(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number : **0 675 068 A1**

(12) EUROPEAN PATENT APPLICATION

(21) Application number : **95302129.2**

(51) Int. Cl.[6] : **B66C 3/10**

(22) Date of filing : **30.03.95**

(30) Priority : **31.03.94 IL 10919594**

(43) Date of publication of application :
04.10.95 Bulletin 95/40

(84) Designated Contracting States :
AT BE CH DE DK ES FR GB GR IE IT LI LU MC NL PT SE

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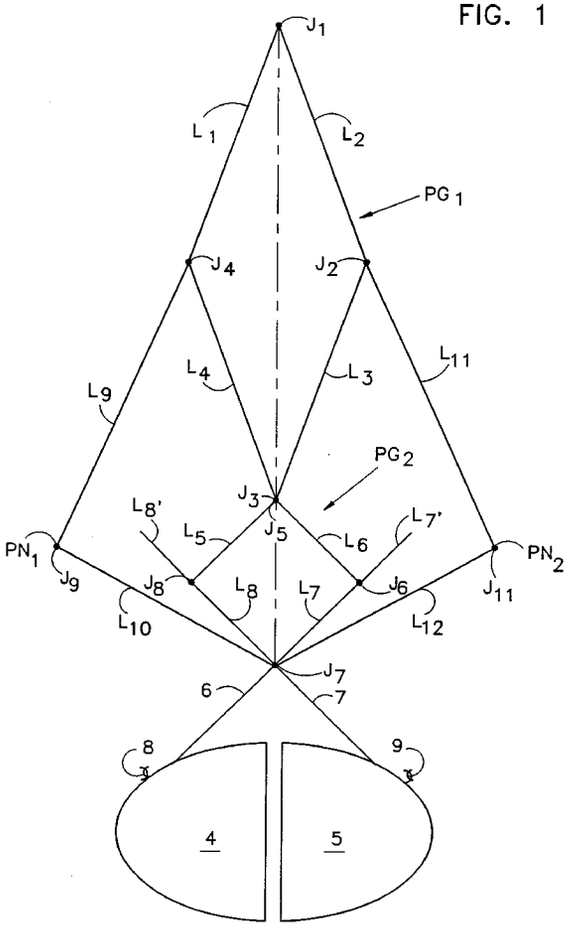
(54) Power shovel.

(57) A power shovel for moving material from the ground includes a linkage mechanism adapted to be suspended from a drive unit capable of raising and lowering a load, and a pair of scoops pivotally mounted to the lower end of the linkage mechanism such that raising the upper end of the linkage mechanism to space the scoops above the ground closes the scoops to enable them to pick up a load on the ground, and lowering the upper end of the linkage mechanism to bring the scoops into contact with the ground opens the scoops to cause them to drop the load. A releasable retainer device is carried by each of the scoops and is selectively engageable with a lower part of the linkage mechanism to retain the scoops in their open position when the upper end of the linkage mechanism is raised, or disengageable from the lower part of the linkage mechanism to permit the pair of scoops to move to a closed position when the upper end of the linkage mechanism is raised.

FIG. 1



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The present invention relates to power shovels for moving material from the ground or other surface, such as used for moving soil in the ground, for moving material lying on the ground or other supporting surface, or for other similar applications.

Power shovels are known including a pair of scoops pivotally mounted to the lower end of a linkage mechanism, which scoops are closed to enable them to pick up a load and opened to cause them to drop the load. Generally, such known power shovel constructions include hydraulic or other devices for opening and/or closing the scoops.

An object of the present invention is to provide a power shovel of a construction which exploits gravity to open and close the scoops at the proper times, and thereby obviates the need for special hydraulic or other actuators for performing this function.

According to a broad aspect of the present invention, there is provided a power shovel for moving material from the ground or other surface, comprising: a linkage mechanism adapted to be suspended from an upper end thereof to a drive unit capable of raising and lowering a load; a pair of scoops pivotally mounted to the lower end of the linkage mechanism such that raising the upper end of the linkage mechanism to space the scoops above the surface closes the scoops to enable them to pick up a load of material on the surface, and lowering the upper end of the linkage mechanism to bring the scoops into contact with the surface opens the scoops to cause them to drop the load; and a releasable retainer device carried by each of the scoops engageable with a lower part of the linkage mechanism to retain the scoops in their open position when the upper end of the linkage mechanism is raised, or disengageable from the lower part of the linkage mechanism to permit the pair of scoops to move to a closed position when the upper end of the linkage mechanism is raised.

According to further features in the preferred embodiment of the invention described below, each of the releasable retainer devices includes a hook carried by the respective scoop at a location thereof to engage or disengage the respective lower part of the linkage mechanism. Each of the hooks is pivotally mounted to an upper surface of the respective scoop.

According to further features in the described preferred embodiment, each of the hooks includes a first abutment contactible by the linkage mechanism to pivot the hook from an engaging position to a disengaging position with respect to the lower part of the linkage mechanism when the upper end of the linkage mechanism is lowered and the scoops are in contact with the surface, to thereby permit the scoops to close to pick up a load when the upper end of the linkage mechanism is thereafter raised. Each of the hooks further includes a second abutment contactible by the linkage mechanism to pivot the hook from a disengaging position to an engaging position with respect to the respective lower part of the linkage mechanism when the upper end of the linkage mechanism is next lowered and the scoops are in contact with the surface, to thereby cause the scoops to open and to drop its load when the upper end of the linkage mechanism is thereafter raised.

As will be described below, a power shovel constructed in accordance with the foregoing features utilizes gravity for opening and closing the scoops at the proper times and, by thus eliminating the need for hydraulic or other power devices for performing these functions, substantially simplifies the construction of the power shovel.

Fig. 1 diagrammatically illustrates one form of power shovel constructed in accordance with the present invention;

Fig. 2 is an enlarged fragmentary view illustrating the construction of the releasable retainer device provided on each of the scoops in the power shovel of Fig. 1;

and Figs. 3, 4 and 5 illustrate three different conditions of the linkage mechanism in the power shovel of Fig. 1 during the operation of the power shovel.

The power shovel illustrated in the drawings comprises a linkage mechanism, generally designated 2, adaped to be suspended from an upper end 3, as by a boom, crane or other suitable apparatus capable of raising a load, conveying it to a desired location, and then lowering the load. A pair of scoops 4, 5 are carried at the lower end of the linkage mechanism 2. The scoops are fixed to arms 5 and 6, respectively, which are pivotally mounted to the lower end of the linkage mechanism 2 such that the scoops may be opened and closed to pick up a load of soil or other material to be conveyed to another location, and then opened again in order to drop the load at the other location.

The power shovel illustrated in Fig. 1 does not require any hydraulic or other actuator devices for opening and closing the scoops 4, 5, but rather utilizes gravity to perform these functions. This is permitted by the special construction of the linkage mechanism 2, and also by the provision of releasable retainer devices 8 and 9 carried by the respective scoops 4, 5, which cooperate with the linkage mechanism 2, as will be described more particularly below.

The linkage mechanism 2 includes a plurality of links defining two parallelograms PG_1, PG_2. The first parallelogram PG_1 includes first, second, third and fourth links L_1-L_4, respectively, coupled together at first, second, third and fourth joints, G_1-G_4, respectively; and the second parallelogram PG_2 includes fifth, sixth, seventh and eighth links L_5-L_8, pivotally coupled together at fifth, sixth, seventh and eighth joints J_5-J_8, respectively.

It will be seen that the first joint J_1 of the first parallelogram PG_1 constitutes the upper end of the linkage mechanism 2; that the third joint J_3 of the first par-

allelogram PG_1, and the fifth joint J_5 of the second parallelogram PG_2 are coaxial; and that the seventh joint J_7 of the second parallelogram PG_2 constitutes the lower end of the linkage mechanism 2 which pivotally mounts the two scoops 4, 5. Thus, the two arms 6, 7 of the scoops 4, 5 constitute extensions of links L_7 and L_8, respectively.

The linkage mechanism 2 includes a further pair of links L_9, L_{10} pivotally coupled together at one of their ends at joint J_9. The opposite end of link L_9 is pivotally coupled to parallelogram PG_1 at joint J_4, and the opposite end of link L_{10} is pivotally coupled to parallelogram PG2 at joint J_7. Similarly, the linkage mechanism 2 includes a second pair of links L_{11}, L_{12}, pivotally coupled together at inner ends at joint J_9, and at their opposite ends to joint J_2 of parallelogram PG_1 and joint J_7 of parallelogram PG_2, respectively.

In addition, joint J9 includes a pin PN_1 which cooperates with the releasable retainer device 8 on scoop 4 as will be described more particularly below. Similarly, joint J_{11} includes a pin PN_2 which cooperates with the releasable retainer device 9 on scoop 5.

Further, links L_7 and L_8 of parallelogram PG_2 include extensions $L_{7'}$, $L_{8'}$, respectively, in the direction opposite to that of their arms 6, 7, for purposes to be described below.

Fig. 2 illustrates the construction of the releasable device 8 on scoop 4. It will be appreciated that releasable retainer device 9 on scoop 5 is of the same construction but merely oriented in the opposite direction.

Retainer device 8 includes a hook 10 fixed to a plate 11 pivotally mounted at its center about axis 12 to the upper end of a post 13. Post 13 is secured at its lower end to the upper surface of scoop 4. One end 11a of plate 11 serves as a first abutment engageable by pin PN_1 of the linkage mechanism 2 for pivoting hook 10 counter clockwise about axis 12; whereas the opposite end 11b of plate 11 serves as a second abutment engageable by the extension L_8, of link L_8 for pivoting the hook counter-clockwise about axis 12. As will be described below, pivoting hook 10 counterclockwise better assures that the hook 10 will engage pin PN_1 at the proper time; whereas pivoting the hook in the clockwise direction by link extension L_8, better assures that the hook 10 will disengage from pin PN_1 at the proper time. It will appreciated that the hook in retainer element 9 of scoop 5 cooperates in a similar manner with respect to pins PN_2 and link extension $L_{7'}$.

Figs. 3-5 illustrate three stages in the operation of the power shovel starting from the condition illustrated in Fig. 3. In this condition of the power shovel, the two scoops 4, 5 are empty and in their open positions; and hooks 10 of the retainer devices 8, 9, are engaged with the pins PN_1 and PN_2, respectively, of the linkage mechanism 2.

The linkage mechanism 2 is then lowered until the scoops 4, 5 contact the ground. Further lowering of the linkage mechanism 2 will bring the two link extensions $L_{7'}$, $L_{8'}$, of the second parallelogram PG_2 into contact with the retainer devices 8, 9 of the two scoops 4, 5. Thus, link extension L_2 will come into contact with abutment 11b (Fig. 2) of hook 10, to pivot the hook clockwise, and thereby to release it from pin PN_1; link extension $L_{7'}$ will actuate retainer device 9 in the same manner to release its hooks from pin PN_2.

The linkage mechanism 2 is then raised, whereupon the scoops 4, 5, scoop up and collect the soil or other material to be loaded.

Fig. 4 illustrates the condition of the power shovel wherein the linkage mechanism 2 has been raised sufficiently to raise the scoops 4, 5 off the ground. In this condition, the scoops are fully closed and are thereby able to convey the load to any desired location. It will be seen that the larger the load, the larger will be the closing force applied by the load to the two scoops 4, 5.

When the load has been conveyed to the desired location, linkage mechanism 2 is then lowered until the two scoops 4, 5 again touch the ground or other surface to receive the load. This is the condition of the linkage mechanism as illustrated in Fig. 5. The linkage mechanism is then further lowered a slight amount, whereupon the two pins PN_1, PN_2 engage the retainer devices 8, 9 on the two scoops 4, 5, to cause their respective hooks to re-engage the two pins PN_1, PN_2. Thus, as shown in Fig. 2, pin PN_1 when lowered to engage abutment 11a, pivots hooks 10 counter-clockwise, so that when the linkage mechanism 2 is again raised, PN_1 will be engaged by hook 10. A similar action occurs between pin PN_2 with respect to the hook of retainer device 9 on scoop 5.

The linkage mechanism 2 may therefore be again raised, whereupon the two pins PN_1, PN_2 become engaged by the hooks of their respective retainer devices 8, 9. As the linkage mechanism is raised, the two scoops 4, 5 are thus pivoted to their open positions, as illustrated in Fig. 3, to thereby drop the load.

The power shovel may then be moved back to the first location in order to pick up another load in the same manner.

It will be seen that joint J_3 common to the two parallelograms PG_1, PG_2, is always located, in all positions of the linkage mechanism 2, between a line through joints J_2 and J_4 of the first parallelogram PG_1, and a line through joints J_7 and J_8 of the second parallelogram PG_2.

While the invention has been described with respect to one preferred embodiment, it will be appreciated that many variations may be made. For example, other releasable retainer devices could be used for selectively retaining the two scoops in their open or closed positions at the proper times. Also, the end of extensions $L_{7'}$, $L_{8'}$ could be provided with springs to engage their respective abutments 11b to soften the

force applied to those abutments. Further, other linkage mechanism could be used. In addition, each of the links described above may actually be constituted of more than one link, e.g., two, three or more links parellel, in order to provide stability to the linkage mechanism particularly if large loads are to be handled.

Claims

1. A power shovel for moving material from the ground or other surface, comprising:

   a linkage mechanism adapted to be suspended from an upper end thereof to a drive unit capable of raising and lowering a load;

   a pair of scoops pivotally mounted to the lower end of the linkage mechanism such that raising the upper end of the linkage mechanism to space the scoops above said surface closes the scoops to enable them to pick up a load of material on said surface, and lowering said upper end of the linkage mechanism to bring the scoops into contact with said surface opens the scoops to cause them to drop said load;

   and a releasable retainer device carried by each of said scoops selectively engageable with a lower part of the linkage mechanism to retain the scoops in their open position when said upper end of the linkage mechanism is raised, or disengageable from said lower part of the linkage mechanism to permit the pair of scoops to move to a closed position when said upper end of the linkage mechanism is raised.

2. The power shovel according to Claim 1, wherein each of said releasable retainer devices includes a hook carried by the respective scoop at a location thereof to engage or disengage the respective lower part of the linkage mechanism.

3. The power shovel according to Claim 2, wherein each of said hooks is pivotally mounted to an upper surface of the respective scoop.

4. The power shovel according to Claim 3, wherein each of said hooks includes a first abutment contactible by the linkage mechanism to pivot the hook from an engaging position to a disengaging position with respect to the respective lower part of the linkage mechanism when said upper end of the linkage mechanism is lowered and the scoops are in contact with said surface, to thereby permit the scoops to close to pick up a load when said upper end of the linkage mechanism is thereafter raised.

5. The power shovel according to Claim 4, wherein said first abutment is contacted by a pin pivotally mounting a pair of links at the lower part of said linkage mechanism.

6. The power shovel according to either of Claims 4 or 5, wherein each of said hooks further includes a second abutment contactible by the linkage mechanism to pivot the hook from a disengaging position to an engaging position with respect to the respective lower part of the linkage mechanism when said upper end of the linkage mechanism is next lowered and the scoops are in contact with said surface, to thereby cause the scoops to open and to drop their load when the upper end of the linkage mechanism is thereafter raised.

7. The power shovel according to Claim 6, wherein said second abutment is contacted by an extension of a link at the lower part of said linkage mechanism.

8. The power shovel according to Claim 7, wherein said first and second abutments are constituted of the opposite ends of a plate secured to the respective hook and pivotally mounting the hook to the respective scoop.

9. The power shovel according to any one of Claims 1-8, wherein said linkage mechanism comprises:

   first, second, third and fourth links pivotally coupled together at first, second, third and fourth joints to define a first parallelogram;

   fifth, sixth, seventh and eighth links pivotally coupled together at fifth, sixth, seventh and eighth joints to define a second parallelogram;

   said first joint of the first parallelogram constituting said upper end of the linkage mechanism, and said third joint of the first parallelogram being coaxial with said third joint of the second parallelogram;

   said linkage mechanism further including ninth and tenth links pivotally coupled together at one of their ends at a ninth joint, and at their opposite ends to said fourth and seventh joints respectively;

   said linkage mechanism further including eleventh and twelfth links pivotally coupled together at one of their ends at an eleventh joint and at their opposite ends to said second and seventh joints respectively;

   said seventh and eighth links of the second parallelogram being formed with extensions facing away from said fifth joint and secured to said pair of scoops.

10. The power shovel according to Claim 9, wherein said links are dimensioned such that, in all con-

ditions of the linkage mechanism, said first joint is always between a line through said second and fourth joints, and a line through said sixth and eighth joints.

FIG. 1

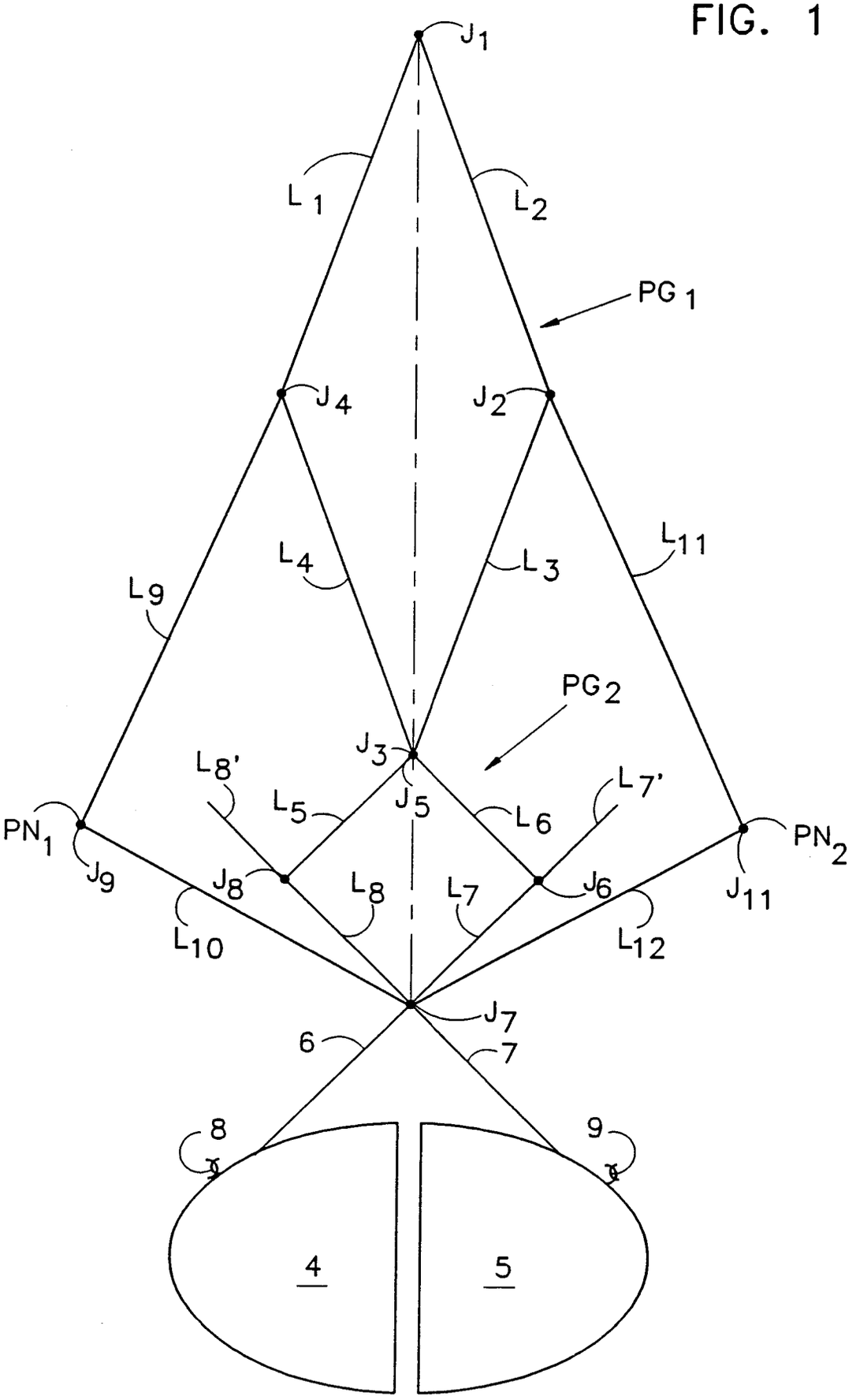
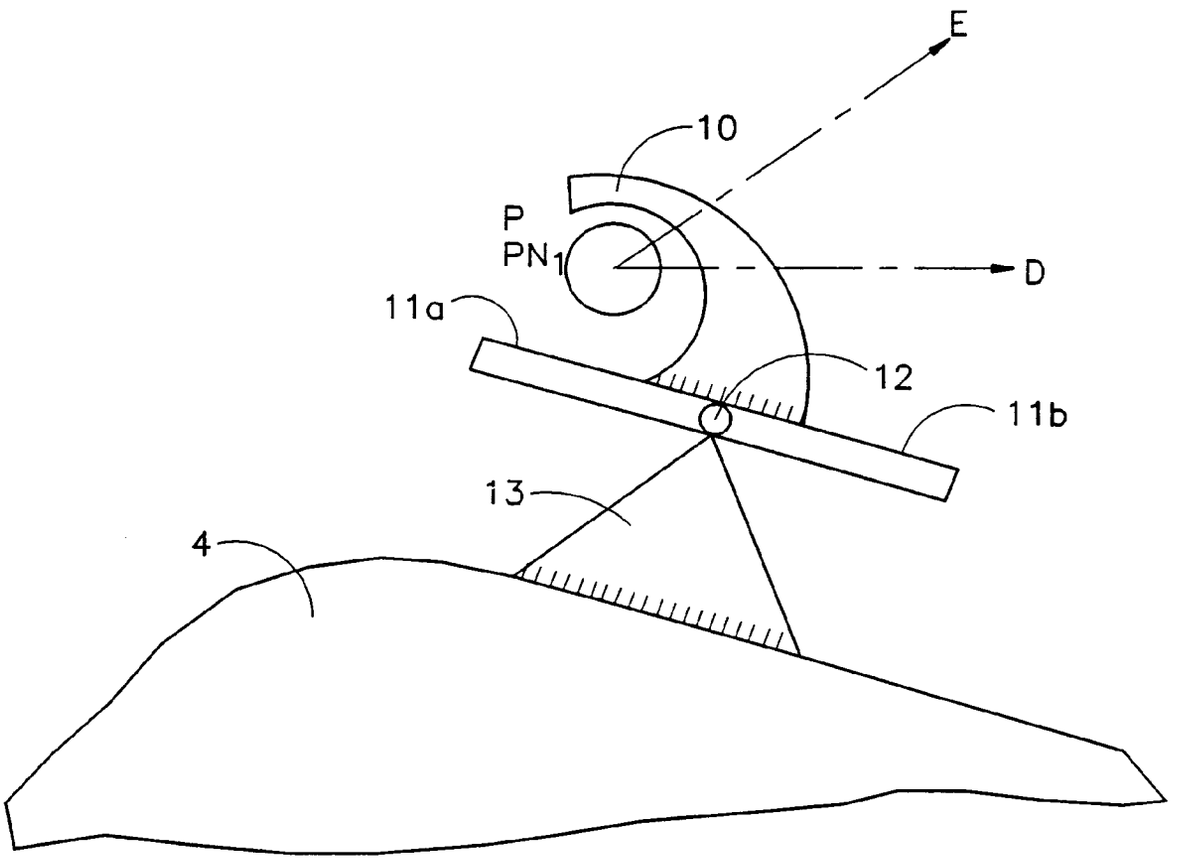

J1
L1
L2
PG1
J4
J2
L4
L3
L11
L9
PG2
J3
L8'
L7'
L5
J5
L6
PN1
PN2
J9
J8
L8
L7
J6
J11
L10
L12
J7
6
7
8
9
4
5

FIG. 2



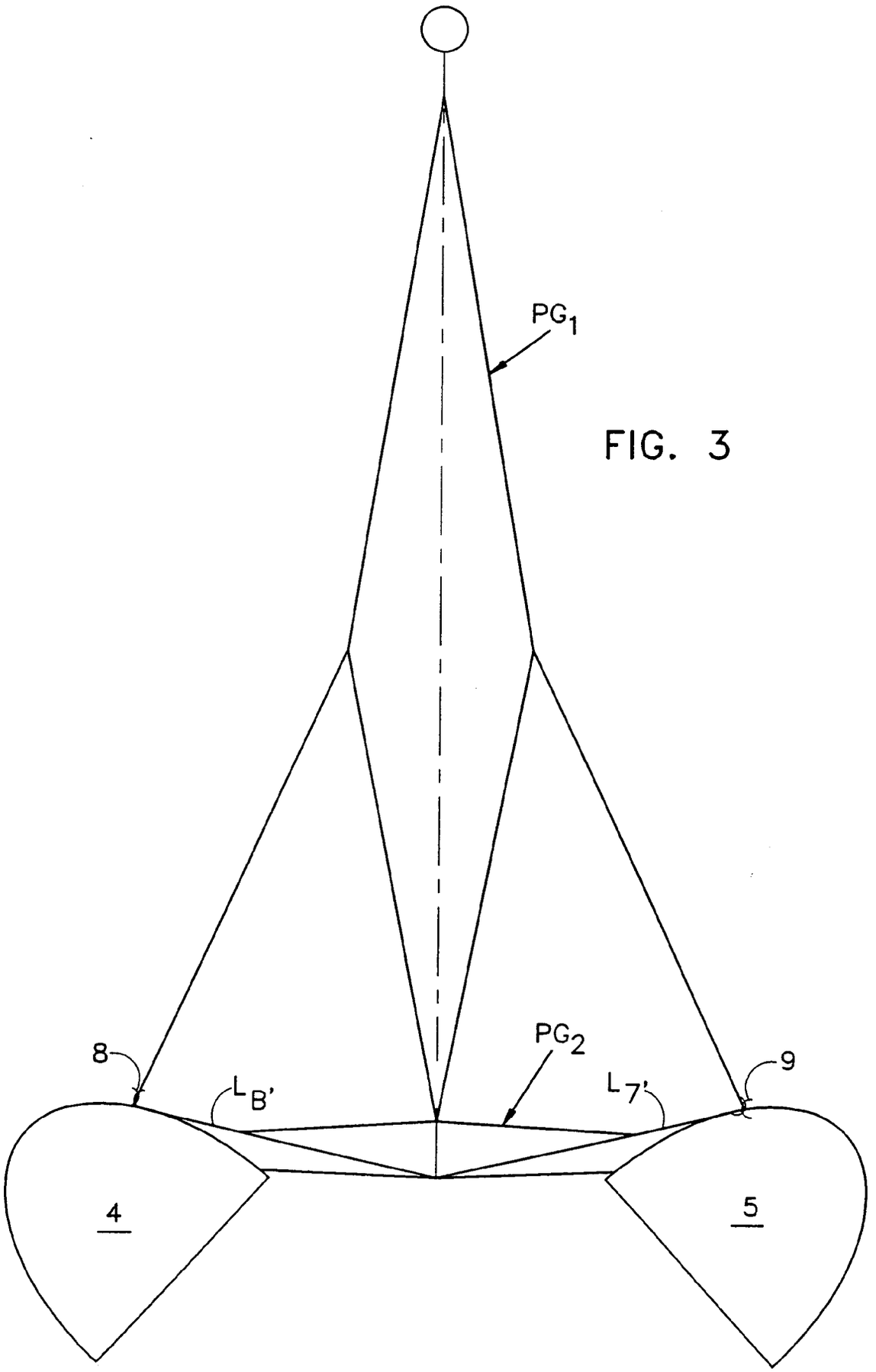


FIG. 3

FIG. 4

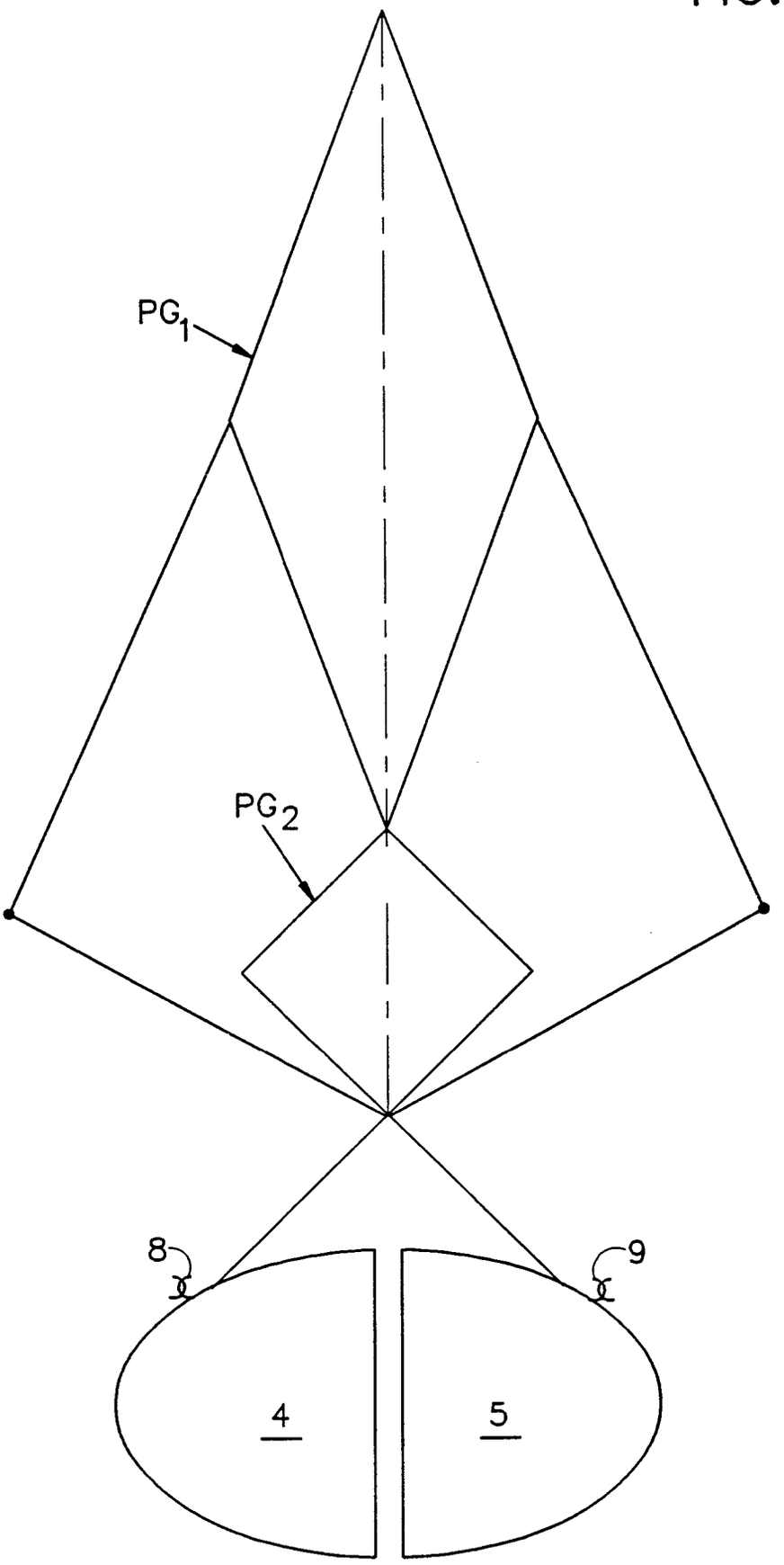
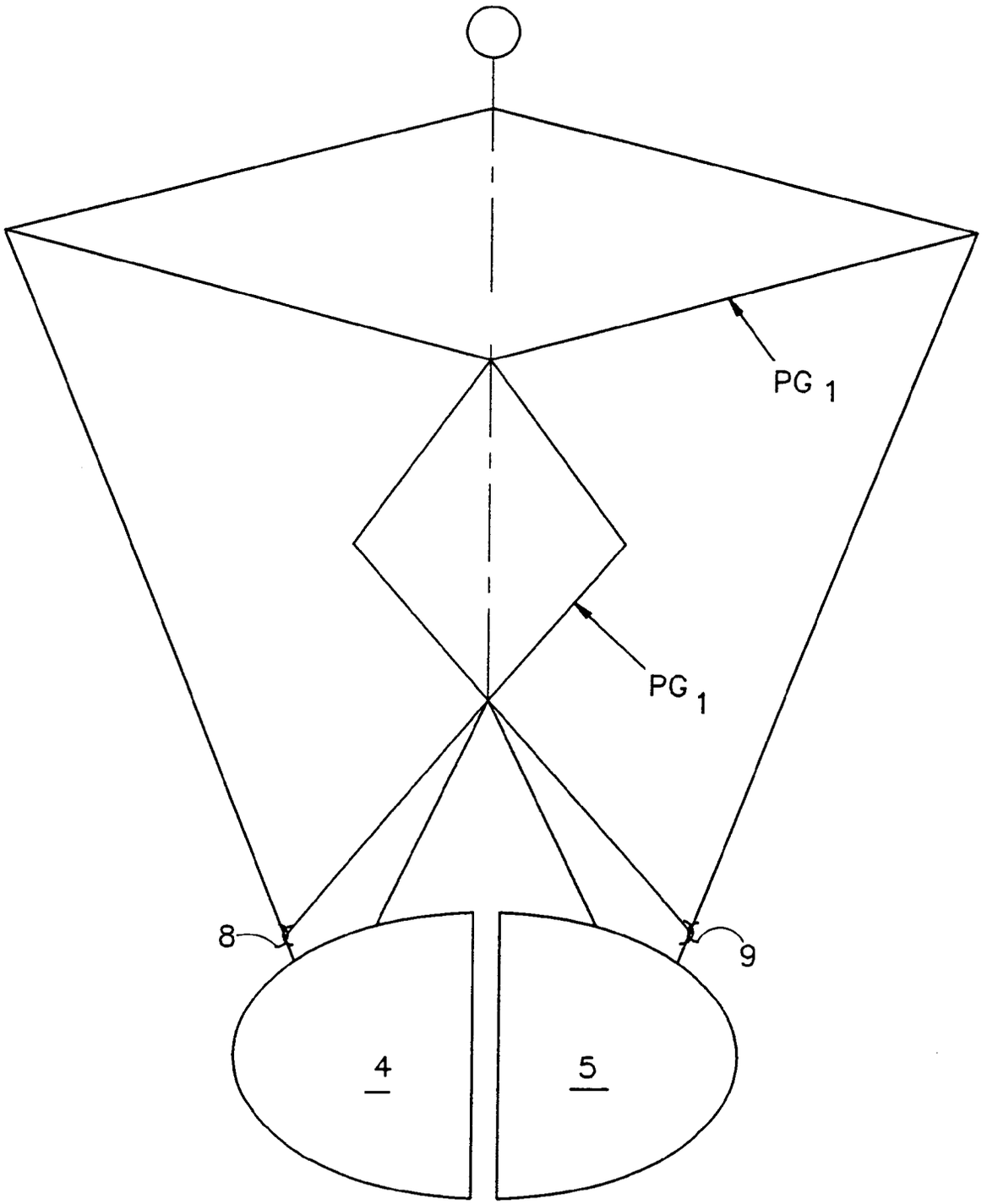


FIG. 5



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EUROPEAN SEARCH REPORT

Application Number
EP 95 30 2129

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.6)
X	GB-A-2 015 471 (NORTHERN ENG IND) 12 September 1979 * the whole document *	1-3	B66C3/10
A	FR-A-577 229 (LASSAUX) 2 September 1924		
A	DE-C-174 762 (BENRATHER MASCHINENFABRIK AG) 28 September 1906		
A	FR-A-503 995 (CANNET) 22 June 1920		
A	DE-B-12 39 455 (ROTTENBACHER) 27 April 1967		

TECHNICAL FIELDS SEARCHED (Int.Cl.6)
B66C E02F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	14 June 1995	De Schepper, H

CATEGORY OF CITED DOCUMENTS

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