciate that the input signal may be generated by different means.

[0028] In one embodiment, the control means controls the angle γ of the frame 2 relative to the vehicle body 3 by extending and contracting a hydraulic piston 17, connected between the vehicle body 3 and the frame 2. The skilled person will appreciate that other means may be used for controlling the angle of the frame 2 relative to the vehicle body 3.

[0029] The control means may also include a calculating means, such as a computer, for calculating the required angle between the rotational axis 9 of the roller 6 and the frame 2, based on the input signal. The required angle is that which ensures that the path 18 followed by the rollers 6 coincides with the path 15 followed by the wheels 12 of the vehicle 4. In an alternative embodiment, the control means may include a mechanical linkage for adjusting the angle between the rotational axis 9 of the roller 6 and the body 2, based on an input signal.

[0030] The operation of the apparatus 1 shown in Figures 1 to 3 will now be described. With reference to Figure 3, as the vehicle 4 begins to travel in a curved path, the castor brackets 14 pivot relative to the frame 2 about their respective axes 7, which causes the rotational axis 9 of each roller 6 to rotate relative to the frame 2. The signal output by the rotational potentiometer 16 varies as a function of the angle α between the rotational axis 9 of the roller 6 and the frame 2. The control means receives the signal output by the rotational potentiometer 16, from which it determines the angle α between the rotational axis 9 of the rollers 6 and the frame 2, and calculates by how much the frame 2 must be rotated about axis 5 relative to the vehicle body 3, such that the area 18 rolled over by the rollers 6 precedes the wheels 12 of the vehicle 4. The control means adjusts the angle γ between the frame 2 and the vehicle body 3 by means of the hydraulic piston 17, as a result of which the path 18 followed by the rollers 6 overlaps with the path 15 followed by the wheels 12 of the vehicle 4.

[0031] As the vehicle 4 then begins to travel along a straight path, the castor brackets 14 carrying the rollers 6 will rotate with respect to the frame 2, with the angle α changing. The signal output by the rotational potentiometer therefore changes and the control means readjusts

the angle γ between the frame 2 and the vehicle body 3 to zero, in order to return the frame 2 to its original position relative to the vehicle body 3.

[0032] Thus the control means maintains the position of the rollers 6 in front of the tracks 15 followed by the wheels 12 of the vehicle 4. In this way any mines in front of the vehicle wheels 12 are detonated by the rollers 6 before the vehicle body 3 passes over that position. Any detonating mines therefore damage the rollers 6 without causing injury to personnel in the vehicle 4.

[0033] Figure 4 illustrates a situation which would occur if the control means were not in operation, but instead the angle γ between the frame 102 and the vehicle body 103 were maintained at zero as the vehicle 104 turned a corner. The rollers 106 would pivot outwards on castor brackets 114, such that their rotational axes 109 pointed towards the centre 110 of the curved path followed by the vehicle 104. In this position, as shown in Figure 4, the area 119 rolled over by the rollers 106 does not precede the tracks 120 of the wheels 112 of the vehicle 104, and the vehicle wheels 112 may pass over undetonated mines.

[0034] In the mine detonating apparatus of the present invention, the control means determines the required angle γ and controls or adjusts the angle γ of the frame 2 accordingly, sufficiently quickly that the situation shown in Figure 4 is substantially avoided.

[0035] It will be appreciated by persons skilled in the art that the above embodiment has been described by way of example only and not in any limitative sense, and that various alterations and modifications are possible without departure from the scope of the invention as defined by the appended claims.

Claims

1. A mine detonating apparatus comprising:-

a body adapted to be pivotally mounted to a vehicle body about a first axis;
at least one roller pivotally mounted to the body about a respective second axis, for varying the angle between a longitudinal axis of at least one said roller and the body, such that, in use, at least one said roller applies pressure to the ground in front of the vehicle; and
control means for

(i) receiving at least one input signal dependent upon the angle between the longitudinal axis of at least one said roller and the body, and
(ii) controlling the angle of the body relative to the vehicle body to maintain the path of at least one said roller along the path of at least one wheel and/or track of the vehicle.

2. A mine detonating apparatus according to claim 1, wherein at least one said roller is castored to said body.

3. A mine detonating apparatus according to claim 1 or claim 2, wherein said input signal is generated by a rotational potentiometer.

4. A mine detonating apparatus according to any one of the preceding claims, wherein the control means further comprises calculating means for calculating a required angle of the body relative to the vehicle body to maintain the path of at least one said roller along the path of at least one wheel and/or track of the vehicle, based on said input signal.

5. A mine detonating apparatus according to any one of the preceding claims, wherein said control means includes at least one hydraulic piston for controlling the angle of the body relative to the vehicle body.

6. A mine detonating apparatus according to any one of the preceding claims, wherein said first axis is substantially vertical when the apparatus is in use.

7. A mine detonating apparatus according to any one of the preceding claims, wherein said second axis is substantially vertical when the apparatus is in use.

8. A mine detonating apparatus according to any one of the preceding claims, comprising at least two rollers pivotally mounted to the body about a respective second axis, arranged such that each wheel of the vehicle is preceded by at least one roller.

9. A mine detonating apparatus according to any one of the preceding claims, comprising two or more roller assemblies pivotally mounted to the body about at least one second axis, each roller assembly comprising a plurality of rollers and arranged to precede a respective wheel of the vehicle.

10. A mine detonating apparatus substantially as described herein, with reference to Figures 1 to 3.

11. A vehicle comprising a mine detonating apparatus according to any one of the preceding claims.

12. A vehicle according to claim 11, wherein the vehicle is an armoured personnel carrier.

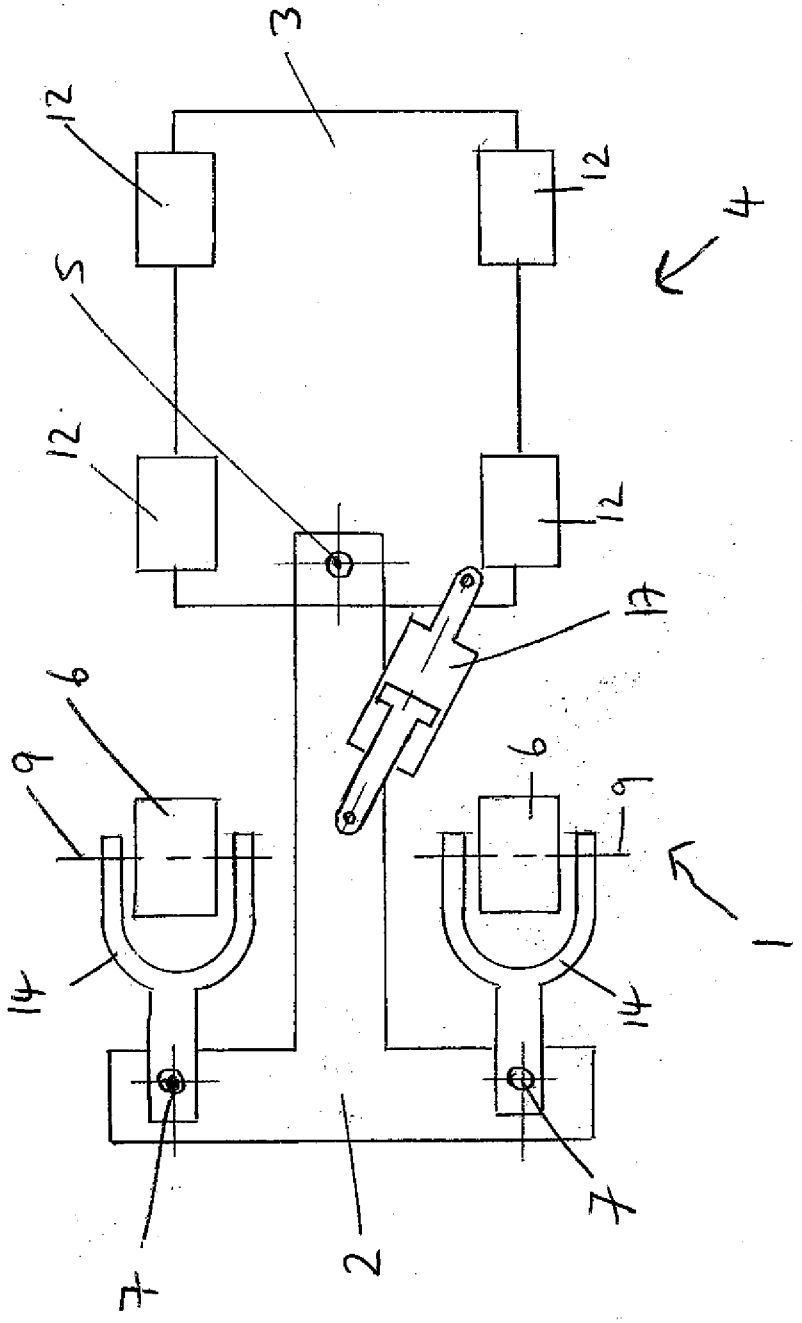

FIGURE 1

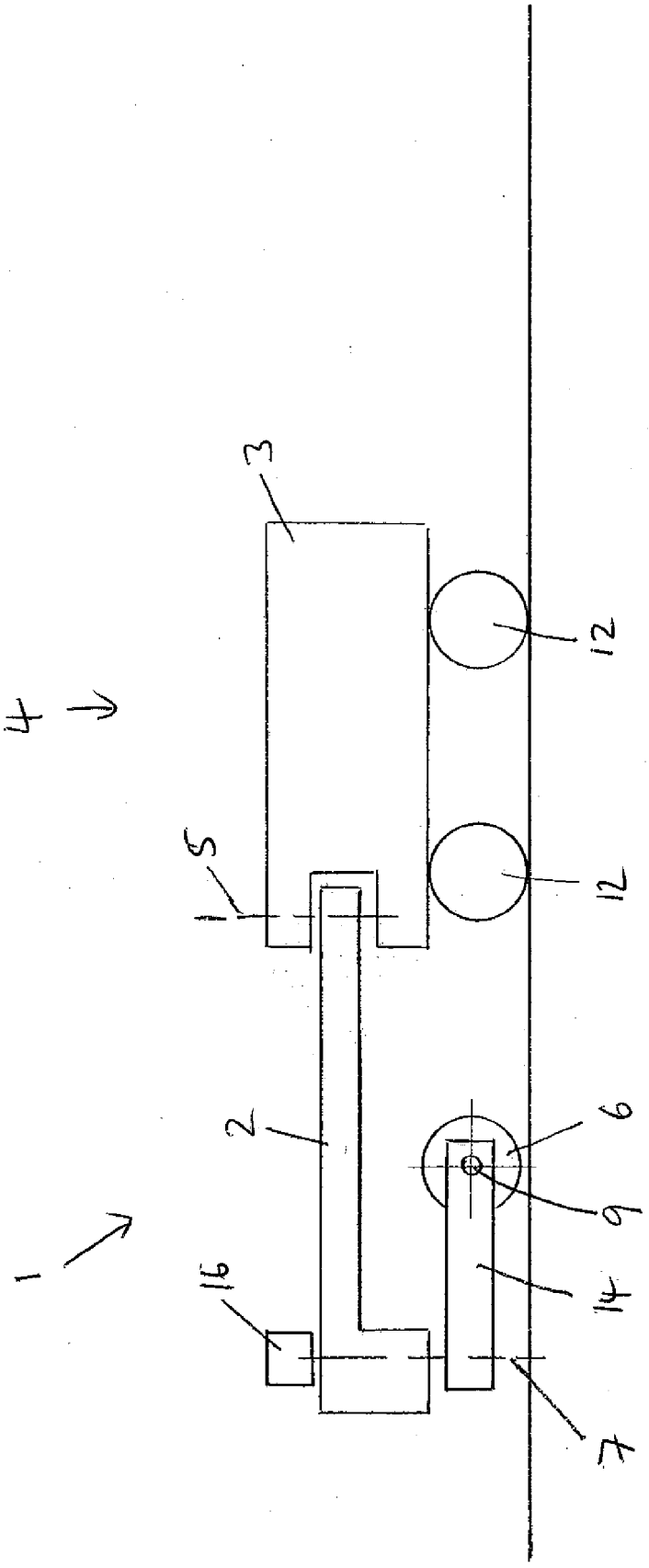

FIGURE 2

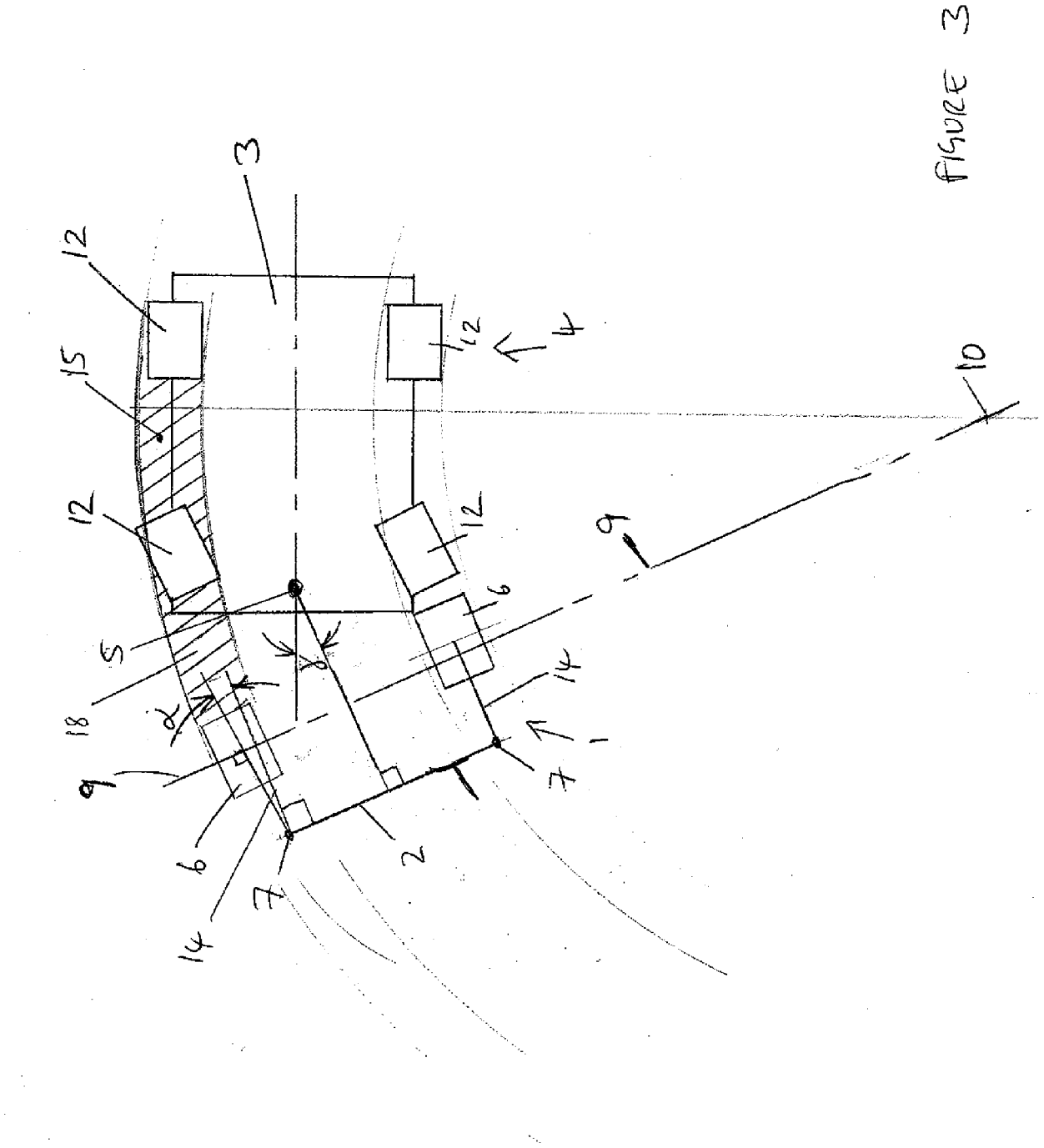

FIGURE 3

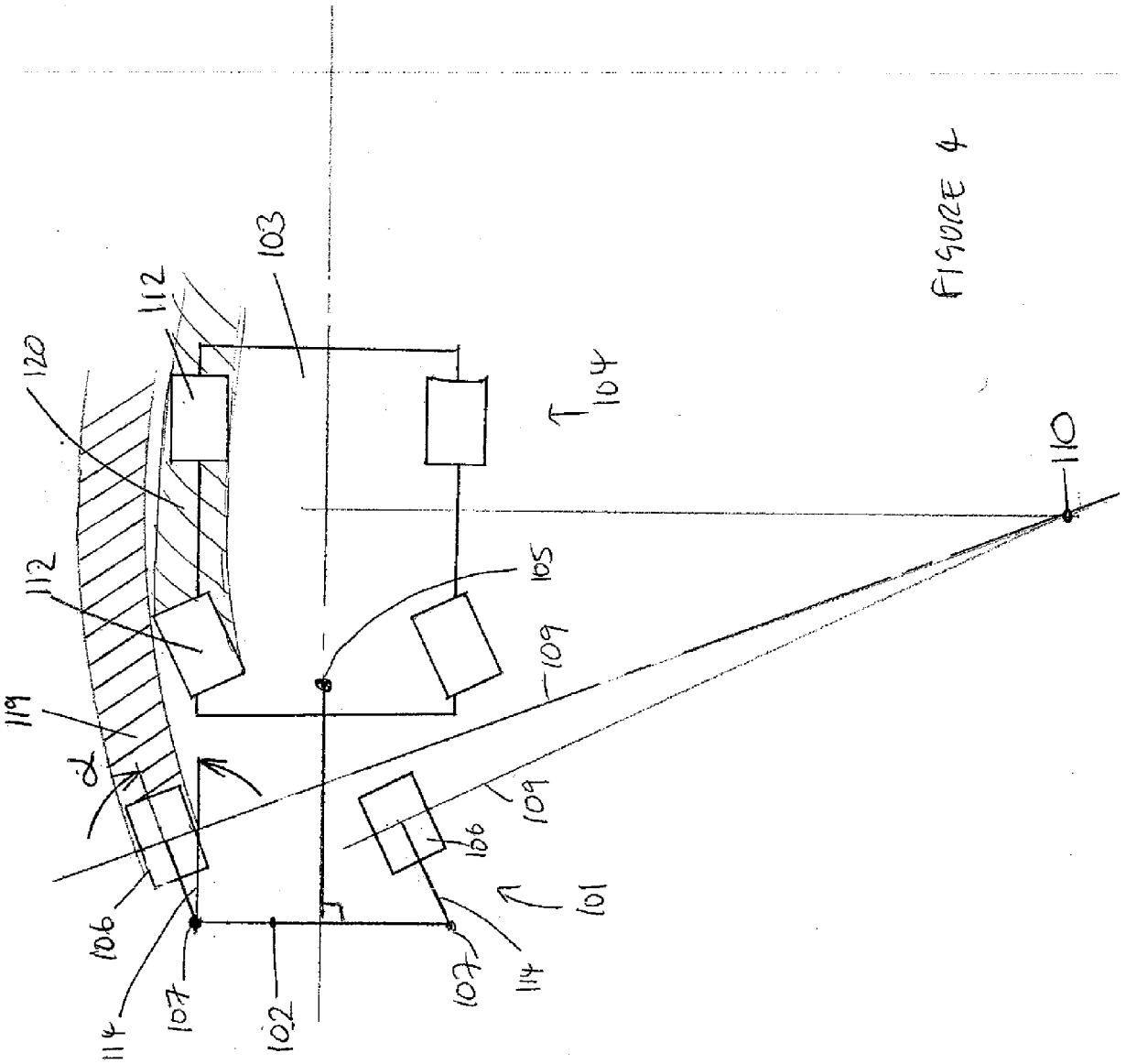
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FIGURE 4

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EUROPEAN SEARCH REPORT

Application Number
EP 09 16 9865

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	12 February 2010	Giesen, Maarten

CATEGORY OF CITED DOCUMENTS

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

REFERENCES CITED IN THE DESCRIPTION

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