RAILROAD CAR RETARDERS

Inventor: Earl E. Frank, Tallman, N.Y.
Assignee: Abex Corporation, New York, N.Y.
Filed: July 25, 1974
Appl. No.: 491,830

References Cited
UNITED STATES PATENTS
3,156,255 11/1964 Gasquet et al. 91/414
3,360,304 12/1967 Adams et al. 188/62 X
3,436,913 4/1969 Muller et al. 60/416 X
3,458,999 8/1969 Reis 60/416
3,680,311 8/1972 Harbonn et al. 60/416 X
3,693,350 9/1972 Petro et al. 91/414 X

Primary Examiner—M. Henson Wood, Jr.
Assistant Examiner—Randolph A. Reese
Attorney, Agent, or Firm—Kinzer, Pfyer, Dorn & McEachran

ABSTRACT
A hydraulic system for operating a railroad car retarder cylinder including an accumulator of large capacity and one of smaller capacity paired therewith.

16 Claims, 7 Drawing Figures
RAILROAD CAR RETARDERS

This invention relates to railroad car retarders. Railroad car retarders are used in railroad classification yards. In the classification yard the cars are cut (separated) from trains. Empty cars may be cut. Cars containing lading may be cut. The cut cars are accumulated on assigned tracks according to destination. To prevent damage, retarders are placed along the traffic rails to slow the cars to a safe coupling speed. The retarders may be actuated hydraulically. The present invention is concerned with a hydraulic system for such retarders.

An object of the present invention is to develop a hydraulic system having accumulators able to service two retarders. Another object of the invention is to construct a hydraulic system including accumulators which can be conveniently located at selective positions within the track area of a railroad classification yard and not necessarily at the side of the yard or right-of-way which has heretofore required extensive piping and remotely located pressuring means involving large drops in pressure when transmitting hydraulic fluid over large distances. A related object of the invention is to store and develop pressure with accumulators so that the foregoing objects may be complied with. Another object of the invention is to construct the hydraulic unit of two easily joined subsystems. Another object of the invention is to combine accumulators of different capacity, one large and one small, whereby loss of pressure due to discharge of the larger accumulator is compensated by the smaller accumulator.

The form of the retarder is not important. It may be a normally open retarder, actuated to a closed position by a hydraulic cylinder; it may be the reverse, namely, normally closed and opened by the cylinder to admit a car wheel; or the retarder could be spring-actuated to one position cylinder actuated to the other position.

In the drawings:

FIG. 1 is a schematic layout showing a portion of a railroad classification yard;

FIG. 2 is a plan view of a railroad control system of the present invention;

FIG. 3 is a section of the structure on the line 3—3 of FIG. 2;

FIG. 4 is a sectional view of the line 4—4 of FIG. 3;

FIG. 5 is a sectional view on the line 5—5 of FIG. 3;

FIG. 6 is a plan view of the manifold; and

FIG. 7 is a schematic view of the hydraulic support.

The plan view of a portion of a railroad classification yard is shown in FIG. 1. This emphasizes the magnitude of separating railroad cars and retarding them in the course of classification. A large portion of the upstream part of the classification yard has been omitted from FIG. 1, concerned with the so-called hump where the cars are initially cut from the train. The cars cut (separated) from the train attain downstream turnouts 10 and 12. Eventually each car will be directed to a classification track 13 in which a final retarder as 14 is installed. The retarder is responsible for slowing the car to an acceptable speed just sufficient to allow that car to float to its destination position on the classification track downstream of the retarder 14. The purpose is to retard the car sufficiently to assure there will be no damage to the lading or car couplings as one car comes to rest against another.

The retarders 14 are operated hydraulically. The retarders may be of various construction. In most instances each retarder is characterized by a pair of retarding levers. The levers apply clamping forces to opposite sides of the car wheels. This slows the car to the desired speed. The retarders may be of the form disclosed in U.S. Pat. No. 3,227,246. There the retarder elements apply clamping forces to opposite sides of the car wheels proportionally to the weight of the car. But as already noted the present invention is not limited to a retarder of a particular form.

Recognizing that FIG. 1 is a schematic drawing and bearing in mind the size of a railroad car, it will be appreciated the area of the classification yard is considerable. The present invention, as already noted, is concerned with a unique hydraulic system by which a single control unit 20, FIG. 1, is able to service two adjacent retarders 14—1 and 14—2 in a dual sense.

The dual control unit 20 of the present invention is shown in plan view in FIG. 2. The essential components are confined in a housing 21. Fluid under pressure furnished by a pump 23 and a manifold pipe 24, FIG. 1, is introduced to an input pipe 26; fluid is returned to the reservoir, not shown, through a return pipe 27.

The hydraulic cylinders for actuating adjacent retarders 14—1 and 14—2 are identified in FIG. 7 as cylinders 14—11 and 14—12.

In order to service the retarder actuating cylinders 14—11 and 14—12, a pair of large capacity accumulators 30 and 31, FIGS. 2 and 5, are supported within the housing 21. Associated with the large accumulators, also for servicing the retarder actuating cylinders, are a pair of small capacity accumulators 30A and 31A. Each accumulator, in a manner to be explained, is charged to capacity from the input supply pipe 26. The larger accumulators 30 and 31 may be of a ten gallon capacity; the smaller accumulators may be of one gallon capacity.

In order to afford flow passages for charging the accumulators, and for directing fluid discharged from the accumulators to a retarder actuating cylinder 14—11 or 14—12, a manifold block 34 is supported within the housing 21, FIGS. 2, 3 and 4. The manifold block 34 also supports a pair of hydraulically balanced four-way valves 37 and 38. Each valve is under control of a solenoid operated pilot control valve 37C and 38C.

The manifold block also serves to support a check valve 39 associated with the input line 26 and supports, as well, a pair of check valves 42 and 43 having a function described hereinafter.

To circulate fluid to and from one of the paired retarder actuating cylinders, a pair of pipes 51 and 52, FIG. 2, communicate with related ports in the manifold block. Similarly, a pair of pipes 53 and 54 communicate with corresponding ports in the manifold block 34 to service the other retarder actuating cylinder.

A pair of pipes 57 and 58, FIGS. 2 and 7, communicate the large capacity accumulators respectively to related ports in the manifold block 34. A pair of pipes as 59 communicate the small capacity accumulators respectively to related ports in the manifold block.

It will be recognized from what is shown in FIG. 2 the manifold block 34 (providing internal passages and ports for transmitting fluid under pressure while serving to support various valve members) represents a unitary subsystem module. The accumulators may be viewed as a separate subsystem. These subsystems may be conveniently arranged within a single housing 21.
3,926,124

which itself may be located between the classification tracks as shown in FIG. 1. In some instances, the sub-system 30A may be located on either side of a classification track. If circumstances do not permit either of these alternatives to be adopted, the subsystems themselves may be separated, one at one location and one at another, while utilizing replacement pipes of a required configuration to supplant the pipes 57, 58 and 59, which is to say the pipes 57, 58, and 59 joining the accumulator subsystem and the manifold system may be viewed as an interface of whatever geometry is necessary to join the two subsystems.

The internal passages and ports presented by the manifold block 34 are shown in FIG. 6. Fluid under pressure supplied by pump 23 is directed to a port which terminates a passage 60 inside the manifold block and flows through the check valve 39 to a passage 61 inside block 34. Passage 61 has two branches 61A and 61B terminating in ports 62A and 62B which communicate with the supply pipes 57 and 58 for charging the accumulators 30 and 31.

A passage 63 inside block 34 communicates with passage 61. This allows fluid to be transmitted through check valve 42 to a passage 64 inside block 34 terminating in a port 64P to which one of the smaller accumulator supply pipes 59 is connected. Similarly, a passage 65 inside block 34 transmits fluid in passage 61 to check valve 43, flowing from there through a passage 66 terminating in a port 66P in block 34 to which the other small accumulator supply pipe 59 is connected.

Referring to FIG. 7 fluid under pressure supplied to passage 60 open check valve 39 and is transmitted through passage 61 directly to the branches 61A and 61B, charging both accumulators 30 and 31 concurrently. At the same time, the branch passages 63 and 65 receive fluid under pressure, opening check valves 42 and 43, enabling the small accumulators 30A and 31A to be charged by way of passages 64 and 66.

To control delivery of fluid under pressure from the accumulators to the retarder actuating cylinders, the hydraulically balanced four-way valves 37 and 38 are employed. These are selectively operable, directional control valves. Each control valve 37 and 38 is normally in a neutral position. This position prevents flow of fluid to the retarder cylinder and is the position shown in FIG. 7. By shifting a directional control valve, the related retarder cylinder at one end receives fluid in one direction from the accumulator subsystem while the opposite end is connected to the return pipe. The direction can be reversed as will be explained.

The smaller accumulators are isolated from one another by the check valves 42 and 43: accumulator 30A can only service retarder cylinder 14-12; accumulator 31A can only service retarder cylinder 14-11. The check valves 42 and 43 enable the large accumulators to service each of the cylinders 14-11 and 14-12; each of these check valves is downstream of the small accumulator, interposed between it and the related large accumulator. The large accumulators could be combined into a single one, or there could be more. Two, however, are found to be optimum for track-side installation in the manner apparent from FIG. 1.

In order to communicate the two large accumulators and accumulator 31A to cylinder 14-11, a passage 71 inside the manifold block communicates with passage 64 and extends to a passage 72 connected to the center port 72P of valve 37. Similar passages are provided for the center port of valve 38, enabling the combined effect of the two large accumulators and accumulator 30A to be communicated to cylinder 14-12. Each small accumulator is thus paired with the two large accumulators for conjointly delivering fluid pressure to the respective retarder cylinders 14-11 and 14-12. In the normal position, the center port of each valve 37 and 38 is blocked, maintaining pressure in the accumulators.

Pressure 72 has branches 72-1 and 72-2. These are pilot lines servicing the hydraulic balancing chambers (pistons) 37A and 37B of valve 37. Valve 38 is balanced in the same manner.

The pilot lines 72-1 and 72-2 are serviced by valve 37C and the latter is operated by solenoids SA and SB.

When the retarder cylinder 14-11 is to be actuated, one of the service line pipes connected thereto (51 and 52) is to be charged with fluid under pressure while the other is to be connected to the return line leading to the reservoir, not shown. To this end, solenoid SA may be energized, shifting pilot valve 37C to the right as viewed in FIG. 7. As a consequence, the pilot valve 37C is effective to transmit fluid under pressure in passage 72 to pilot line 72-2. The valve positioning chamber of pilot cylinder 37B is charged while that of 37A is connected to the reservoir, shifting valve 37 to the left. This connects center port 72P to passage 76 in the manifold block leading to pipe 52. At the same time pipe 51 is communicated to a port 76P to which is connected pipe 27 leading to the hydraulic reservoir, or tank.

The same connections are used for actuating retarder cylinder 14-12 by shifting valve 38.

Actuation of retarder cylinder 14-11 in a reverse sense is characterized by solenoid SB being energized. When this happens, valve 37 is shifted to the right, FIG. 7, pipe 51 is charged with fluid under pressure, actuating the retarder in a reverse sense, and pipe 52 is the one communicated to port 76P.

The same reversal mode prevails for valve 38.

When valve 37 is located in an operative or non-center position, the accumulators 30, 31 and 31A discharge into passage 64. When valve 38 is so located, accumulators 30, 31 and 30A discharge to operate cylinder 14-12.

There is an immediate large pressure drop as the large capacity accumulators 30 and 31 discharge to service one or the other of the retarder cylinders. The large accumulators may discharge, for example, at the rate of 750 gallons per minute. The pressure drop across the check valve 42 or 43 may be as much as 400 psi: 800 psi at start, down to 400 psi in a few seconds. While the retarder cylinder may require only 200 psi for actuation, a problem arises in holding the pressure substantially steady for the required time while the accumulators are discharging. To compensate for the large pressure drop as the large capacity accumulators discharge, provision is made for discharging each of the small capacity accumulators at a slower rate, say a gallon a minute. To attain a slow rate of discharge from the small accumulators, the passages 64 and 66 are provided with restricting orifices 78 which may be as little as 1/32 of an inch in diameter. These may be fixed orifices, or adjustable.

When a directional control valve 37 or 38 is shifted on command that a retarder cylinder be actuated, three of the accumulators discharge, the two large ones rapidly and, concurrently with one of the smaller ones
which discharges at a much slower rate. The smaller accumulator, as noted, compensates (modulates) the larger pressure drop.

Eventually, in a matter of several seconds or more, the larger accumulators are at less pressure than the smaller one. Back pressure, in passage 64 for example, closes valve 42; accumulator 31A continues to supply sustaining pressure for the retarder cylinder 14-11. In the instance of retarder cylinder 14-12, back pressure from accumulator 30A closes check valve 43 when the large accumulators reach less pressure.

The system is of particular advantage when both retarder cylinders are required to operate simultaneously. Each of the large accumulators is able, independently, to operate a retarder cylinder three successive times. However, if retarder cylinder 14-12 is required to be operated at the same time cylinder 14-11 is being operated, check valve 42 prevents cylinder 14-11 from discharging ("dumping") to cylinder 14-12, and vice versa. Simultaneous operation may arise in say five percent of the time and the present system is able to handle the event.

When the accumulator pressure in passage 61, tending to close check valve 39, is less than the supply pressure in passage 60, check valve 39 opens and the accumulators are recharged. Check valves 42 and 43 open to permit the smaller accumulators to be recharged. It is assumed, of course, valves 37 and 38 are both restored to their normal or neutral position.

A needle valve 85 can be opened to drain the accumulators when there is a system malfunction to be corrected.

The present system reduces cost. Instead of an accumulator independently at each retarder (position) the accumulators are arranged to service two retarders at once if necessary. The piping is less. The maintenance is less. Nor are there accumulators at a remote location with long pipes connecting to the retarder cylinders.

Each check valve (42 and 43) may be provided with a built-in orifice which will act as a slow release means for any pressure build-up between the cylinder and check valve depending on which related four-way valve is energized. Each orifice is identified by reference character 80, FIG. 7.

Each orifice 80 will accommodate and permit fluid to pass through in the event the cylinders tend to collapse under load due to car weights in excess of the pressure setting of the system.

When the system is fully charged with the orifice 80 in the check valves (42 and 43) there will be no fluid flow across the orifice as the pressure will be in an equilibrium state. When either four-way valve (37 or 38) is energized, the accumulators (30 and 31) and either 30A or 31A) will discharge pressurized fluid to the cylinder calling for oil across check valve 42 or 43. When the cylinder has been fully charged, there will be a slight bleed-back through the orifice 80 until the system pressure (line 26) has exceeded the pressure between the cylinder and the check valve (42 or 43) in which event the flow across orifice 80 will stop.

When an excessively heavy car enters the retarder (one that exceeds the pressure setting of the system) the fluid between check valve 42 or 43 and the cylinder (14-11 or 14-12) will rise in pressure according to the amount the cylinders collapse due to excessive loads. The pressure rise will force the oil across orifice 80 and into accumulators 30 and 31 which will act as dampeners, preventing the oil pressure from rising to an abnormal level.

I claim:

1. In a hydraulically operated railroad car retarder system in which retarders on adjacent tracks are actuated by respective hydraulic cylinders, hydraulic apparatus for actuating the respective retarder cylinders independently or concurrently and comprising:
   a pair of accumulator subsystems each of which includes at least one large accumulator of predeter-
   mined capacity and a small accumulator of less capacity paired therewith for conjointly delivering
   fluid pressure to the respective retarder cylinders; directional valve means interposed between each of
   the accumulator subsystems and each of the retarder cylinders to control delivery of fluid under
   pressure from the accumulator subsystems respectively to the retarder cylinders;
   and means to restrict delivery of fluid from each of the smaller accumulators to a rate substantially less than the rate of delivery from the larger accumula-
   tor.

2. Apparatus according to claim 1 including a plurality of check valves enabling all accumulators to be charged from a single source while limiting discharge of each small accumulator to only one of the retarder cylinders.

3. Apparatus according to claim 2 including a manifold block separated from the accumulators and provid-
   ed with passages enabling the accumulators to be charged and enabling fluid to be translated through the valves to and from the retarder cylinders, said direc-
   tional valve means and the check valves being mounted on the manifold block.

4. Apparatus according to claim 1 including a pair of opposing check valves limiting discharge of each small accumulator to only one of the retarder cylinders.

5. Apparatus according to claim 4 including a manifold block separated from the accumulators and provid-
   ed with passages enabling the accumulators to be charged and enabling fluid to be translated through the valves to and from the retarder cylinders, said direc-
   tional valve means and the check valves being mounted on the manifold block.

6. Apparatus according to claim 1 including a manifold block separated from the accumulators and provid-
   ed with passages enabling the accumulators to be charged and enabling fluid to be translated through the valves to and from the retarder cylinders, said valve means being mounted on the manifold block.

7. In a hydraulically operated railroad car retarder system in which a retarder is actuated by a hydraulic cylinder, hydraulic apparatus for actuating the cylinder and comprising:
   at least one large accumulator of predetermined capacity and a smaller accumulator of less capacity paired therewith for conjointly delivering fluid pressure to the retarder cylinder;
   directional valve means interposed between said cylinder and said accumulators to control delivery of fluid under pressure from the accumulators to the retarder cylinder;
   and means to restrict delivery of fluid from the smaller accumulator to a rate substantially less than the rate of delivery from the larger accumula-
   tor.

8. Apparatus according to claim 7 in which the restricting means is a restricting orifice.
9. Apparatus according to claim 8 in which a check valve is interposed between the accumulators to prevent the small accumulator from discharging into the large accumulator.

10. In a hydraulically operated railroad car retarder system in which a pair of adjacent retarders are actuated by respective hydraulic cylinders, hydraulic apparatus for actuating the cylinders independently or concurrently and comprising:
   an accumulator of predetermined capacity;
   a pair of directional valves interposed between the accumulator and each of the retarder cylinders to control delivery of fluid under pressure from the accumulator to a retarder cylinder to be actuated;
   and
   a check valve interposed between each directional valve and the accumulator to prevent hydraulic fluid from discharging from one retarder cylinder to the other at a time when both retarder cylinders are to be actuated concurrently.

11. A retarder system according to claim 10 in which there is an orifice across each check valve.

12. In the hydraulically operated railroad car retarder system in which retarders on adjacent tracks are actuated by respective first and second hydraulic cylinders, hydraulic apparatus for actuating the respective first and second retarder cylinders independently or concurrently and comprising:
   at least one large accumulator of predetermined capacity,
   first and second smaller accumulators of less capacity, each being paired with the large accumulator for conjointly delivering fluid pressure to the first and second retarder cylinders respectively,
   means to restrict delivery of fluid from each of the smaller accumulators to a rate substantially less than the rate of delivery from the larger accumulator,
   a plurality of check valves preventing delivery of fluid pressure from the first and second smaller accumulators to the second and first retarder cylinders respectively, and
   directional valve means interposed between the accumulators and retarder cylinders to control delivery of fluid under pressure from the accumulators to the retarder cylinders.

13. The apparatus of claim 12 wherein said check valves enable all accumulators to be charged from a single source but prevent delivery of fluid pressure from one smaller accumulator to the other.

14. The apparatus of claim 12 in which one of said check valves is interposed between each directional valve and a large accumulator to prevent hydraulic fluid from discharging from one retarder cylinder to the other at a time when both retarder cylinders are to be actuated concurrently.

15. The apparatus of claim 14 in which there is an orifice across said one of said check valves interposed between each directional valve and a large accumulator.

16. The apparatus of claim 15 in which the restricting means is a restricting orifice.