United States Patent [19]

Schwarzkopf

[11] **3,904,194**

[45] **Sept. 9, 1975**

[54] **HYDRAULIC ACTUATED ORBITAL AMUSEMENT RIDE**

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[22] Filed: **Mar. 27, 1974**

[21] Appl. No.: **455,321**

[30] **Foreign Application Priority Data**

Oct. 10, 1973 Germany 2350821

[52] **U.S. Cl.** ..... **272/49;** 60/DIG. 2; 254/93 R; 272/29; 272/51

[51] **Int. Cl.** **A63g 27/04;** A63g 1/28

[58] **Field of Search** ..... 272/29, 36, 37, 38, 39, 272/40, 41, 49, 50, 51, 6, 7; 254/93 R; 60/DIG. 10, 477, 428, 435, 330

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Assistant Examiner—Arnold W. Kramer
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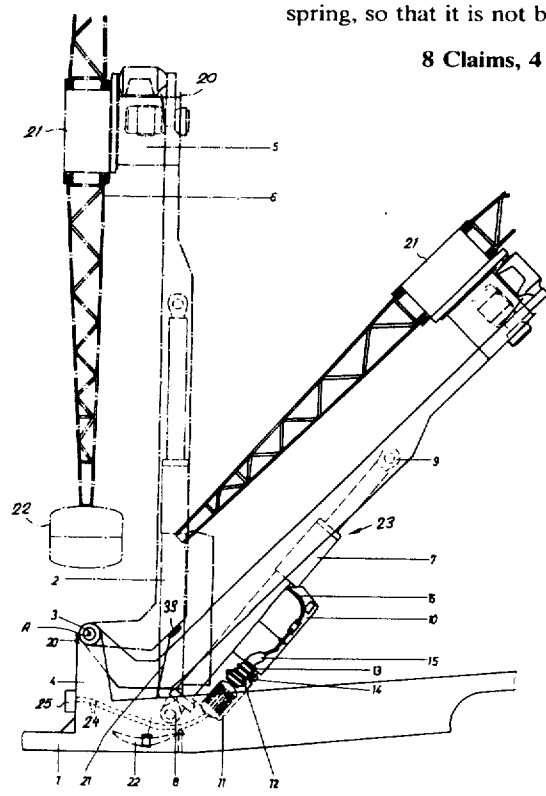
[57] **ABSTRACT**

An orbital amusement ride has an arm which is pivoted at one end on a support and is provided at its other end with a turntable on which are carried a plurality of angularly equispaced cars or baskets for the riders. A hydraulic jack (piston-and-cylinder arrangement) has one end pivoted on the arm and the other end pivoted on the support so that extension of this jack lifts the arm from a horizontal to a vertical position so that baskets on the turntable at the other end of the arm orbit in a vertical plane. The reservoir for hydraulic fluid of the jack is provided directly on the jack as is the pump and the motor which operate this pump. The pump has at least its intake side directly in the reservoir and its output side connected through a rigid conduit to the jack. A plurality of such pumps each operated by a respective motor can be provided, with a respective brake between each of the pumps and the respective motor. These motors and brakes are brought into and out of play sequentially so as to move the arm into and out of its stationary end positions gradually. The brakes are effective to prevent rotation of the pump and fluid flow back from the jack to the reservoir only when they are electrically actuated. Thus in case of power failure it is possible to bring the arm gradually back into the horizontal position, the fluid flowing back through a restriction in the hydraulic conduit and through the pump. In its upright position the arm is secured by a cable attached to a spring, so that it is not brought to a stop abruptly.

8 Claims, 4 Drawing Figures



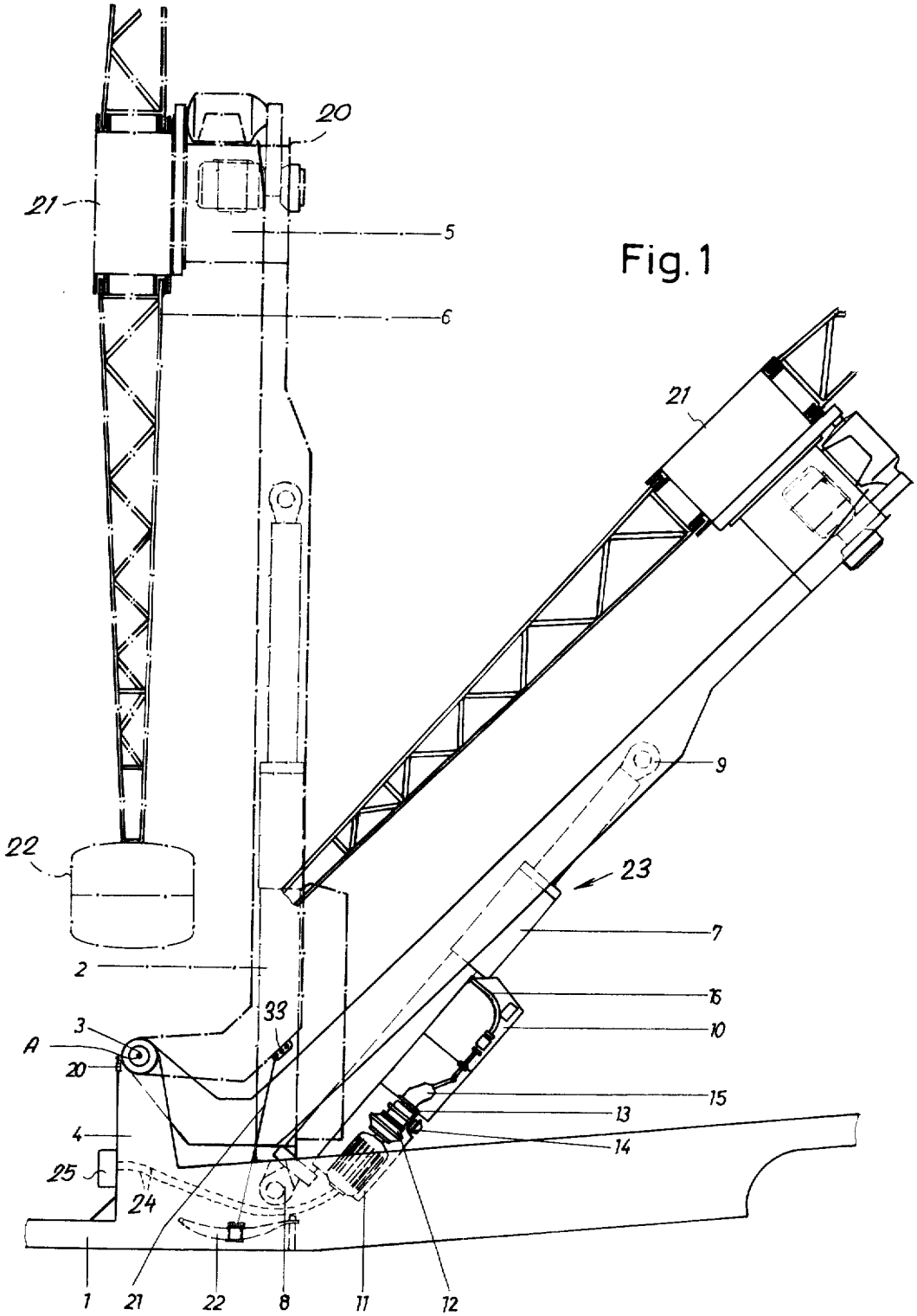


Fig. 1

FIG. 2

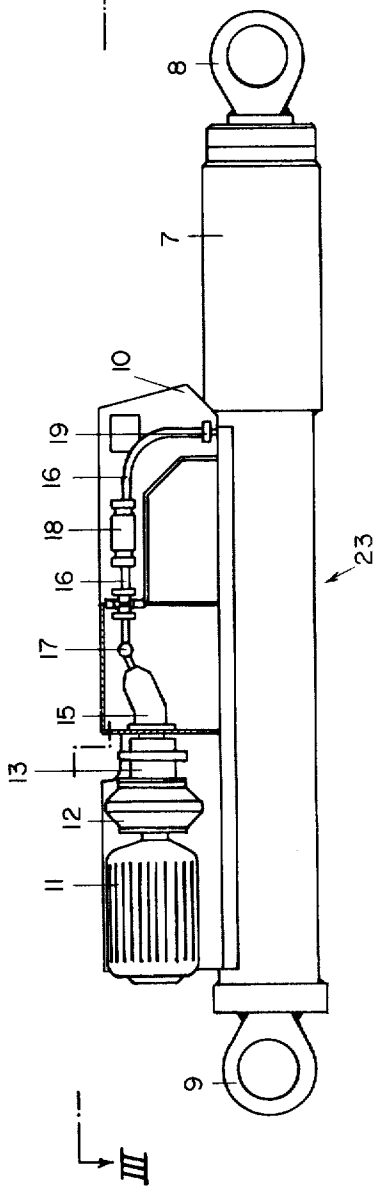
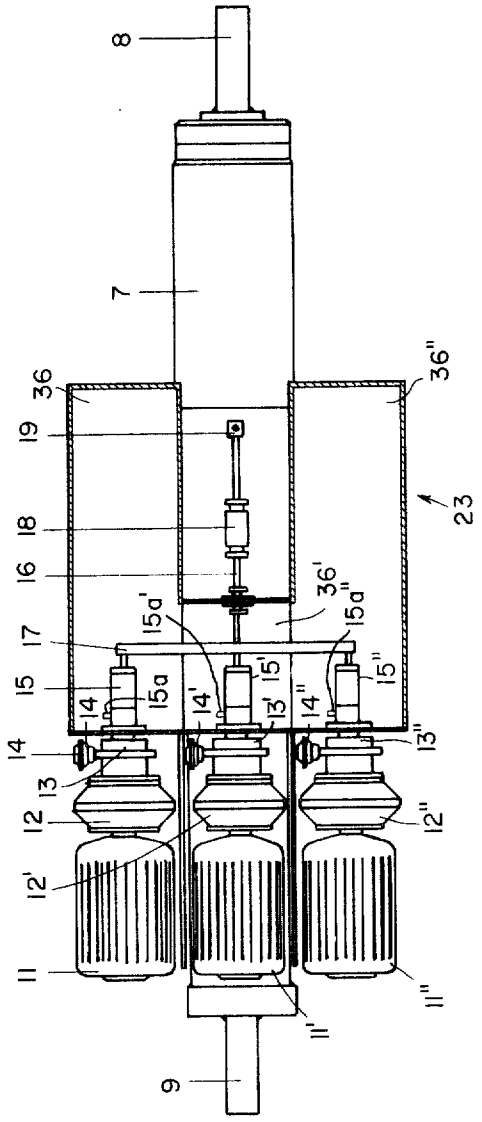


FIG. 3


8
7
36
36"
19
23
18
16
36'
15a'
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9

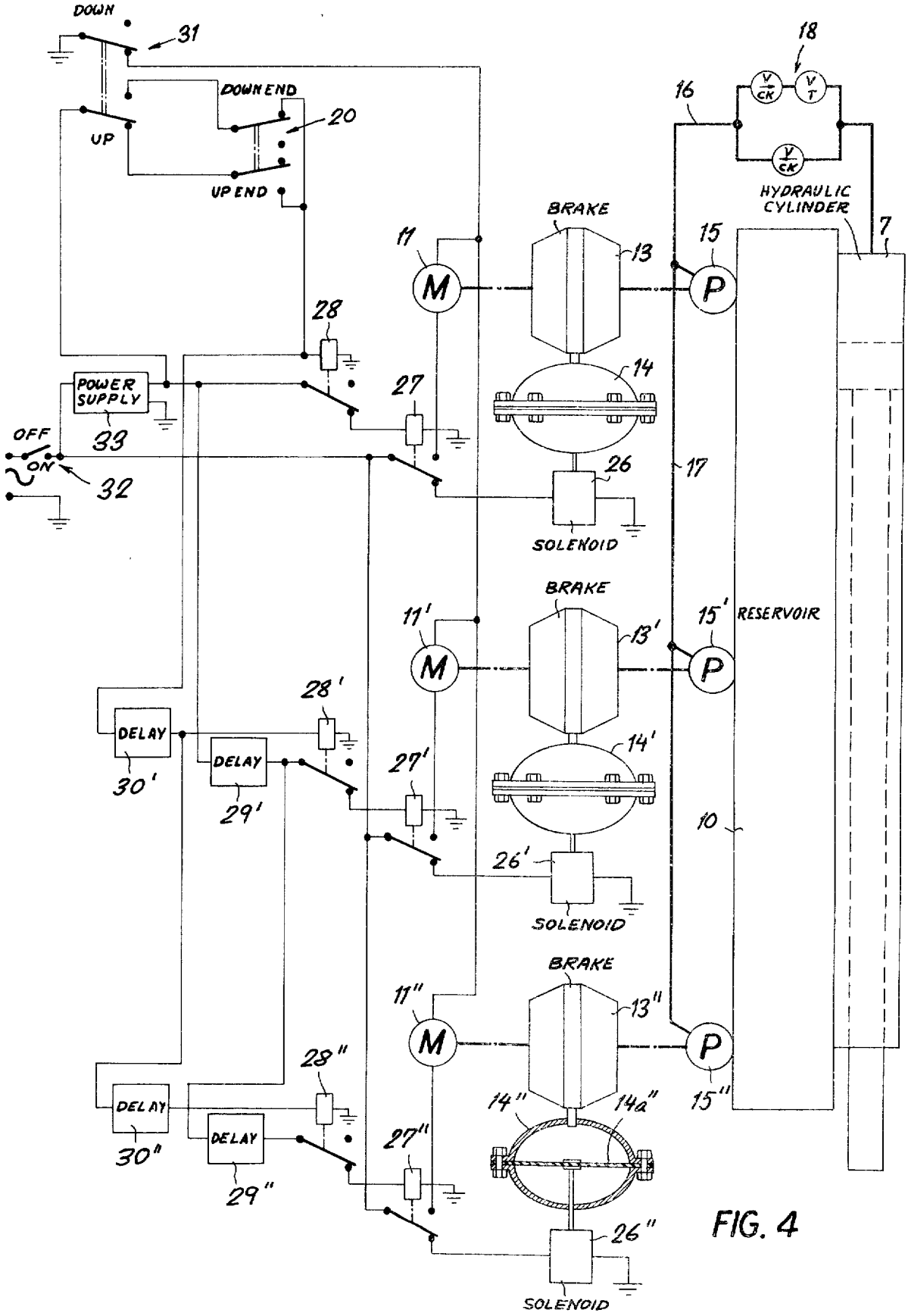
DOWN
31
DOWN END
20
UP
UP END
18
16
HYDRAULIC CYLINDER
7
BRAKE
11
13
15
M
P
28
27
14
POWER SUPPLY
33
OFF
ON
32
26
SOLENOID
17
BRAKE
11'
13'
15'
RESERVOIR
28'
DELAY
30'
DELAY
29'
27'
14'
10
26'
SOLENOID
BRAKE
11"
13"
28"
DELAY
30"
DELAY
29"
27"
14"
14a"
15"
26"
SOLENOID

FIG. 4

HYDRAULIC ACTUATED ORBITAL AMUSEMENT RIDE

FIELD OF THE INVENTION

The present invention relates to an orbital amusement-park ride and more particularly to an apparatus having a plurality of seats or the like swung in a circular path which can be lifted from a horizontal position to a vertical position.

BACKGROUND OF THE INVENTION

There is known an amusement-park ride in which one end of an arm is pivoted on the ground and the other end is provided with a turntable assembly on which are mounted a plurality of seats, cars, or baskets which are equispaced from the center of the assembly and angularly equispaced about the periphery thereof. Means is provided at the outer end of the arm to rotate this assembly at relatively high speed, subjecting riders in the seats or cabins to considerable centrifugal force. In addition means is provided to raise the free end of the arm from the ground, thereby changing the orientation of the circular path in which the seats are orbited, from a horizontal plane to an upright plane, centrifugal force preventing the riders from falling out of the seats or carts. The turntable can be a spider or a disk.

As a general rule the free end of the arm is raised by means of a large hydraulic jack (piston-and-cylinder arrangement). In one arrangement the arm is connected from a central point to a fixed point on the ground with a rigid link and the jack serves to draw the lower end of the arm towards the fixed end of the link, thereby raising the other end of the arm. In this system the use of the hydraulic jack in traction has been found to be considerably disadvantageous, in that the ram is extended most of the time, thereby exposing the piston rod to the elements, in general it is considered bad practice to use hydraulic ram for pulling rather than for pushing.

In another known arrangement the lower end of the arm is pivoted at a fixed point on the ground or on a trailer carrying the arrangement and the other end of this arm is raised by means of a hydraulic cylinder whose end is attached to a fixed point (usually on the trailer or at ground level) and whose other end is attached to the arm near the end thereof. In such arrangement the various flexible hydraulic lines which interconnect the cylinder and the pump and reservoir which pressurize it are frequently damaged in use, (c.g. by repeated flexure), so that the cylinder can rapidly depressurize in case of an accident, thereby dropping the entire assembly and creating a considerable injury hazard for the users.

In another known arrangement the seats or cabins are hung from the periphery of a spider which is pivoted on the free end of the arm. As the spider is rotated at high speed the hanging seats swing outwardly, so that the riders first are standing or sitting in these cabins or cages in a vertical position whence they are swung into a horizontal position due to centrifugal force, and finally into a vertical position again, sometimes upside down, sometimes right side up, as their seats or baskets are whirled about a horizontal axis. Such an apparatus is an extremely successful ride in an amusement park or the like, but also presents a considerable possibility of injury. Should the lines leading to the hydraulic cylinder burst, the arm can swing too rapidly back down into the horizontal position or if means is provided to lock the arm in the upper position it is almost impossible to return the arm to the horizontal position without injury to the riders.

Another problem with such devices is that, should there be an electric power failure, it is impossible to return them to a horizontal starting position in which the passengers can get out. In general and electric motor is used to power a pump which pressurizes the lifting cylinder, and another electric motor serves to rotate the spider carrying the baskets or chairs. Frequently such devices are so constructed that the arm will remain in the upright position and be impossible to move in case of a power failure. Thus the riders, usually fearful because of the power failure and immobilization of the device, must remain in their seats until electric power can be restored.

Another difficulty with known devices of the above-described type is that they do not function smoothly. They start and stop relatively abruptly, which freqently is frightening and discomfitting for the users. Furthermore due to the considerable size of many of these devices considerable stress is exerted on their various linkages and pivots when they are started and stopped rapidly, thereby shortening the duration of their life.

OBJECTS OF THE INVENTION

It is therefore an object of the present invention to provide an improved amusement ride of the above-described general type.

Another object of this invention is the provision of such an apparatus which has a long service life and is very safe in use.

A further object of the present invention is to provide an orbital amusement ride which can be operated, in case of power failure, at least to discharge the users thereof.

Yet another object of this invention is to provide such an apparatus which operates smoothly, starting and stopping gradually.

SUMMARY OF THE INVENTION

These objects are attained according to the present invention in amusement apparatus having an arm pivoted at one end on a support and carrying at its other end a turntable rotatable about an axis transverse to the arm. A plurality of seats, baskets or cabins are mounted on this turntable and are adapted to receive the users of the apparatus. A hydraulic jack has one end pivoted on the arm between the ends thereof and another end pivoted on the support such that extension of the jack lifts the turntable end of the arm. A reservoir for hydraulic fluid is rigidly mounted on the jack and a pump is mounted on the jack and has at least its intake side in the reservoir and its output side operatively connected to the jack for pressurizing and extending it. Thus the need for flexible hydraulic conduits and complicated connectors to the jack are eliminated, one need only provide a flexible electrical cable, having a relatively long service life to operate the pump.

In accordance with further features of this invention the pump is mounted entirely within the reservoir and its output side is connected via a rigid conduit to the jack. Thus it is almost impossible for the device to leak.

According to another feature of this invention the pump is operated by a motor which is connected to this pump through a hydraulic torque converter and a

brake. The slip of the hydraulic torque converter as it is started up insures that the system will start smoothly and will stop smoothly. The brake is locked when the arm is in a predetermined upright position, so that it inhibits rotation of the pump and thereby prevents fluid from flowing back through this pump into reservoir.

The brake according to yet another feature of this invention is operated by a solenoid-actuated membrane cylinder which when electrically energized causes the brake to operate and prevent rotation of the pump, but when not energized allows rotation of the pump and flow of fluid back through the pump into reservoir. Thus, should the power fail, it is possible to bring the arm back into a horizontal or lowered position. A pressure-limiting valve which is according to this invention only effective in the direction of flow from the jack towards the reservoir, is provided in the conduit between the pump and the jack so as to insure that the arm will lower slowly back into place.

In accordance with further features of this invention there are provided several such pumps each having respective motors, torque converters, and brakes and all operated in parallel and feeding the jack through a common manifold. Means is provided to operate the motors and brakes sequentially so that the device will start up slowly, one pump switching in after the other, and will stop slowly, one brake switching in after the other.

Finally according to this invention there is provided an inextensible element such as a cable or chain which is connected with a spring between the arm and the support. The element and spring are taut between the arm and the support when the arm is in a predetermined upright condition so that this arm is brought to rest resliently by the spring, thereby avoiding any sudden shocks. The support according to the present invention is a trailer adapted to be hauled behind a tractor to the site where the amusement apparatus is used.

BRIEF DESCRIPTION OF THE DRAWING

The above and other objects, features, and advantages of the invention will become more readily apparent from the following description, reference being made to the accompanying drawing in which:

FIG. 1 is a side view of the apparatus according to this invention;

FIG. 2 is a side view of the lifing unit of the device of FIG. 1;

FIG. 3 is a section taken along the line III—III of FIG. 2; and

FIG. 4 is a schematic diagram illustrating a feature of the present invention.

SPECIFIC DESCRIPTION

As shown in FIG. 1, a support 1, here a trailer adapted to be hauled behind a tractor, is provided with an arm 2 which is pivoted at a bearing 3 defining a horizontal axis A on an upright 4 on the support 1. The free end of the arm is provided with a drive assembly 5 having a motor 20 which is adapted to rotate a turntable 21 carrying a plurality of arms 6 each adapted to suspend a basket 22 adapted to carry one or more passengers. A drive unit 23 has a hydraulic jack 7 with a piston rod connected at 9 on the arm 2 intermediate the ends thereof and its cylinder pivoted at 8 on the support 1 adjacent the upright 4. The arm 2 is generally L-shaped and is displaceable between a horizontal position and a vertical position, the latter shown in dot-dash lines in FIG. 1. In this vertical position the cylinder 7 lies directly in line with the main portion of the arm 2.

As shown in a more detail in FIGS. 2 and 3 the drive unit 23 includes three drive motors 11, 11' and 11'' each connected via a respective torque converter 12, 12', and 12'' and a brake 13, 13', and 13'' to a respective axial piston pump 15, 15', and 15'' connected through a manifold 17 to a rigid conduit 16 which opens into the cylinder 7. The flexible power cord 24 shown in FIG. 1 is connected to a control box 25 on the support 1 and serves to operate the motors, 11, 11', and 11''. A reservoir 10 comprises two outer parts 36 and 36'' in which are received the pumps 15 and 15'' respectively, and a central part 36' between and bridging these two outer parts and receiving the pump 15'. Thus the inlets 15*a*, 15*a*', and 15*a*'' of the pumps open directly into the chambers 36, 36' and 36'' and the outlets of these pumps feed directly into the manifold 17 also provided within this reservoir 10. A pressure release valve 19 is provided on the conduit 16 as is a pressure limiting valve 18 which only limits fluid flow in the direction of the cylinder toward the pumps.

Each of the brakes 13, 13' and 13'' is operated by a respective solenoid controlled membrane valve 14, 14' and 14'' which when electrically energized closes its brake and prevents fluid flow through the respective pumps 15, 15', 15''.

The arm 2 is provided with a lug 33 to which is secured one end of a cable 21 whose other end is secured to the middle of a leaf spring 22 carried on the support 1. In the fully raised position of the arm 2 shown in dot-dash lines in FIG. 1 this cable 21 is taut. Thus it serves to define the vertical end position of the arm 2, and brings this arm to a gradual stop as it attains this position.

FIG. 4 illustrates how each of the membrane valves 14, 14', and 14'' is operated by a respective solenoid 26, 26' and 26''. The membrane valve 14'' which is identical to the pumps 14 and 14'' is provided with a membrane 14*a*'' operated by the solenoid 26'' so that when this latter is energized the brake 13'' is also energized to lock the pump 15'' and motor 11''. A switch 20 is provided on the upright 4 adjacent the pivot 3 and is closed in one direction when the arm is lifted almost into the vertical position as illustrated in dot-dash lines and is closed in another position when the arm is almost all the way down. There is provided in the control box 25 a DPDT switch 31 which operates relays 27, 27', 27'', 28, 28', 28'' as will be described herein below. Delays 29' and 30' are connected to the relays 27' and 28' and similar Delays 29'' and 30'' are connected to the relays 27'' and 28'' so as to operate these relays sequentially.

The device operates as follows:

Assuming that the arm 2 is in the down position, the switch 20 will be in the illustrated position. Closing off an on-off switch 32 will energize a power supply 33 and, if the switch 31 is then moved to the illustrated position to display the arm 2 into the upper position, the relay 27 will be immediately energized to activate the motor 11, which is grounded in this position of the switch 31. The relay 27' will be activated a short time after the relay 27 as a result of the lag caused by the delay circuit 29'. The relay 27'' will be similarly activated after another delay as a result of the time lag in delay 29''. Thus the relays 27, 27' and 27'' will close

sequentially, thereby switching the motors **11, 11'** and **11''** in one after the other so as to operate the pumps **15, 15'** and **15''** one after the other and thereby start the arm **2** moving slowly.

As the arm **2** approaches its fully raised position the end switch **20** will be displaced from its illustrated position so as to activate first a relay **28** which will cut off the relay **27** and cause the valve **14** to be activated by its solenoid **26.** This will stop the pump **15.** The relay **28'** will be activated a short time later as a result of the time lag in delay **30'**, and the relay **28''** will follow, activated by its delay **30''**. Thus the motors **11, 11'** and **11''** will be turned off one after the other as the arm **2** moves into its upper position and the brakes **13, 13'** and **13''** will be similarly activated to slow the arm **2** down and stop it gradually.

To lower the arm **2** from the up to the down position the DPDT switch **31** is moved from the illustrated position. This disconnects all of the motors **11, 11'** and **11''** from their grounds and similarly disconnects all the relays **28, 28'** and **28''**. Thus the relays **27, 27'** and **27''** are sequentially actuated as described above so as to sequentially disconnect the solenoids **26, 26'** and **26''** and thereby allow the arm to gradually pick up speed and drop to the horizontal position.

As the arm **2** approaches this horizontal position the switch **20** will be moved back into the position illustrated in FIG. **4.** This will again sequentially operate the relays **28, 28'** and **28''** to disconnect the secondary relays **27, 27'** and **27''** thereby sequentially actuating the valves **14, 14'** and **14''** and hence brakes **13, 13'** and **13''**. Once again the arm will be gradually slowed down and brought gently to rest in the horizontal position.

The system according to the present invention presents several considerable advantages. First of all mounting the reservoir **10** directly on the cylinder eliminates one of the chief causes of problems in such arrangements that is damage to or simple wearing-out of the hydraulic line pressurizing the cylinder. Furthermore provision of the pumps right in the reservoir also increases their service life considerably as it maintains them fairly cool, while protecting them completely from corrosion. Furthermore the use of three separate electric motors and brakes forms a system which, even should one or two of the motors or brakes fail still remains completely operative and absolutely safe. Furthermore treble drive motors and brakes allow the arm to be started and stopped gradually, thereby also greatly increasing its service life while protecting it from shocks.

Even should the electric power fail all of the brakes will open and the fluid will be allowed back into the reservoir through the throttle **18** which is effective only in the direction of flow from the cylinder **7** to the reservoir **10.** Thus heating of the hydraulic fluid is reduced to a minimum so that once again the service life of the system is increased considerably. These factors are extremely important in the construction of equipment such as amusement park rides since rarely are they given the type of servicing which normally would be given, for example, to construction equipment. In addition it is extremely important that such equipment be safe as possible to protect the users. The apparatus according to the present invention is extremely safe and extremely robust so that it requires the minimum of service, and therefore ideally fulfills the requirements of amusement-part apparatus.

I claim:

1. An amusement apparatus comprising:

a support;

an arm pivoted at one end on said support;

a turntable at the other end of said arm rotatable thereon about an axis transverse to said arm;

a hydraulic jack having one end pivoted on said arm intermediate the ends thereof and another end pivoted on said support, whereby extension of said jack lifts said other end of said arm;

a reservoir for hydraulic fluid on said jack; and

an electromotor-driven pump on said jack having an intake side in said reservoir and in the reservoir fluid and an output side connected through a rigid conductor to said jack for pressurizing and thereby extending same, the drive for said pump comprising in line an electric motor, a torque converter and a brake connected to said pump;

a solenoid-operated membrane in a fluid valve controlling actuation of said brake upon energization of the solenoid; and

electrical control circuit means for selectively actuating said motor and deactivating said solenoid and brake, and for deactivating the motor and actuating the solenoid and brake to respectively actuate or deactivate said jack to raise or lower said arm.

2. The apparatus defined in claim **1** wherein said pump is entirely received within said reservoir.

3. The apparatus defined in claim **2** wherein said valve is effective upon energization of the solenoid to actuate said brake which, by blocking rotation of the pump, prevents fluid flow through said pump between said reservoir and said jack.

4. The apparatus defined in claim **1,** further comprising two additional such pumps, valves and brakes, a manifold connecting all of said pumps to said conductor, and a respective electric motor operatively connected to each of said pumps.

5. The apparatus defined in claim **4** wherein said circuit means includes means for sequentially switching on and switching off said motors.

6. The apparatus defined in claim **5** wherein said means for switching includes a switch at said one end of said arm operable by movement of said arm with respect to said support.

7. The apparatus defined in claim **6** wherein a respective one of each brakes is operatively connected to each of said pumps, said circuit means including said switch at said one end of said arm operable in an upright position of said arm and delay means for sequentially actuating said brakes.

8. The apparatus defined in claim **1,** further comprising a spring and an inextensible element connected between said arm and said support and displaceable into a taut position inhibiting further pivoting of said arm on displacement thereof into a predetermined upright position.

* * * * *