Aug. 27, 1963

N. BARTLETT

3,101,943

AMUSEMENT RIDE

Filed Nov. 1, 1960

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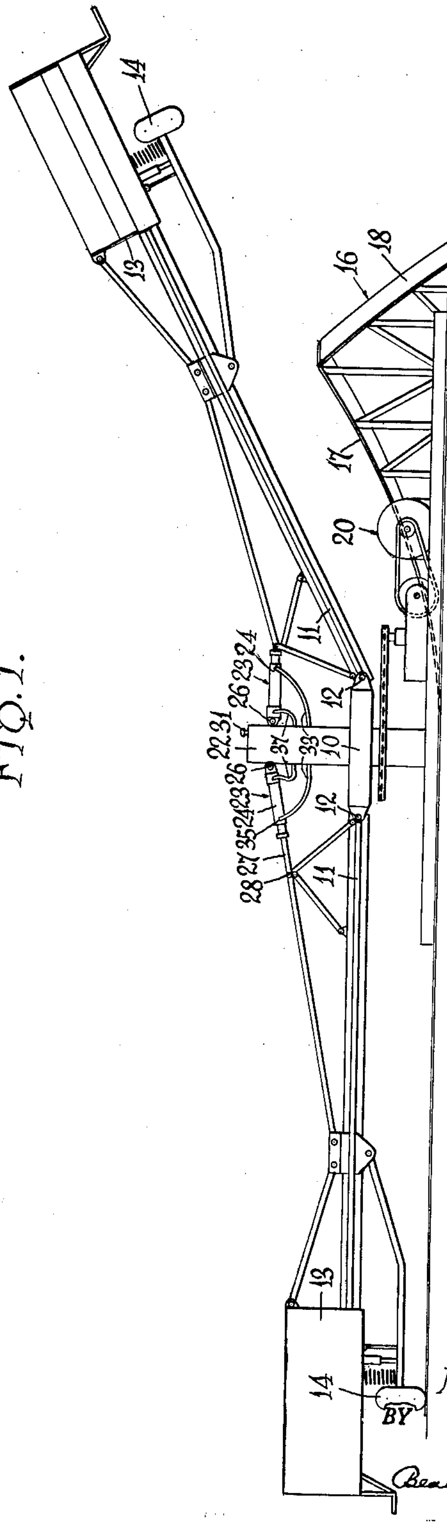

Fig. 1.

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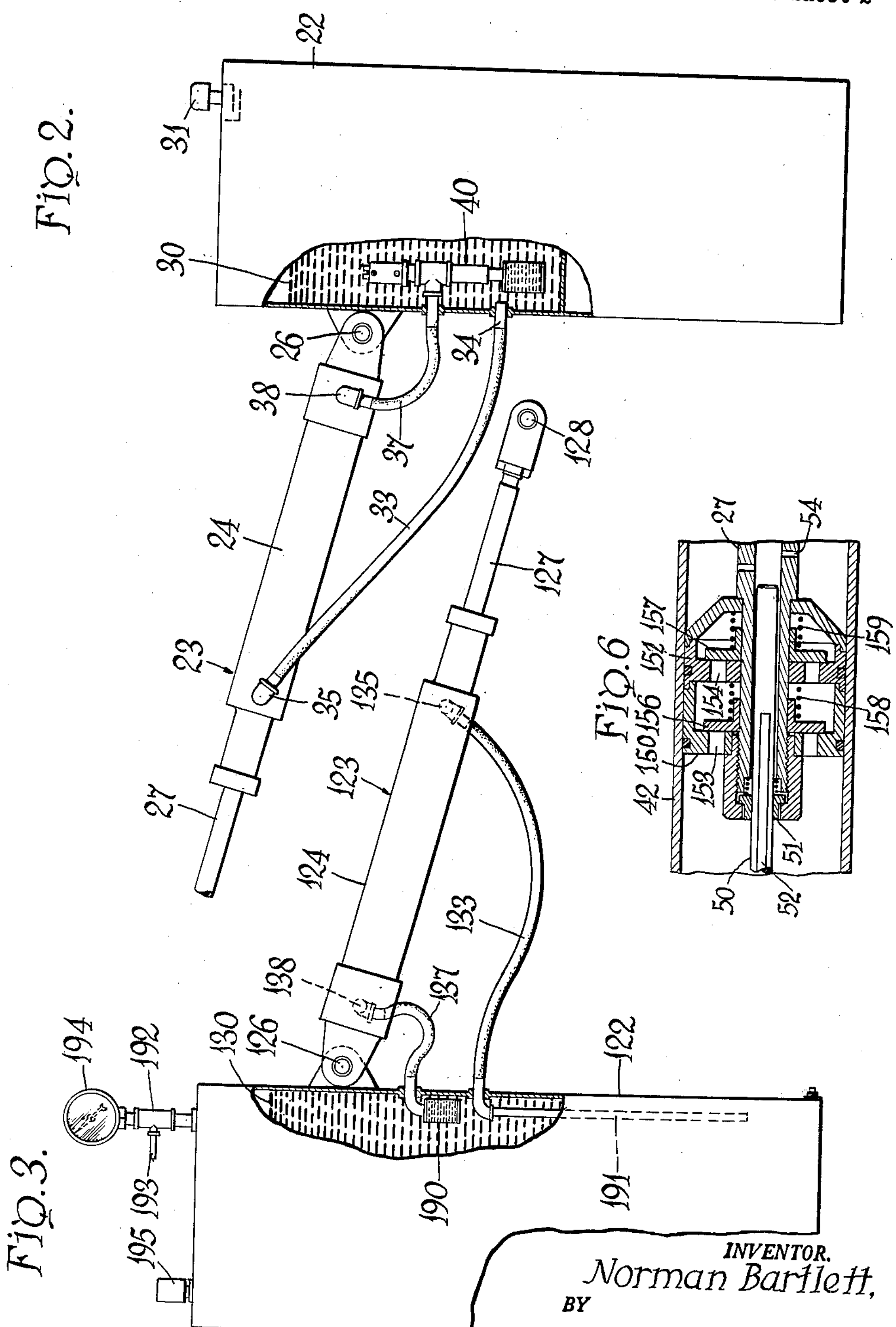

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Fig. 4.

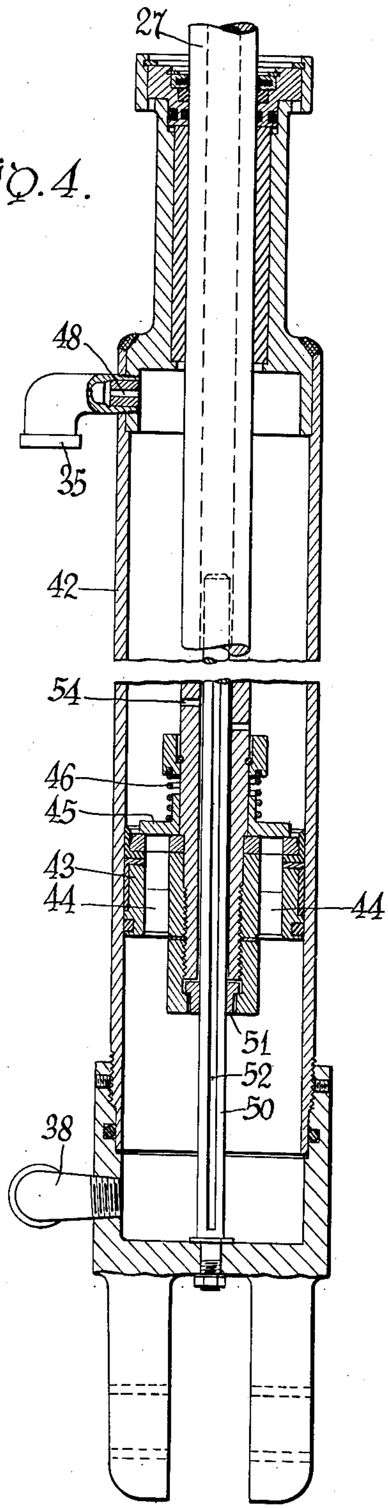
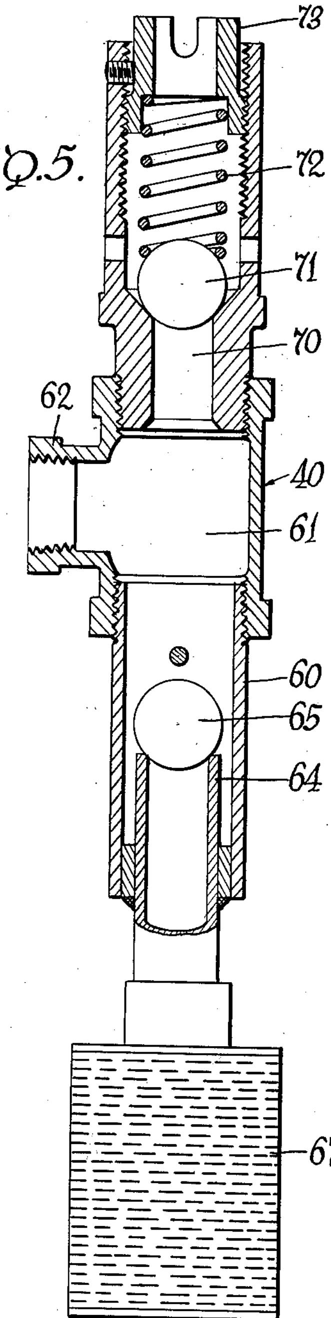


Fig. 5.



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United States Patent Office 3,101,943
Patented Aug. 27, 1963

3,101,943
AMUSEMENT RIDE

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Filed Nov. 1, 1960, Ser. No. 66,644
9 Claims. (Cl. 272—36)

This invention relates to amusement rides and more particularly to an amusement ride of the roundabout type.

My prior Patent No. 2,895,735, dated July 21, 1959, discloses an amusement ride wherein a circular series of wheeled cars or passenger carriers are attached to the outer ends of arms which radiate from and are rotated by an upright central mast or support, the latter being power driven to rotate about its generally vertical axis and thus propel the series of cars about a circular pathway. Along this pathway is an ascending ramp with an abrupt drop-off so that the cars are successively raised by movement upwardly along the ramp and projected into space when they reach the ramp drop-off. The "free flight" simulation thus achieved gives a thrilling, interesting and very attractive amusement ride sensation, both to passengers and spectators.

In the amusement ride of my aforesaid patent hydraulic means are provided which take over when each successive car leaves the ramp and retard the gravity descent of each car to a desired degree so that descending motion of each car takes place safely and at a predetermined rate of speed which rate may be variable throughout the descending movement of the car. Since any hydraulic retardation of the upward movement of a car as it ascends the ramp is not only useless but wasteful of motive power and imposes unnecessary strains and loads on the ride structure and drive means, it is desirable that the hydraulic means impose as little resistance to upward movement as is practical and convenient.

My present invention comprises improvements in the amusement ride of my aforesaid Patent No. 2,895,735 and such improvements relate entirely to the portion of the ride combination consisting in the force means which is operable to control the descending motion of the cars or carriers by imposing yieldable forces which oppose the force of gravity which comes into play as to each carrier as soon as such carrier leaves the ramp which elevates the same. In addition to retarding the descending movements of the cars for reasons of safety and passenger comfort, the retardation of descent prolongs the "free flight" phase of the ride action and thus augments the "free flight" sensation.

The present invention provides hydraulic force means operable to impose a yieldable hydrodynamic resistance to the descent of each car as it leaves the ramp in a safer and more certain manner and one which will be certain to provide the desired degree of resistance to descent under all conditions, as for instance when oil flow is unusually slow due to low temperature conditions and under circumstances wherein wear of packings and other conditions would tend to admit air to the hydraulic system. The arrangement of my present invention insures that the hydraulic unit of each car will always have a proper supply of hydraulic fluid in the chamber or other component which directly acts in opposition to the force of gravity acting on each car as it leaves the ramp.

The hydraulic system of the present invention also provides, in conjunction with the novel hydraulic cylinder pressurizing arrangement of the invention, means for providing an adequate reserve supply of oil common to the several units and for insuring transmission and availability thereof to the several individual hydraulic units and, more particularly, to the portions of the hydraulic

units which require an adequate hydraulic fluid supply to insure safe and certain retardation of the descending movements of the several cars.

A further important object of the present invention is to provide hydraulic force means which will surely and safely retard downward movement of the passenger carriers under all conditions and despite possible failure of certain elements of the hydraulic force means. To this end a valved piston structure is provided wherein two valves or sets of valves associated with the piston are arranged in series, whereby failure of one valve or set of valves will not prevent the hydraulic force means from exerting its desired yieldable retarding action.

Various other objects and advantages are attendant upon the use of the teachings of the present invention in the construction of hydraulic force retarding means for safely retarding the descent of amusement ride passenger carriers in rides of the type illustrated in my aforesaid prior patent. Such other objects and advantages concern safety and certainty of operation under both normal and abnormal conditions, economical construction, convenience in erection and dismantlying of the ride, ready and certain adjustability of the rate of hydraulic resistance to suit various operating conditions, and other advantages which will appear to those skilled in the amusement ride and hydraulic control arts from a consideration of the accompanying drawings and the following specification which set forth typical embodiments of the principles of the present invention.

It is to be understood that the embodiments illustrated in the drawings and described in the following specification are only illustrative and that the principles of the present invention are not limited thereto nor otherwise than as defined in the appended claims. For simplicity, the disclosure of my aforesaid prior Patent No. 2,895,735 is to be considered as incorporated herein by reference since the hydraulic control components disclosed in detail herein are expressly for use in the general amusement ride combination set forth at large in the prior patent.

In the drawings:

FIG. 1 is a general elevational view of one form of amusement ride embodying the hydraulic motion controlling means of the present invention;

FIG. 2 is a fragmentary elevational view of the upper portion of the central mast or rotatable support of the amusement ride of FIG. 1 showing one form of the hydraulic resistance arrangement of the present invention;

FIG. 3 is an elevational view similar to FIG. 2 showing a modified hydraulic resistance arrangement;

FIG. 4 is a longitudinal central cross-sectional view through the hydraulic cylinder of either FIG. 2 or FIG. 3;

FIG. 5 is a vertical cross-sectional view through a control element portion of the embodiment of FIG. 2 on a considerably enlarged scale; and

FIG. 6 is a longitudinal cross-sectional view through a portion of a cylinder structure similar to FIG. 4 but with a multiple valved piston therein, this figure being viewed similarly to FIG. 4.

Like characters of reference denote like parts throughout the several figures of the drawings and, referring to FIG. 1, a central rotatable support structure is designated **10** and has pivoted thereto as at **11** a plurality of radiating arms **12**, each having a passenger carrier **13** connected to its outer end. The passenger carriers **13** have ground wheels **14** and, upon rotation of the central support structure, are adapted to traverse a circular path which includes a ramp structure **16** having an inclined carrier-elevating portion **17** and a relatively abrupt terminal portion **18** at the crest of the inclined portion **17**.

The foregoing structure is substantially the same as that shown in my aforesaid prior patent excepting that, as shown in FIG. 1 hereof, the central support **10** is substantially vertical instead of somewhat inclined, as in the prior patent. This difference is immaterial to the considerations of the present invention. Drive means for power operation of the rotatable central support structure is indicated generally by the numeral **20**.

The upper terminal portion of central support **10** comprises a cylindrical reservoir for hydraulic fluid and is designated by the numeral **22** in FIGS. 1 and 2.

Each of the radiating arms **11** has associated therewith a hydraulic piston and cylinder mechanism designated generally by the reference numeral **23** in FIGS. 1 and 2, the cylinder **24** thereof being pivoted at one end to the reservoir **22** or other part of support **10** as at **26** and the piston rod **27** thereof being pivoted at its outer end to an upwardly offset truss portion of the associated radiating arm **11** as at **28**.

Obviously, upward movement of an arm **11**, as when its associated passenger carrier **13** ascends the incline **17** of ramp **16**, causes the piston rod **27** to move inwardly with respect to cylinder **24** and descending movement of an associated carrier and radiating arm causes the piston rod **27** thereof to move outwardly of its cylinder **24**.

As indicated earlier herein and in my prior patent, the useful purpose of the hydraulic system of the present invention is to slow the descent of the cars after they leave the ramp. Any incidental hydraulic resistance which the apparatus imposes to upward movement is adventitious and actually undesirable. Of course any hydraulic flow through conduits, however generously the conduits may be proportioned, is subject to fluid friction. Nevertheless, the hydraulic system of the present invention may be referred to as single acting in the sense that the useful resistance thereof is uni-directional and any incidental hydraulic resistance in the other direction is present only because it is unavoidable or is merely tolerated and should be kept as low as practical design considerations permit.

In any event, if free fluid flow from the cylinder is provided on the upward movement of its associated arm and passenger carrier resistance of the cylinder to movement will be limited to approximately fifteen pounds per square inch times the piston diameter, since the most resistance that the intake side can offer, however restricted the inflow passage, is the resistance to the creation of a vacuum, that is, the pressure of one atmosphere.

Referring now particularly to FIG. 2, it will be noted that the hydraulic reservoir contains oil or other hydraulic fluid to a level indicated at **30** in FIG. 2 and the interior of the reservoir is vented to the atmosphere as at **31**. A conduit **33** communicates freely with the oil supply in reservoir **22** at one end as indicated at **34** in FIG. 2 and is connected at its other end to the outer end of cylinder **24** by a coupling **35**. A second conduit **37** communicates with the inner end of cylinder **24** as by a coupling **38** and at its other end connects with a valve unit designated generally by the numeral **40** in FIG. 2.

The cylinder **24** is shown on an enlarged scale in longitudinal cross-section in FIG. 4 and valve unit **40** is illustrated in longitudinal cross-section on a still further enlarged scale in FIG. 5. Referring to FIG. 4, piston rod **27** is tubular in construction and has a piston **43** fixed to its inner end within the cylinder **24**. Piston **43** is provided with passages **44** which extend therethrough in an axial direction and are normally closed by an annular valve **45** which encircles the piston rod **27** and is urged to a passage-closing position by a compression coil spring **46**.

Hydraulic fluid flow through coupling **38** between the adjacent end of the interior of cylinder **24** and conduit **37** is free and open but, as shown in FIG. 4, coupling **35** contains a restricted orifice **48** which limits the rate of fluid flow between the adjacent end of the interior of cylinder **24** and conduit **33**.

A further restricted fluid flow path from the space within the cylinder **24** above piston **43**, as viewed in FIG. 4, is as follows. A valve rod **50** is fixed at one end to the lower end of cylinder **24**, as viewed in FIG. 4, and projects into the hollow interior of tubular piston rod **27**. Valve rod **50** fits loosely within the interior of piston rod **27** but a packing **51** is provided at the entry end thereof and the other end of piston rod **27**, not shown, is closed off.

Valve rod **50** is provided with a longitudinal groove **52** similar to a keyway and groove **52** is tapered along its length, being deeper at its lower end as viewed in FIG. 4 than at its upper end, for purposes which will presently appear. An orifice **54** in the wall of piston rod **27** establishes fluid flow from the space within cylinder **24** above the piston to the space within the cylinder below the piston by way of the orifice **54**, the annular clearance between the piston rod **27** and valve rod **50**, and the variable restricted orifice through packing **51** by way of groove **52**.

Reference will now be had to FIG. 5 which illustrates the valve unit **40** which controls communication between conduit **37** and the hydraulic fluid at the interior of reservoir **22**. Valve unit **40** comprises a generally vertical tubular body **60** which includes a central chamber **61** to which conduit **37** connects as at **62**. Below the connection **62** the chamber **61** contains a valve seat **64** and a ball member **65** which seats thereon to form a check valve which permits free upward flow into chamber **61** from the interior of reservoir **22** generally by way of a screen or filter **67** but prevents downward flow from chamber **61** into the reservoir proper.

Upward fluid flow from chamber **61** is by way of a valve passage **70** which is normally closed at its upper end by a ball check valve **71** which is adjustably urged to closed position by a compression coil spring **72**. A threaded spring seat member **73** permits adjustment of the pressure of spring **72** against ball check valve **71** and it will be noted that fluid is prevented from flowing into chamber **61** through valve pasage **70** but fluid may flow from chamber **61** to the reservoir **22** through valve passage **70** only if there is sufficient fluid pressure within chamber **61** to overcome the resistance of coil spring **72**.

The operation of the foregoing hydraulic control system will now be described and it may be noted preliminarily that a primary object of the arrangement thus far described is to insure that the outer end of cylinder **24**, the upper end as viewed in FIG. 4, is filled with hydraulic fluid at the time when the piston reaches its innermost position, an extreme lower position as viewed in FIG. 4.

Unless special pressure arrangements are provided mere atmospheric pressure cannot be relied upon to move hydraulic fluid through restricted flow orifices with sufficient rapidity to insure filling of a rapidly expanding chamber. This phenomenon is known to those skilled in the hydraulic arts. The expanding chamber will "pull a vacuum," that is, it will create a vacuous space or partial vacuum in the chamber owing to the inability of hydraulic fluid to flow thereinto through relatively restricted passages or orifices within the limited time available for the purpose.

Accordingly, the piston may begin its return movement against a partial vacuum in a chamber only partially filled with liquid and the required hydraulic resistance to piston movement will not be present. This condition would be hazardous in a passenger carrying ride of the kind here in contemplation.

Since cylinders **24** pivot on their connections with the central structure **10** of the ride, the inner ends of the cylinders may at times be higher and at other times lower than the outer ends. Also, the inner end of cylinder **24** is shown lowermost in FIG. 4 and the outer end uppermost. Nevertheless, for convenience in describing the operation as related to raising and lowering carriers, we shall refer to contracting movements of the piston and cylinder assemblies as the "upstroke" of the pistons, the movements caused by ascending movements of the passenger carriers, and the expanding movements caused by descent of the passenger carriers as the "downstroke."

On the upstroke of piston **43** oil passes through the passages **44** to the bottom of the cylinder, the valve **45** being but lightly biased to closed position. The top of the cylinder (the bottom as viewed in FIG. 4) contains a greater volume of oil per inch of length because of the presence of the piston rod 27 in the bottom of the cylinder (the top as viewed in FIG. 4). Therefore the differential oil which cannot be accommodated in the bottom of the cylinder must find some escape from the top of the cylinder on the upstroke.

Since check valve 65 seats against pressure from chamber 61 of the valve unit 40, the differential oil pressure from the upper end of the cylinder 24 acts against spring loaded check valve 71 but cannot unseat the same excepting by fluid pressure of the order of 70 pounds per square inch due to the pressure of coil spring 72. This resistance maintains a pressure in the upper end of cylinder 24 of 70 pounds per square inch during the upstroke of the piston 43.

This pressure forces hydraulic fluid rapidly and forcibly through the piston passages 44 and positively insures that the lower end of the cylinder is full of hydraulic fluid at the completion of the upstroke of the piston.

On the downstroke the piston valve 45 is closed and oil can escape from the lower part of the cylinder only through the restricted orifice 48 and through the further restricted path which includes flow through the groove 52 of the valve rod or metering rod 50, as previously described. The metering rod 50 is desirable since it readily affords a variable orifice which imposes an increasingly greater hydraulic resistance as the passenger carrier reaches the lower part of its descending movement.

However, this feature is not indispensible and may be eliminated, in which case all fluid egress on the downstroke would be by way of orifice 48. As a further alternative the structure comprising the hollow piston rod and the valve rod 50 may be eliminated and the interior wall of cylinder 22 may be provided with one or more longitudinal tapered grooves.

On the hydraulically restricted and relatively slow downstroke oil flows freely into the top of cylinder 24 under atmospheric pressure by flow of oil from reservoir 22 past the freely raisable check valve 65. It will be understood that there is a separate valve unit 40 in the reservoir 22 for each cylinder 24.

The modified form of the hydraulic control means illustrated in FIG. 3 will now be described. Speaking generally, the theoretical operation of this embodiment is quite similar to that of the embodiment of FIG. 2 excepting that, in place of the valve unit 40 and particularly the spring loaded check valve 71, a corresponding hydraulic pressure is maintained against the top of cylinder 22 on the upstroke by maintaining superatmospheric fluid pressure against the oil in the reservoir.

For more convenient understanding, parts in FIG. 3 corresponding to parts in FIG. 2 are identified by reference numerals 100 units higher. Thus the reservoir is designated 122, the cylinder 124, its upper and lower conduits 137 and 133, its pivotal connection 126, the piston rod 127 and the piston rod pivotal connection with the associated passenger carrier arm is designated 128.

In the embodiment of FIG. 3 the piston 124 and its piston rod and related structure may be identical in construction to that illustrated in detail in FIG. 4, including the conduit couplings 135 and 138. Also as in the preceding embodiment conduit 137 has free and open communication with cylinder 124 and conduit 133 has restricted orifice communication. In the present embodiment the conduits 133 and 137 have free and open communication with the interior of reservoir 122 below the level of hydraulic liquid therein, the latter being indicated at 130 in FIG. 3. Conduit 137 terminates within reservoir 122 in a strainer 190 and conduit 133 has a downward extension 191 within the reservoir.

In FIG. 3 the numeral 192 indicates a connection to the interior of reservoir 122 which may include a

Schrader valve 193 for conveniently applying air pressure to the interior of the reservoir and a pressure gauge 194 may also be provided. The numeral 195 indicates a pressure limiting safety valve. To attain operation similar to that described in connection with the preceding embodiment an air pressure of the general order of 70 pounds per square inch may be maintained above the liquid in reservoir 122.

The operation of this embodiment is the same as described in detail in connection with the preceding embodiment excepting that on the upstroke the oil is forcibly impelled through the piston passages by the air pressure maintained on the liquid in the reservoir 122 instead of by the pressure force generated by the resistance of the check valve 71. In a similar manner this insures that the lower portion of the cylinder will be completely filled with hydraulic liquid and will not develop a partial vacuum during the rapid upstroke.

On the downstroke the operation is substantially identical to that previously described. It is preferable to employ a Chevron type packing between the lower end of the cylinder 124 and the piston rod 127 since such a packing is particularly effective to prevent leakage on the downstroke during which fairly high hydraulic pressure forces develop within the lower end of the cylinder. This is true of both embodiments. During the downstroke oil under pressure from the reservoir 122 will insure that the top of the cylinder is filled with oil through conduit 137.

Reference will now be had to the multiple valve piston structure illustrated in FIG. 6 and in this connection it is to be understood that the piston structure of FIG. 6 may be substituted in its entirety for the piston structure 43, 44, 45 of the embodiment of FIG. 4 in conjunction with both of the embodiments of the invention illustrated in FIGS. 2 and 3. Since the cylinder of the embodiment of FIG. 6 is identical with the cylinder 42 of the previous embodiments, the same reference numeral is employed herein to designate the same. The same is true of piston rod 27, valve rod 50, packing 51, valve rod groove 52 and orifice 54.

Referring now to the structure of the piston itself in the embodiment of FIG. 6, a pair of interfitting piston components are designated by the numerals 150 and 151, each component including axial valve passages 153 and 154, respectively, which are normally closed by valves 156 and 157 which are resiliently urged to passage closing positions by compressing coil springs 158 and 159.

From the foregoing it will be noted that a preponderance of hydraulic fluid pressure at the left of the piston structure as viewed in FIG. 6, as when the piston structure is moving to the left, forces both of the valves 156 and 157 to become unseated to permit hydraulic fluid flow through the piston from left to right. When the pressure differential reverses, as when the piston structure begins its movement from left to right, the valves 156 and 157 will both normally immediately seat against the piston components 150 and 152, respectively, to close the valve passages 153 and 154. In the event that either of the valves 156 or 157 should fail to close by reason of any malfunction such as sticking or jamming or spring breakage, or an obstruction beneath the valve, the other valve will close and because of the series arrangement of the valves safe and certain operation of the device and proper retarding action of the downward movement of the associated passenger carrier will still ensue.

I claim:

1. In an amusement ride, a support and a passenger carrier adapted to raise and lower relative to said support, means for raising said passenger carrier, and hydraulic force means for controlling lowering movement of said carrier, said hydraulic force means comprising a cylinder and a piston connected for movement toward one end of said cylinder upon raising movement of said carrier and toward the other end upon lowering movement

of said carrier, a liquid reservoir, a first conduit therefrom leading to said one end of said cylinder, and a second conduit therefrom leading to said other end of said cylinder, said first conduit having a pair of connections with the interior of said reservoir, one of said connections having a check valve providing free communication into said conduit from said reservoir but preventing retrograde flow, said other connection having a pressure responsive check valve preventing flow from said reservoir to said conduit and permitting flow from said conduit to said reservoir only under a predetermined differential pressure of the order of several atmospheres.

2. In an amusement ride, a support and a passenger carrier adapted to raise and lower relative to said support, means for raising said passenger carrier, and hydraulic force means for controlling lowering movement of said carrier, said hydraulic force means comprising a cylinder and a piston connected for movement toward one end of said cylinder upon raising movement of said carrier and toward the other end upon lowering movement of said carrier, valve means permitting free liquid flow from said one end of said cylinder to said other end but preventing retrograde flow, a liquid reservoir, a first conduit therefrom leading to said one end of said cylinder, and a second conduit therefrom leading to said other end of said cylinder, said first conduit having a pair of connections with the interior of said reservoir, one of said connections having a check valve providing free communication into said conduit from said reservoir but preventing retrograde flow, said other connection having a pressure responsive check valve preventing flow from said reservoir to said conduit and permitting flow from said conduit to said reservoir only under a predetermined differential pressure of the order of several atmospheres.

3. In an amusement ride, a support and a passenger carrier adapted to raise and lower relative to said support, means for raising said passenger carrier, and hydraulic force means for controlling lowering movement of said carrier, said hydraulic force means comprising a cylinder and a piston connected for movement toward one end of said cylinder upon raising movement of said carrier and toward the other end upon lowering movement of said carrier, a liquid reservoir, a first conduit therefrom leading to said one end of said cylinder, and a second conduit therefrom leading to said other end of said cylinder, valve means between said first conduit and the interior of said reservoir providing free communication into said conduit from said reservoir but permitting retrograde flow from said conduit to said reservoir only upon a predetermined differential pressure in said conduit of the order of several atmospheres.

4. In an amusement ride, a support and a passenger carrier adapted to raise and lower relative to said support, means for raising said passenger carrier, and hydraulic force means for controlling lowering movement of said carrier, said hydraulic force means comprising a cylinder and a piston connected for movement toward one end of said cylinder upon raising movement of said carrier and toward the other end upon lowering movement of said carrier, valve means permitting free liquid flow from said one end of said cylinder to said other end but preventing retrograde flow, a liquid reservoir, a first conduit therefrom leading to said one end of said cylinder, and a second conduit therefrom leading to said other end of said cylinder, valve means between said first conduit and the interior of said reservoir providing free communication into said conduit from said reservoir but permitting retrograde flow from said conduit to said reservoir only upon a predetermined differential pressure in said conduit of the order of several atmospheres.

5. In an amusement ride, a support and a passenger carrier adapted to raise and lower relative to said support, means for raising said passenger carrier, and hydraulic force means for controlling lowering movement of said carrier, said hydraulic force means comprising a cylinder and a piston connected for movement toward one end of said cylinder upon raising movement of said carrier and toward the other end upon lowering movement of said carrier, check valve means in said piston permitting free fluid flow from said one end of said cylinder to said other end but preventing retrograde flow, a liquid reservoir, a first conduit therefrom leading to said one end of said cylinder, and a second conduit therefrom leading to said other end of said cylinder, and means establishing free communication into said first conduit from said reservoir but permitting retrograde flow only under a predetermined differential pressure of the order of several atmospheres.

6. In an amusement ride, a support and a passenger carrier adapted to raise and lower relative to said support, means for raising said passenger carrier, and hydraulic force means for controlling lowering movement of said carrier, said hydraulic force means comprising a cylinder and a piston connected for movement toward one end of said cylinder upon raising movement of said carrier and toward the other end upon lowering movement of said carrier, a liquid reservoir, a first conduit therefrom leading to said one end of said cylinder, and a second conduit therefrom leading to said other end of said cylinder, said first conduit having a pair of connections with the interior of said reservoir, one of said connections having a check valve providing free communication into said conduit from said reservoir but preventing retrograde flow, said other connection having a pressure responsive check valve preventing flow from said reservoir to said conduit and permitting flow from said conduit to said reservoir only under a predetermined differential pressure of the order of several atmospheres, said second conduit including a restricted orifice to retard liquid flow from said other end of said cylinder.

7. In an amusement ride, a support and a passenger carrier adapted to raise and lower relative to said support, means for raising said passenger carrier, and hydraulic force means for contolling lowering movement of said carrier, said hydraulic force means comprising a cylinder and a piston connected for movement toward one end of said cylinder upon raising movement of said carrier and toward the other end upon lowering movement of said carrier, valve means permitting free liquid flow from said one end of said cylinder to said other end but preventing retrograde flow, a liquid reservoir, a first conduit therefrom leading to said one end of said cylinder, and a second conduit therefrom leading to said other end of said cylinder, said first conduit having a pair of connections with the interior of said reservoir, one of said connections having a check valve providing free communication into said conduit from said reservoir but preventing retrograde flow, said other connection having a pressure responsive check valve preventing flow from said reservoir to said conduit and permitting flow from said conduit to said reservoir only under a predetermined differential pressure of the order of several atmospheres, said second conduit including a restricted orifice to retard liquid flow from said other end of said cylinder.

8. In an amusement ride, a support and a passenger carrier adapted to raise and lower relative to said support, means for raising said passenger carrier, and hydraulic force means for controlling lowering movement of said carrier, said hydraulic force means comprising a cylinder and a piston connected for movement toward one end of said cylinder upon raising movement of said carrier and toward the other end upon lowering movement of said carrier, a liquid reservoir, a first conduit therefrom leading to said one end of said cylinder, and a second conduit therefrom leading to said other end of said cylinder, valve means between said first conduit and the interior of said reservoir providing free communication into said conduit from said reservoir but permitting retrograde flow from said conduit to said reservoir only upon a predetermined differential pressure in said conduit of the

order of several atmospheres, said second conduit including a restricted orifice to retard liquid flow from said other end of said cylinder.

9. In an amusement ride, a support and a passenger carrier adapted to raise and lower relative to said support, means for raising said passenger carrier, and hydraulic force means for controlling lowering movement of said carrier, said hydraulic force means comprising a cylinder and a piston connected for movement toward one end of said cylinder upon raising movement of said carrier and toward the other end upon lowering movement of said carrier, valve means permitting free liquid flow from said one end of said cylinder to said other end but preventing retrograde flow, a liquid reservoir, a first conduit therefrom leading to said one end of said cylinder, and a second conduit therefrom leading to said other end of said cylinder, valve means between said first conduit and the interior of said reservoir providing free communication into said conduit from said reservoir but permitting retrograde flow from said conduit to said reservoir only upon a predetermined differential pressure in said conduit of the order of several atmospheres, said second conduit including a restricted orifice to retard liquid flow from said other end of said cylinder.

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