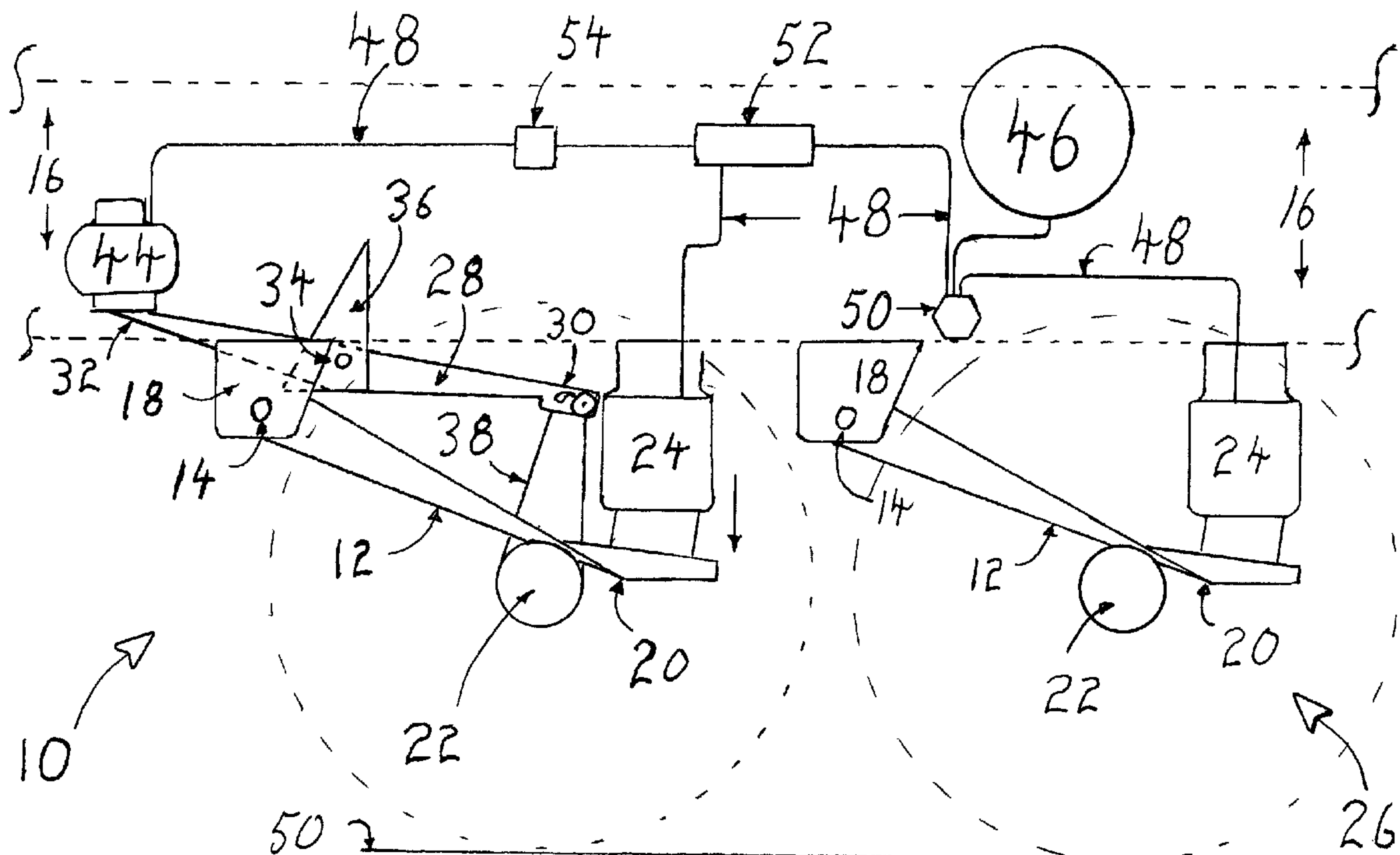




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(54) Titre : SUSPENSION A ESSIEU RELEVABLE  
(54) Title: LIFT AXLE SUSPENSION



(57) Abrégé/Abstract:

A lift axle suspension includes an axle and a first suspension air bag acting one of directly or indirectly in a downward direction upon the axle. A lever is provided having a first end, a second end, and a fulcrum selectively positioned between the first end and the second end. The first end is linked to the axle. A second lift air bag acts in a downward direction upon the second end of the lever. This causes the lever to pivot about the fulcrum such that the first end of the lever, which is linked to the axle, is raised. An air diverter selectively supplies air to either the first suspension air bag to lower the axle or the second lift air bag to raise the axle.

**ABSTRACT OF THE DISCLOSURE**

A lift axle suspension includes an axle and a first suspension air bag acting one of directly or indirectly in a downward direction upon the axle. A lever is provided having  
5 a first end, a second end, and a fulcrum selectively positioned between the first end and the second end. The first end is linked to the axle. A second lift air bag acts in a downward direction upon the second end of the lever. This causes the lever to pivot about the fulcrum such that  
10 the first end of the lever, which is linked to the axle, is raised. An air diverter selectively supplies air to either the first suspension air bag to lower the axle or the second lift air bag to raise the axle.

**TITLE OF THE INVENTION:**

Lift Axle Suspension

**FIELD OF THE INVENTION**

5 The present invention relates to a lift axle suspension.

**BACKGROUND OF THE INVENTION**

There are numerous examples of lift axle suspensions in the patent literature, including: United States Patents  
10 3,201,141 (Bernstein (1965); 4,000,913 (Gibson 1977);  
4,256,326 (Cantrell et al 1981); 5,403,031 (Gottschalk et al  
1995); 5,549,322 (Hauri 1996); 5,655,788 (Peaker 1997) and  
6,416,069 (Ramsey 2002).

15 The use of a lift axle suspension enables a driver of a  
vehicle to lift one or more axles in order to selectively  
transfer more weight to the tires that remain on the ground.  
This may be done when the vehicle is loaded in order to  
increase traction or provide more controlled braking. This  
20 may be done when the vehicle is not loaded in order to save  
tire wear.

**SUMMARY OF THE INVENTION**

The present invention is an alternative lift axle  
25 suspension that is believed to provide advantages by virtue  
of its relative simplicity.

According to the present invention there is provided a  
lift axle suspension that includes a pivoting arm, an axle  
30 and a first suspension air bag acting one of directly or  
indirectly in a downward direction upon the axle. A lever is  
provided having a first end, a second end, and a fulcrum  
positioned between the first end and the second end. The  
first end is linked to the axle. A second lift air bag acts  
35 in a downward direction upon the second end of the lever.

This causes the lever to pivot about the fulcrum such that the first end of the lever, which is linked to the axle, is raised. Means is provided for selectively supplying air to either the first suspension air bag to lower the axle or the  
5 second lift air bag to raise the axle.

The above described lift axle suspension is characterized by the use of a second air bag to exert a force upon a lever causing the lever to pivot about its fulcrum and  
10 lift the axle. It provides a distinct advantage over spring biased systems which have an inherent imbalance in weight distribution as a result of the action of the biasing spring.

#### 15 **BRIEF DESCRIPTION OF THE DRAWINGS**

These and other features of the invention will become more apparent from the following description in which reference is made to the appended drawings, the drawings are for the purpose of illustration only and are not intended to  
20 in any way limit the scope of the invention to the particular embodiment or embodiments shown, wherein:

**FIGURE 1** is a side elevation view of a lift axle assembly constructed in accordance with the teachings of the present invention, with the axle in a lowered position.

25 **FIGURE 2** is a detail, partial side elevation view of the fulcrum and first end of a lever as illustrated in **FIGURE 1**.

**FIGURE 3** is a side elevation view of the lift axle assembly illustrated in **FIGURE 1**, with the axle in a raised position.  
30

#### **DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT**

The preferred embodiment, a lift axle suspension generally identified by reference numeral 10, will now be

described with reference to **FIGURES 1** through **3**.

Structure and Relationship of Parts:

Referring to **FIGURE 1**, pivot arm 12 having pivotal end  
5 14 that is pivotally attached to vehicle frame 16 by pivot  
arm bracket 18. Remote end with adapter 20 is attached to  
axle with wheels 22 and is actuated by first suspension air  
bag 24 shown in extended mode. All elements 12 through 24  
10 are shown as basic lift axle suspension 26. Preferred  
embodiment 10 comprises lever 28 having a first end 30 and  
second end 32 which rotates about fulcrum 34 which is  
attached to frame 16 by lever bracket 36. An adjustable  
sling 38 adapts first end 30 to axle with wheel 22.  
15 Referring to **FIGURE 2**, lever 28 is further adapted with a  
plurality of adjustably positioned fulcrum points 40 and a  
sling adjusting mechanism 42. Referring to **FIGURE 1**, second  
end 32 is actuated by second lift air bag 44 shown in  
deflation mode. Air supply 46 provides pressure through  
20 connection hoses 48. Pressurized air is channelled through  
load leveler valve 50 to air diverter 52 and regulator 54.  
Referring to **FIGURE 3**, axle with wheels 22 is shown in  
the elevated position relative to any other axle with wheels  
at ground level 56. Second lift air bag 44 is now shown in  
25 extension mode and first suspension air bag 24 is now shown  
in deflation mode.

Operation:

The use and operation of a lift axle suspension  
30 generally identified by reference numeral 10, will now be  
described with reference to **FIGURES 1** through **3**. The weight  
and contact height of select axles with wheels 22 in  
multiple, tandem-axle type vehicles may be changed by  
changing the settings of load leveler valve 50, air diverter

52 and regulator 54. Depending upon the need, air will be diverted to second lift air bag 44 which in turn actuates second end 32 of lever 28 causing lever 28 to rotate about the fulcrum 34 and, in turn, lift first end 30. First end 30  
5 then exerts upward pressure on adjustable sling 38, lifting axle with wheel 22 which, in turn, lifts remote end with adapter 20 which is now able to place first suspension air bag 24 in deflation mode due to the release of pressure allowed by regulator 54. The result is an elevated wheel  
10 position relative to ground level 56 such that the tires on axles with wheels 22 that are part of lift axle suspensions 10 are conserved.

Further, should the need to adapt the lift axle suspension 10 to a different vehicle, an operator may select  
15 one of adjustably positioned fulcrum points 40 and adjust the sling by operating sling adjustment mechanism 42.

The operation of the above described lift axle suspension can be manual or automatic. Some jurisdictions do  
20 not allow operators of multiple, tandem-axle type vehicles to manually operate a lift axle suspension at his or her own discretion. The reason that laws were passed in such jurisdictions is due to abuses in the past, where operators were exceeding legal load limits. The lift axle suspension,  
25 as illustrated in **FIGURES 1** through **3**, may be actuated by means of an automatic system having predetermined settings. This is accomplished by having the divertor automatically make a selected diversion in response to air pressure. When air pressure is below a preset level, the axle is lifted.  
30 When air pressure is above a preset level, the axle is lowered.

In this patent document, the word "comprising" is used in its non-limiting sense to mean that items following the  
35 word are included, but items not specifically mentioned are

not excluded. A reference to an element by the indefinite article "a" does not exclude the possibility that more than one of the element is present, unless the context clearly requires that there be one and only one of the elements.

5

It will be apparent to one skilled in the art that modifications may be made to the illustrated embodiment without departing from the spirit and scope of the invention as hereinafter defined in the Claims.

10

**THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:**

1. A lift axle suspension, comprising:
  - 5 an axle;
  - a first suspension air bag acting one of directly or indirectly in a downward direction upon the axle;
  - a lever having a first end, a second end, and a selectively positioned fulcrum between the first end and the
  - 10 second end, the first end being linked to the axle;
  - a second lift air bag acting in a downward direction upon the second end of the lever, thereby causing the lever to pivot about the fulcrum such that the first end of the lever which is linked to the axle is raised; and
  - 15 means for selectively supplying air to either the first suspension air bag to lower the axle or the second lift air bag to raise the axle.
2. The lift axle suspension as defined in Claim 1, wherein
- 20 the first end of the lever is linked to the axle by an adjustable sling.
3. The lift axle suspension as defined in Claim 1, wherein
- 25 the means for selectively supplying air to either the first suspension air bag to lower the axle or the second lift air bag to raise the axle is automatic.
4. The lift axle suspension as defined in Claim 3, wherein
- 30 the means for selectively supplying air is determined by air pressure.
5. The lift axle suspension as defined in Claim 1, wherein
- 35 the axle is secured to a pivoting arm and the first suspension air bag acts upon the axle via the pivoting linkagearm.

6. A lift axle suspension, comprising:

a pivoting arm having a pivotal attachment end and a remote end;

5 an axle secured to the remote end of the pivoting arm;

a first suspension air bag acting in a downward direction upon the axle via the pivoting arm;

10 a lever having a first end, a second end, and a fulcrum selectively positioned between the first end and the second end, the first end being linked to the axle by an adjustable sling;

15 a second lift air bag acting in a downward direction upon the second end of the lever, thereby causing the lever to pivot about the fulcrum such that the first end of the lever which is linked to the axle is raised;

an air supply tank for supplying air via connection hoses;

a load leveler valve for maintaining the level of the vehicle;

20 an air diverter for selectively diverting air from the air supply tank to either the first suspension air bag to lower the axle or the second lift air bag to raise the axle; and

25 an air regulator for regulating the pressure of air in the connection hoses, and the selected one of the first suspension air bag or the second lift air bag.

7. The lift axle suspension as defined in Claim 6, wherein the air diverter acts upon air pressure to automatically  
30 selectively divert air to the first suspension air bag or the second lift air bag.

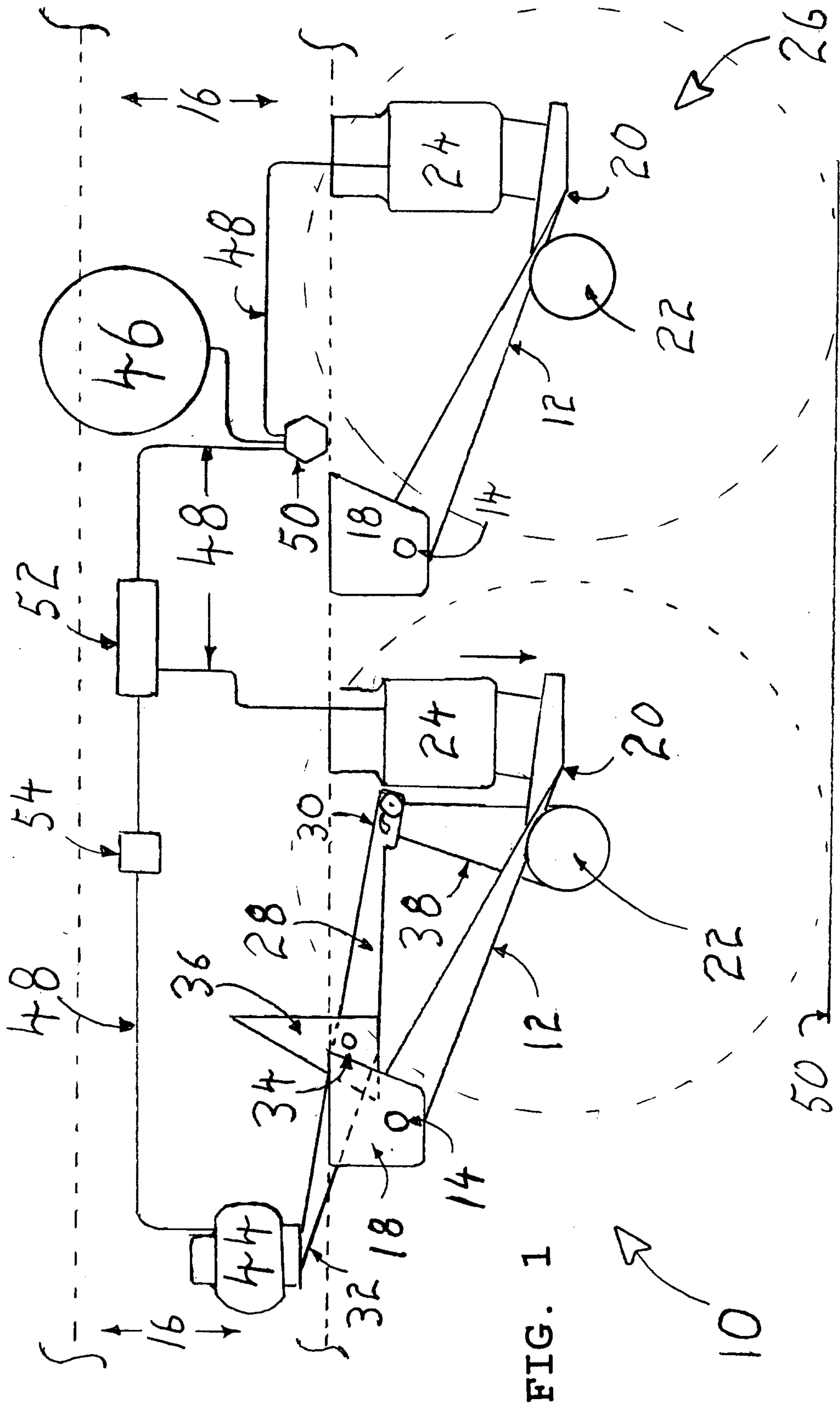


FIG. 1

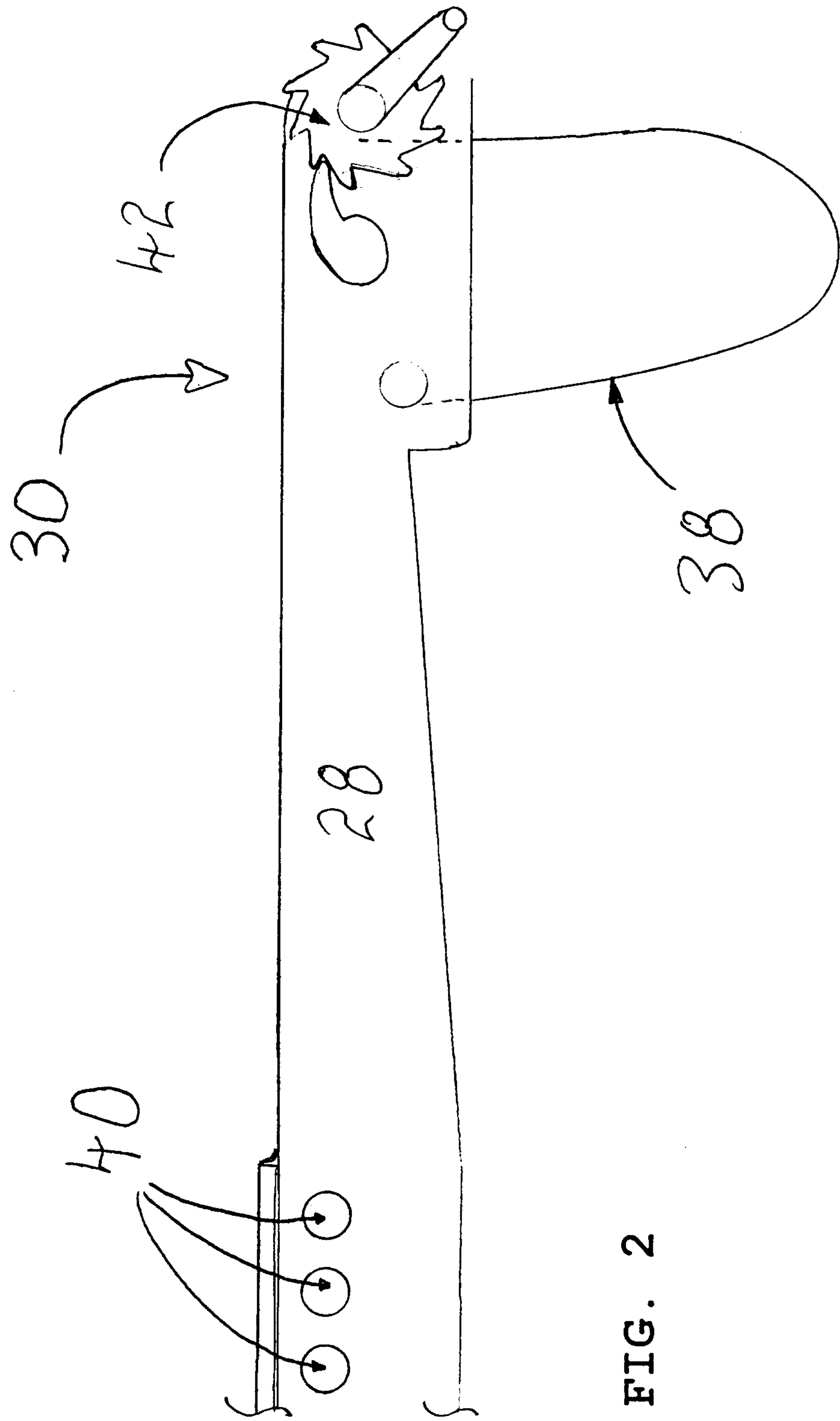


FIG. 2

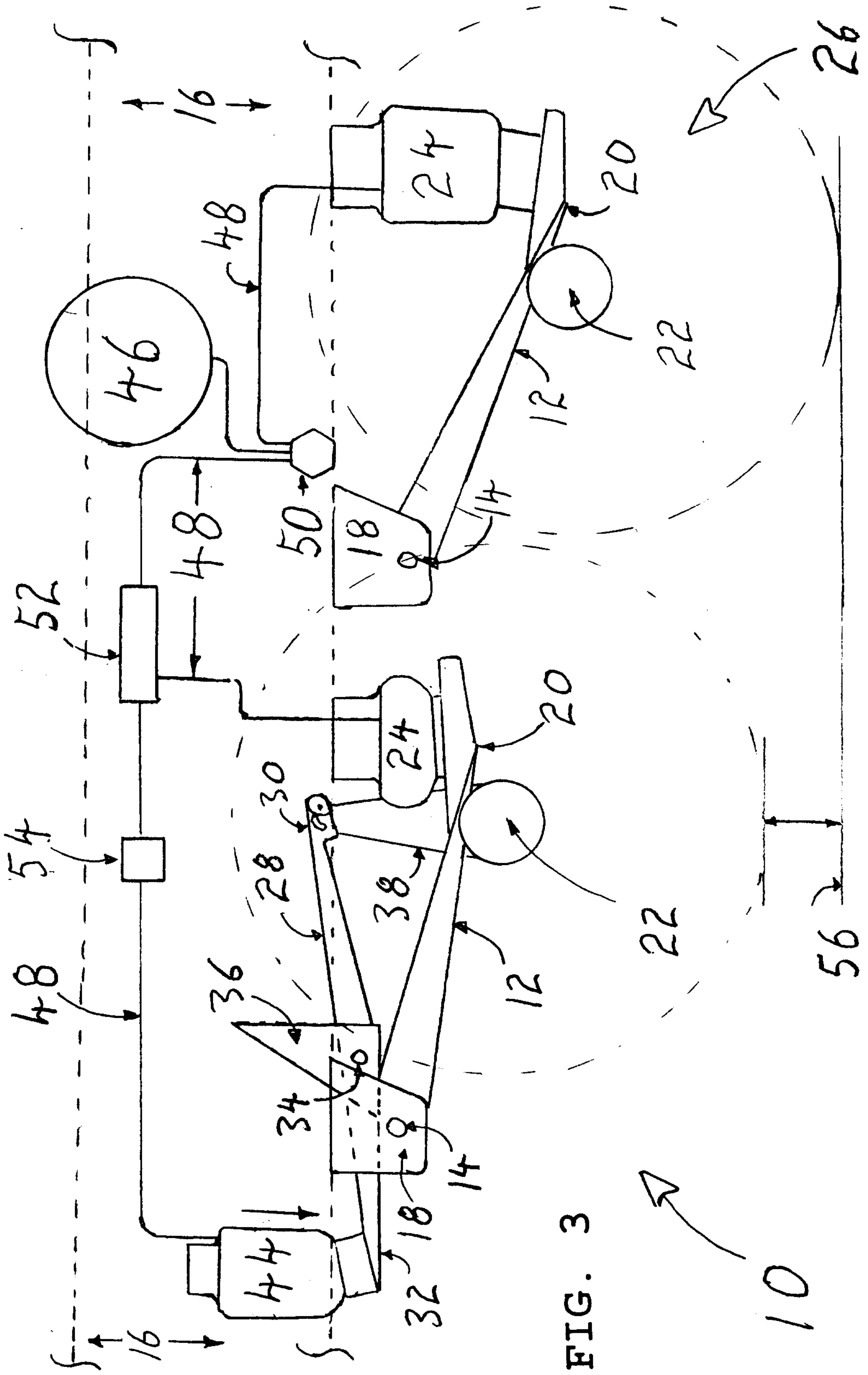


FIG. 3

