

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
11 September 2009 (11.09.2009)

PCT

(10) International Publication Number
WO 2009/109768 A2

(51) International Patent Classification: Not classified

(21) International Application Number:
PCT/GB2009/000641

(22) International Filing Date:
9 March 2009 (09.03.2009)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
0804227.7 7 March 2008 (07.03.2008) GB
0814130.1 1 August 2008 (01.08.2008) GB

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(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— without international search report and to be republished upon receipt of that report (Rule 48.2(g))

(54) Title: AN APPARATUS FOR OSCILLATING AND ORIENTING A VANE AND A VESSEL INCLUDING SUCH AN APPARATUS

(57) Abstract: An apparatus for oscillating and orienting a vane comprising a main lever connected to a main pivot; a main drive linkage adapted to pivot the main lever from side to side about the main pivot in a pivot plane; a vane pivotally connected to the main lever remote from the main pivot and adapted to pivot about a vane axis; an angle change assembly adapted to pivot the vane about the vane axis during pivoting of the main lever such that the orientation of the vane relative to a fixed axis in the pivot plane is independent of the orientation of the main lever; the apparatus further comprising a displacement means connected to the angle change assembly and adapted such that displacement of the displacement means alters the orientation of the vane relative to the fixed axis.



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**An Apparatus For Oscillating And Orienting a Vane And A Vessel Including Such
An Apparatus**

5 The present invention relates to an apparatus for oscillating and orienting a vane and also to a vessel including such an apparatus. More particularly, but not exclusively, the present invention relates to an apparatus comprising a main lever adapted to oscillate from side to side, a vane pivotally connected to the main lever and an angle change assembly adapted to pivot the vane during oscillation of the main lever such that the
10 angle of the vane is independent of the angle of the main lever, the apparatus further comprising means to adjust the angle of the vane. More particularly, but not exclusively, the present invention relates to a vessel including such an apparatus, the apparatus being attached to the hull of the vessel by a pivot.

15 It is known to drive a vessel in a fluid by means of a vane attached to a pivoting arm. In use the pivoting arm is pivoted about a pivot axis displacing the vane from side to side in the fluid. A complex angle change mechanism varies the angle of the vane in the fluid. As the arm pivots from side to side the angle change mechanism ensures that the vane follows a complex path in the fluid so that the vessel is propelled forwards in the fluid.
20 Such an apparatus is relatively complex. It is also difficult to steer using such an apparatus.

Conventional propeller driven vessels are also known. Typically such vessels comprise a separate rudder to steer the vessel. Vessels whereby the steering is controlled by varying
25 the angle of the propeller relative to the vessel are uncommon due to their complexity.

The present invention seeks to overcome the problems of the prior art.

Accordingly, in a first aspect, the present invention provides an apparatus for oscillating
30 and orienting a vane comprising

a main lever connected to a main pivot;

a main drive linkage adapted to pivot the main lever from side to side about the main pivot in a pivot plane;

5

a vane pivotally connected to the main lever remote from the main pivot and adapted to pivot about a vane axis;

10

an angle change assembly adapted to pivot the vane about the vane axis during pivoting of the main lever such that the orientation of the vane relative to a fixed axis in the pivot plane is independent of the orientation of the main lever;

15

the apparatus further comprising a displacement means connected to the angle change assembly and adapted such that displacement of the displacement means alters the orientation of the vane relative to the fixed axis.

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The apparatus of the current invention is relatively simple comprising few moving parts. It is also very flexible allowing the direction of travel to be altered merely by displacing the displacement means so changing the angle of the vane in the fluid. The apparatus therefore acts as both propulsion and steering means.

Preferably, the apparatus further comprises a motor adapted to drive the main drive linkage.

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In an alternative embodiment the apparatus comprises a foot pedal connected to the main drive linkage and arranged such that displacement of the foot pedal drives the main drive linkage.

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Preferably, the vane is underbalanced. When the displacement means is slack the vane therefore feathers naturally in the flow.

Preferably, the displacement means is self centering. This allows for hands free operation of the apparatus.

5 Preferably, the displacement means comprises a handgrip arranged such that displacement of the handgrip alters the orientation of the vane relative to the fixed axis.

Alternatively, the displacement means comprises a wheel arranged such that rotation of the wheel alters the orientation of the vane relative to the fixed axis.

10 Preferably, the angle change linkage comprises a main angle change arm parallel to the main lever and connected thereto by at least two side arms, the angle change assembly and main lever together forming a parallelepiped linkage.

The vane can be connected to at least one of the side arms of the parallelepiped linkage
15 such that the vane maintains a fixed angle to the side arm.

Preferably, the displacement means is connected to the main angle change arm and is adapted to displace the main angle change arm along its length.

20 In a further aspect of the invention there is provided a vessel comprising

a hull; and,

an apparatus for oscillating and orienting a vane comprising
25

a main lever connected to a main pivot;

a main drive linkage adapted to pivot the main lever from side to side about the main pivot in a pivot plane;
30

a vane pivotally connected to the main lever remote from the main pivot and adapted to pivot about a vane axis;

5 an angle change assembly adapted to pivot the vane about the vane axis during pivoting of the main lever such that the orientation of the vane relative to a fixed axis in the pivot plane is independent of the orientation of the main lever;

10 the apparatus further comprising a displacement means connected to the angle change assembly and adapted such that displacement of the displacement means alters the orientation of the vane relative to the fixed axis;

15 the main pivot of the apparatus being connected to the hull.

The present invention will now be described by way of example only and not in any limitative sense with reference to the accompanying drawing in which

20 Figure 1 shows a vessel including an apparatus according to the invention in perspective view;

Figure 2 shows in schematic form an apparatus according to the invention pivoting about the main axis; and,

25 Figure 3 shows the apparatus of figure 2 with a different orientation of the vane.

Shown in figure 1 is a vessel 1 according to the invention including an apparatus 2 according to the invention. The vessel 1 comprises a hull 3. Arranged on a top face 4 of the hull 3 is a seat (not shown) in which the operator sits in use.

30

The apparatus 2 comprises first and second main pivots 5,6 attached to the hull 3. Main levers 7,8 are connected to the main pivots 5,6 and are free to oscillate about the pivots 5,6 from side to side. Foot pedals 9,10 are arranged on the top face 4 of the hull 3 in front of the seat and are free to be reciprocally displaced along guide rails 11,12 as shown. The
5 foot pedals 9,10 are arranged such that they can be reciprocally displaced by the feet of a user sat in the seat. Arranged between the foot pedals 9,10 and the main levers 7,8 is a main drive linkage 13 arranged such that reciprocal displacement of the foot pedals 9,10 pivots the main levers 7,8 from side to side about the main pivots 5,6. In this embodiment the main drive linkage comprises cords 14 connected between the foot pedals 9,10 and
10 main levers 7,8. The cords 14 extend around the pivots 15 as shown such that the linear displacement of the foot pedals 9,10 causes rotation of the main levers 7,8 about the main pivots 5,6.

Pivotaly connected to each of the main levers 7,8 remote from the main pivots 5,6 are
15 vanes 16,17. The vanes 16,17 are free to rotate about vane axes 18,19 which are substantially parallel to the main axis of the main pivots 5,6. The vanes are fixed to the main levers 7,8 so that their centre of pressure is behind their axis of rotation. This makes the vanes underbalanced, and means that they will align themselves naturally with the flow.

20 Arranged on each side of the seat on the upper face 4 of the hull 3 are displacement means 20,21, each comprising a hand grip (not shown) connected to a shaft 22,23. The end of each shaft 22,23 is pivotally connected to the top face 4 of the hull 3. The hand grips are arranged such that a user sat in the seat can displace the hand grips backwards
25 and forwards. The hand grips are elastic and self centering. This, in association with underbalanced foils means that the system will operate hands free.

Angle change linkages 24,25 are connected between the vanes 16,17 and the hand grips. Each angle change linkage 24,25 comprises a main angle change arm 26,27 at least a
30 portion of which extends substantially parallel to the associated main lever 7,8 and connected to the hand grip shaft 23,23. Each main angle change arm 26,27 is pivotally

connected to the associated main lever 7,8 by first and second side arms 28,29,30,31. One of the side arms 28,30 is connected to the associated main lever 7,8 at its associated main pivot 5,6. The main levers 7,8, main angle change arms 26,27 and side arms 28,29,30,31 together form parallelepiped linkages. Each vane 16,17 is connected to the side arm 29,31 proximate to the vane 16,17 such that the vane 16,17 remains at a fixed orientation relative to the side arm 29,31 during the side to side oscillation of the main lever 7,8.

In use a user reciprocally displaces the foot pedals 9,10 backwards and forwards. The motion of the foot pedals 9,10 drives the main drive linkage 13 which in turn pivots the main levers 7,8 about the main pivots 5,6. If the hand grips are kept stationary then the parallelepiped linkages ensure that the orientation of the vanes 16,17 is not affected by the pivoting of the main levers 7,8. The orientation of each vane is therefore independent of the orientation of its associated main lever 7,8.

A user may adjust the orientation of a vane 16,17 by displacing the associated hand grip either backwards or forwards. Displacement of a hand grip displaces the associated main angle change arm 26,27 along its length. This rotates the side arms 28-31 relative to the main levers 7,8 by an amount related to the displacement of the hand grip so causing a corresponding rotation of the associated vane 16,17. As the main lever 7,8 pivots from side to side with the vane 16,17 in the new position the vane 16,17 maintains a new constant orientation although the orientation is now different to the original orientation.

In order to drive the vessel 1 forwards the user reciprocally drives the foot pedals 9,10 causing the main levers 7,8 to pivot from side to side. The main drive linkage 13 of this embodiment is adapted such that the main levers 7,8 pivot in antiphase, with the vanes 16,17 first being displaced away from each other and then towards each other. During the first part of the pivoting motion of the main levers 7,8 the user displaces the grips such that each vane 16,17 is pivoted to a first orientation relative to a fixed axis, providing forward thrust as the vane 16,17 moves through the fluid. At the extremity of the pivoting motion of the main levers 7,8 the hand grips are displaced such that each vane 16,17 reverses its orientation relative to the fixed axis. During the second part of the pivoting

motion the main levers 7,8 pivot in the opposite direction about their respective main pivots 5,6 displacing the vanes 16,17 in the opposite direction. As the orientation of the vanes 16,17 relative to the fixed axis during this second part of the pivoting motion is opposite to that in the first part this continues the forward motion.

5

By changing the phase relation between the rotation of the vanes 16,17 about the vane axes 18,19 and the main levers 7,8 about the main pivots 5,6 other directions of travel are possible. For example the vessel 1 can be driven backwards or round in a circle.

10 Figure 2 shows in schematic form an alternative embodiment of an apparatus according to the invention. Like parts are referred by like reference numerals. The main lever 8 pivots from side to side in a pivot plane about a main pivot 6. A fiducial fixed axis in the pivot plane is shown dotted. As the main lever 8 pivots about the main pivot 6 the parallelepiped linkage 8,26,28,29 ensures that whilst the vane 16 is displaced from side to
15 side it remains in fixed orientation to the fixed axis. The orientation of the vane 16 is therefore independent of the orientation of the main lever 8.

Figure 3 shows the same embodiment as figure 2. In this embodiment the displacement means 21 has been displaced, so tilting the parallelepiped linkage as shown. This pivots
20 the vane 16 about the vane axis 18. As the main lever 8 pivots about the main pivot 6 the vane 16 maintains a fixed orientation relative to the fixed axis although this is now a different orientation to figure 2.

In a further embodiment of the invention the displacement means comprises a steering
25 wheel. Rotation of the wheel displaces the main angle change arms 26,27 forwards or backwards as required, so rotating the vanes 16,17.

In an alternative embodiment of the invention the vessel 1 further comprises a motor connected to the main drive linkage 13 for driving the main levers 7,8 without the use of
30 a users feet.

In a further alternative embodiment of the invention the foot pedals 9,10 are adapted to be rotated about a common axis similar to the pedals of a bicycle.

In the above embodiments the vessel 1 comprises two main levers 7,8 driven by a main drive linkage 13. In an alternative embodiment the vessel 1 comprises one main lever
5 having a vane connected thereto. In further alternative embodiments the vessel 1 comprises more than two main levers, each having at least one vane connected thereto..

CLAIMS

1. An apparatus for oscillating and orienting a vane comprising

a main lever connected to a main pivot;

a main drive linkage adapted to pivot the main lever from side to side about the main pivot in a pivot plane;

a vane pivotally connected to the main lever remote from the main pivot and adapted to pivot about a vane axis;

an angle change assembly adapted to pivot the vane about the vane axis during pivoting of the main lever such that the orientation of the vane relative to a fixed axis in the pivot plane is independent of the orientation of the main lever;

the apparatus further comprising a displacement means connected to the angle change assembly and adapted such that displacement of the displacement means alters the orientation of the vane relative to the fixed axis.
2. An apparatus as claimed in claim 1, further comprising a motor adapted to drive the main drive linkage.
3. An apparatus as claimed in claim 1, further comprising a foot pedal connected to the main drive linkage and arranged such that displacement of the foot pedal drives the main drive linkage.
4. An apparatus as claimed in any one of claims 1 to 3, wherein the vane is underbalanced.

5. An apparatus as claimed in any one of claims 1 to 4, wherein the displacement means is self centering.
6. An apparatus as claimed in any one of claims 1 to 5, wherein the displacement means comprises a handgrip arranged such that displacement of the handgrip alters the orientation of the vane relative to the fixed axis.
7. An apparatus as claimed in any one of claims 1 to 5, wherein the displacement means comprises a wheel arranged such that rotation of the wheel alters the orientation of the vane relative to the fixed axis.
8. An apparatus as claimed in any one of claims 1 to 7, wherein the angle change linkage comprises a main angle change arm parallel to the main lever and connected thereto by at least two side arms, the angle change assembly and main lever together forming a parallelepiped linkage.
9. An apparatus as claimed in claim 8, wherein the vane is connected to at least one of the side arms of the parallelepiped linkage such that the vane maintains a fixed angle to the side arm.
10. An apparatus as claimed in either of claims 8 or 9 wherein the displacement means is connected to the main angle change arm and is adapted to displace the main angle change arm along its length.
11. A vessel comprising

a hull; and

an apparatus as claimed in any one of claims 1 to 10, the main pivot of the apparatus being connected to the hull.

12. An apparatus substantially as hereinbefore described.
13. A vessel substantially as hereinbefore described.

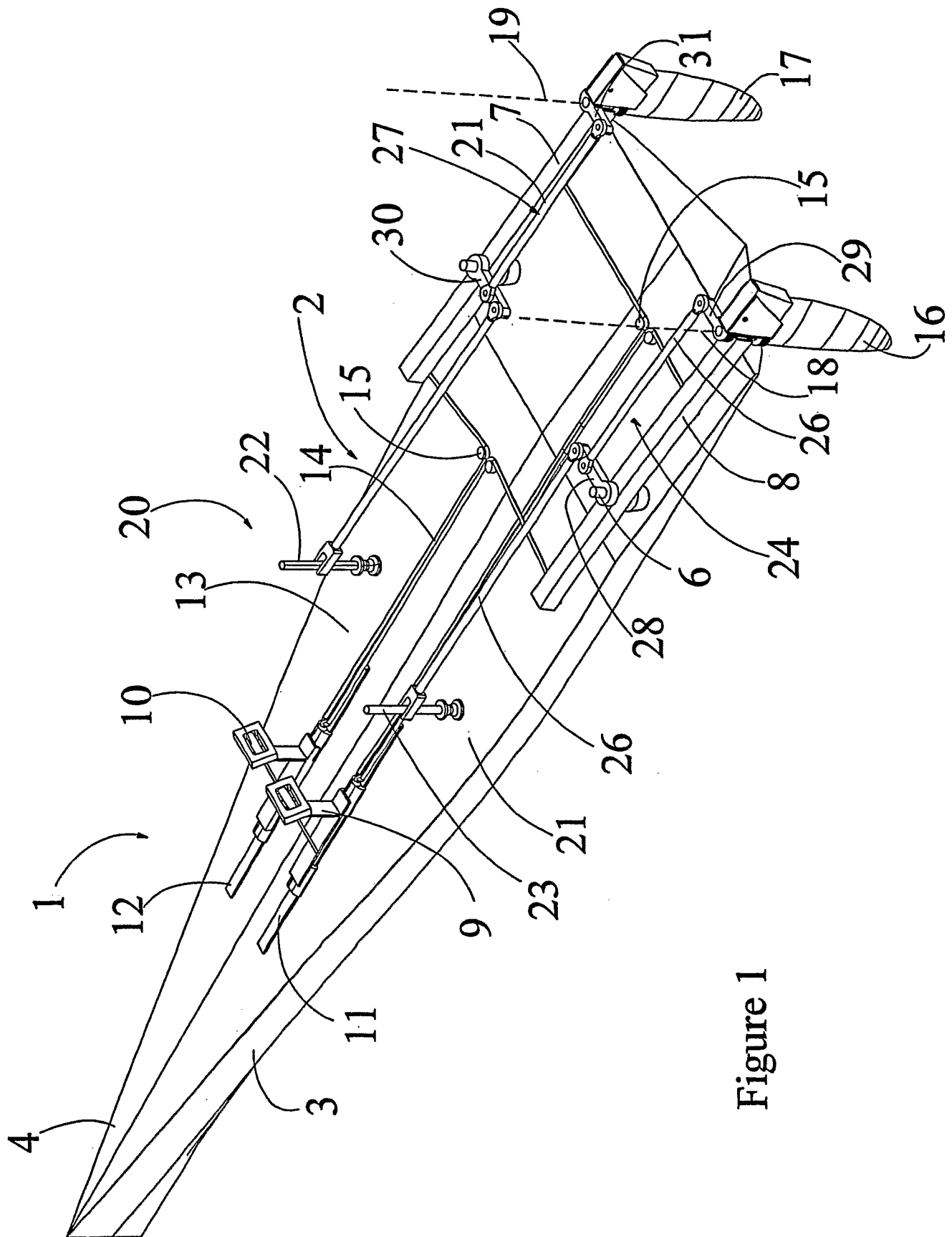


Figure 1

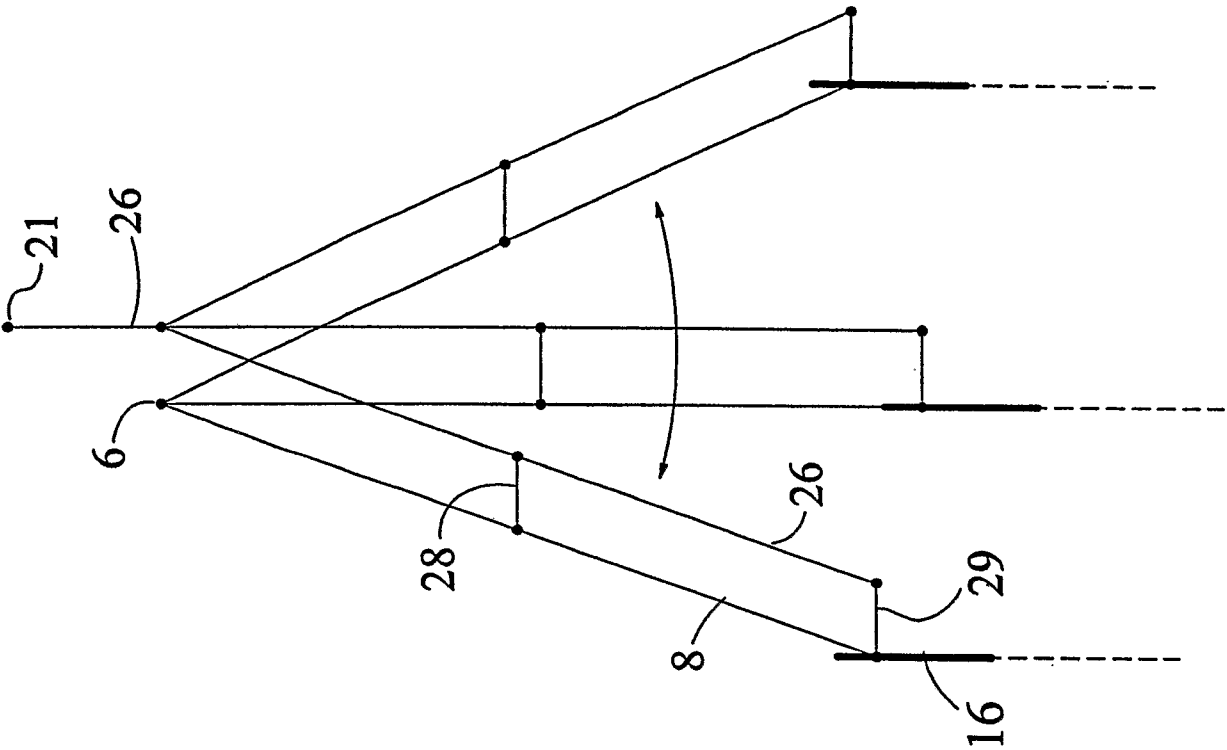


Figure 2

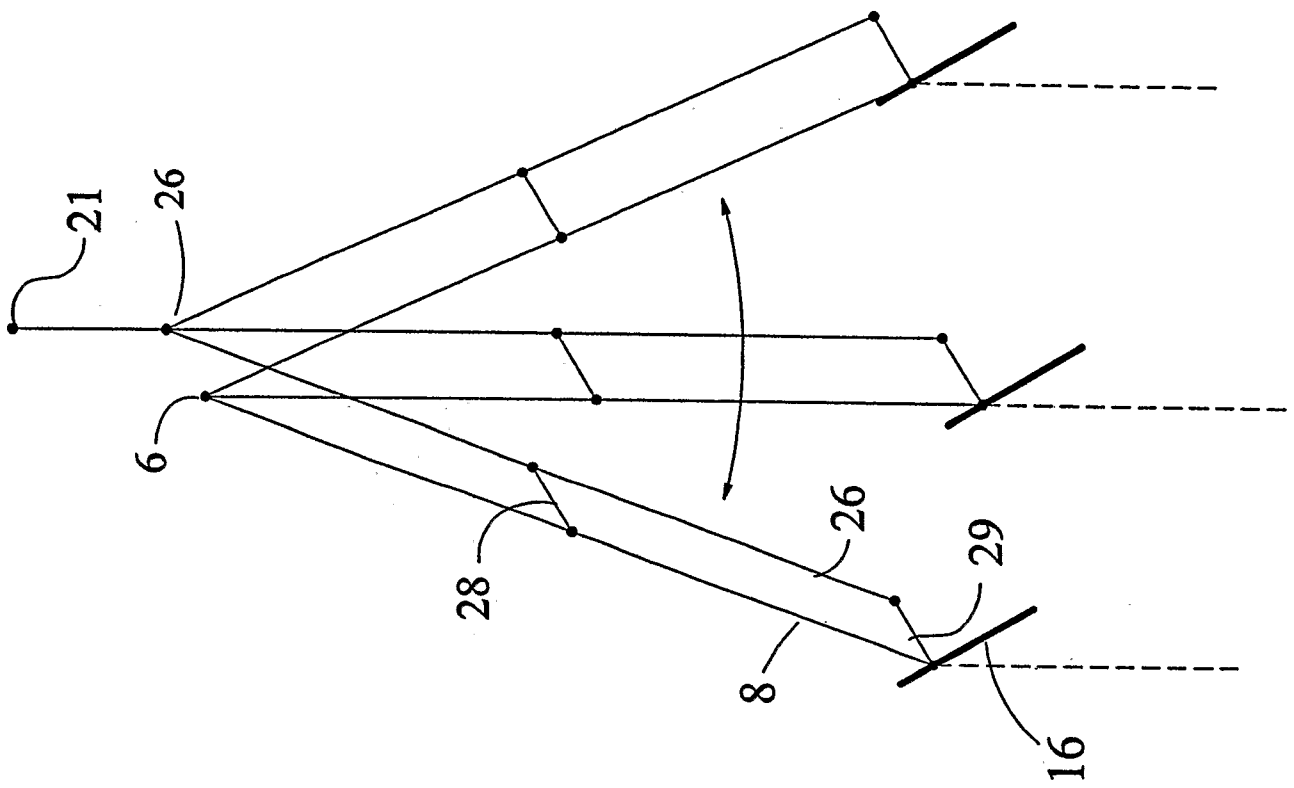


Figure 3