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[54] **RAILROAD TANK CAR BALL VALVE**
7 Claims, 3 Drawing Figs.

[52] **U.S. Cl.** **251/144,** 251/315
[51] **Int. Cl.** **F16k 5/06**
[50] **Field of Search** 251/144, 309, 315; 137/267, 581

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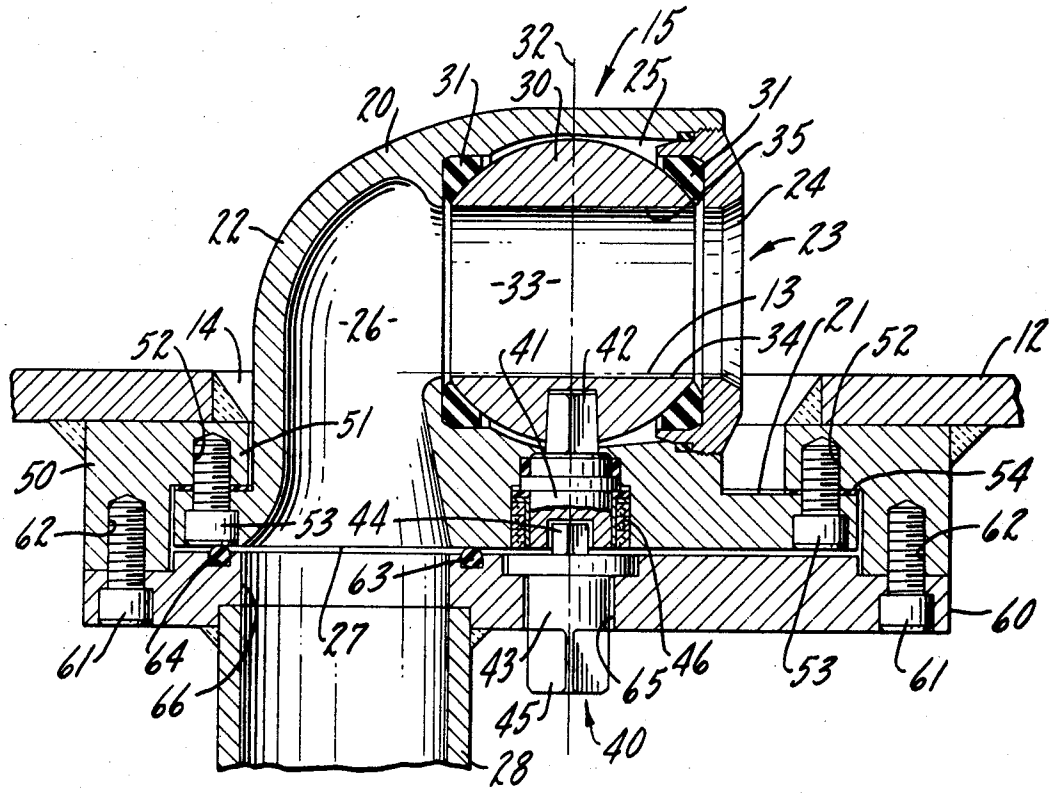
ABSTRACT: A railroad tank car has a ball valve operable from its underside mounted within the car tank in a manner that permits complete drainage.



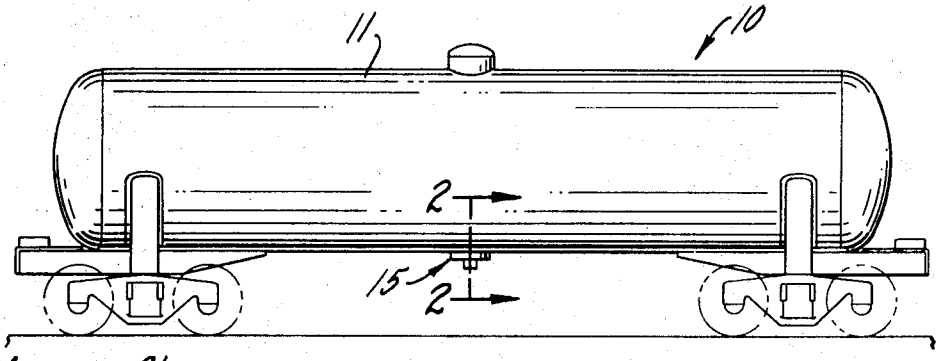


Fig. 1.

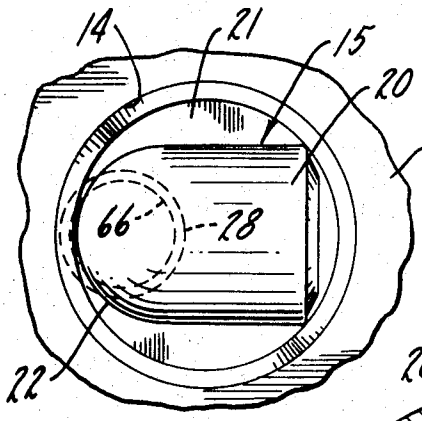


Fig. 3.

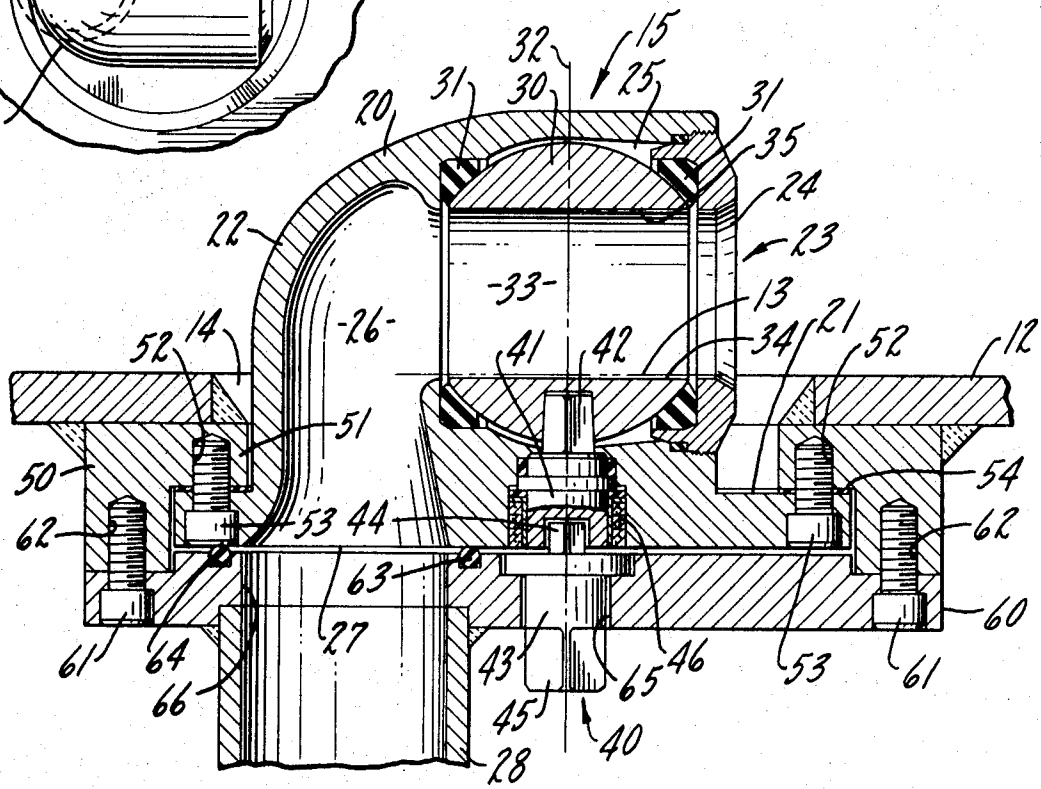


Fig. 2.

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RAILROAD TANK CAR BALL VALVE

This invention relates to railroad tank cars having bottom valves for controlling fluid flow through discharge outlets.

Heretofore, certain types of valves that have many desirable characteristics, such as ball valves, have only rarely been used in the bottom discharge outlets of tank cars for carrying fluids at relatively high pressures (e.g., above 27 p.s.i.a.). One reason for this is that previous arrangements for housing or attaching such valves created disadvantages that outweighed the inherent advantages of the basic valve structure. For example, in one prior art arrangement the entire structure of a ball valve was located below and on the outside of a tank car. This was dangerous because the contents of the car would be lost if the valve was sheared off by an obstruction in the path of the car. But locating the entire ball valve structure of prior art embodiments inside of a tank car where it would be safe from external obstructions would result in other disadvantages. For example, portions of the valve structure might interfere with drainage of the car or might necessitate entry into the car to install or replace the valve.

Accordingly, it is an object of this invention to provide a tank car with a bottom-operated, internal, bottom outlet discharge valve that does not possess the prior art defects mentioned above.

Another object is to provide a tank car that can be completely drained through a bottom outlet valve even though the bottom surface of the car does not slant towards the outlet.

Another object is to provide discharge outlet structure for a tank car in which the contents of the tank will not be lost even though a portion of the structure is sheared off by an external obstruction.

Another object is to provide a railroad tank car with an improved arrangement for discharging a fluid commodity.

Another object is to provide a tank car with an internal bottom outlet valve that can be attached and removed without requiring entering of the car.

Another object is to provide an improved combination of a railroad tank car and a ball valve.

Another object is to provide a railroad tank car with a compact internal discharge outlet valve arrangement that defines its own sump.

Other objects and advantages of the invention will be apparent from the drawing, specification and claims, and the scope of the invention will be pointed out in the claims.

Briefly stated, according to one aspect of the invention, a railroad tank car including a container having a discharge opening at its bottom has internal valve means for controlling flow through the opening. The valve means includes flow control means mounted for rotation about a vertical axis, and there is a substantially horizontal fluid flow passage through the flow control means. The lowermost surface of the fluid flow passage is below the lowermost interior surface of the container.

In the drawing:

FIG. 1 is a schematic, side view of a railroad tank car having valve means in accord with the teachings of this invention.

FIG. 2 is a partially broken away, cross-sectional view on an enlarged scale taken on the line 2–2 in FIG. 1.

FIG. 3 is a plan view on a reduced scale of the structure shown in FIG. 2.

In the drawing, a conventional railroad tank car 10 includes a fluidtight container 11 made from metal of predetermined thickness and having the configuration of a right circular cylinder with a horizontal longitudinal axis. Thus the lowermost surface 12 on the inside of container 11 lies essentially in a horizontal plane which includes reference line 13. Container 11 has a circular bottom outlet opening 14 of predetermined diameter in which valve means 15 in accord with this invention is mounted. Tank car 10 also includes conventional components and accessories such as trucks, couplers, a manway, a fluid inlet, pressure relief valves, and the like; however, some of such features are not shown and none are described in detail in this application because they are conventional and their specific structure is not a part of this invention. Tank car 10 may have an internal operating pressure at or above atmospheric pressure, depending on the commodity transported.

Valve means 15 for controlling flow through opening 14 is shown as a ball valve including cast metal housing means 20 having a circular flange portion 21 larger in diameter than opening 14 around the periphery thereof. An internal conduit portion 22 in housing means 20 extends upwardly from flange 21 through opening 14 into the interior of container 11. An entrance port 23 is defined in part by a removable annular cap member 24 attached to an end of housing 20 by screw threads. A substantially horizontal first channel 25 extends from port 23 and connects with a generally vertical second channel 26. Channel 26 terminates in a discharge port 27 which communicates with a tubular tank car discharge outlet fitting 28 adapted to be coupled to means for receiving the contents of container 11. Fitting 28 is only partially shown in order to simplify the drawing, and because the specific structure of such a fitting is conventional and is not a part of this invention.

Generally spherical flow control means 30 is rotatably mounted in first channel 25. Means 30 is supported by a pair of conventional annular resilient gasket means 31 which are compressed between means 30 and the interior of housing 20 and cap member 24. Flow control means 30 is mounted for rotation about a generally vertical axis 32, and has a substantially horizontal flow control passage 33 therethrough. As revealed by line 13, the lowermost surface 34 of passage 33 is below the lowermost surface 12 of the interior of container 11, and the uppermost surface 35 of passage 33 is above surface 12.

Means 40 for rotating flow control means 30 includes a first segment 41 passing through a suitably shaped hole through housing 20. Segment 41 has a generally rectangular protrusion 42 which mates with a correspondingly rectangular cavity in member 30. A second segment 43 has a similar rectangular protrusion 44 mating with a correspondingly rectangular cavity in segment 41. Segments 41 and 43 define a valve stem coincident with axis 32. An outer end 45 of means 40 is exposed on the outside of the tank car for grasping by a suitable tool, such as a wrench, or connection to an automatic operating mechanism. Gasket means 46 provides a fluidtight seal between segment 41 and housing 20 and is held in tight by conventional retaining means, not shown. Rotation of end 45 causes corresponding rotation of segments 41 and 43 and flow control means 30, so as to partially or completely close off flow through passage 33.

An annular reinforcing ring 50 made of metal thicker than the wall of container 11 is welded to the outside of container 11 around the entire periphery of opening 14. Ring 50 has an inwardly extending shoulder portion 51 that terminates flush with the edge of opening 14. A plurality of threaded cavities 52 are spaced around portion 51. A corresponding number of bolts 53 pass through appropriately dimensioned openings in flange portion 21 and are threaded into cavities 52; thus housing 20 is attached to container 11 within the confines of ring 50 in a manner that permits removal without requiring a workman or tools to enter container 11. Suitable gasket means 54 is compressed between flange 21 and shoulder 51 so as to provide a fluidtight seal around valve means 15.

A protective plate 60 is removable attached to ring 50 by threaded bolts 61 passing through suitable holes in plate 60 and received in threaded cavities 62 in ring 50. An O-ring 63 in a groove 64 in plate 60 is compressed against the underside of housing 20 to provide a fluidtight seal between port 27 and fitting 28. Discharge fitting 28 is welded to plate 60 and removable therewith. Segment 43 is rotatably supported in a hole 65 through plate 60 and is removable therewith. A hole 66 through plate 60 provides fluid communication between port 27 and fitting 28.

Before filling tank car 10 with a fluid commodity, such as liquified petroleum gas, and during the transportation thereof

to its final destination, flow control means **30** is rotated to a first or flow-blocking position essentially 90° from that shown in FIG. **2**. This closes off channel **25** and prevents discharge of the fluid. On arrival of car **10** at its destination, fitting **28** is coupled in any conventional manner to the means for receiving the contents of container **11**. Then end **45** is grasped and means **40** rotated 90° to a second position as shown in FIG. **2** in which one end of passage **33** communicates with port **23** and the other end communicates with channel **26**. Complete discharge of the contents of container **11** can then take place because the mounting arrangement and structure of valve means **15** defines a sump therefor. This occurs because all parts of housing **20** are spaced inwardly away from the edge of opening **14**, thereby preventing any portion of valve means **15** from blocking flow into opening **14**. Essentially all fluid in container **11** passes through port **23**, passage **33**, channels **25** and **26**, port **27** and finally into discharge fitting **28** because the lowermost surface **34** of member **30** is below the lowermost surface **12** of container **11**. The only fluid remaining in container **11** will be the small amount occupying the space between the edge of opening **14** and the outside of housing **20** below the level of surface **34** and down to flange **21**. For all practical purposes, such a minute volume of fluid is negligible. A further advantage of this arrangement is that the inside surface of container **11** need not slant toward valve means **15** to assure complete drainage of container **11**.

If an obstruction below the bottom of tank car **10** shears off protective plate **60** by breaking bolts **61**, valve means **15** and its mounting arrangement will remain intact. The only way valve **15** can be broken off container **11** by an obstruction is for the damage done by the obstruction to be sufficient to shear off welded reinforcing ring **50**. In such event, the damage to container **11** would be sufficient to rupture container **11** even if valve means **15** were not present. Therefore, valve means **15** in accord with this invention does not significantly increase the vulnerability of container **11**.

It will be understood that while the form of the invention herein shown and described constitutes a preferred embodiment, it is not intended herein to illustrate all of the equivalent forms or ramifications thereof. It will also be understood that the words used are words of description rather than of limitation, and that various changes may be made without departure from the spirit or scope of the invention herein disclosed, and it is aimed in the appended claims to cover all such changes as fall within the true spirit and scope of the invention.

What we claim is:

1. A railroad tank car comprising:
   - I. a container having a discharge opening in the bottom thereof and a lowermost interior surface; and
   - II. valve means for controlling flow through said opening comprising:
     - A. housing means having
       1. a flange portion attached to the outside of said container adjacent said opening; and
       2. a conduit portion extending upwardly from said flange portion through said opening into the interior of said container beyond the lowermost interior surface of said container, there being an entrance port into said conduit portion, a substantially horizontal first channel leading from said entrance port and communicating with a generally vertical second channel which communicates with a discharge port;
     - B. flow control means mounted for rotation about a generally vertical axis in said first channel, there being a substantially horizontal passage through said flow control means;
     - C. means rotatable about a generally vertical axis operable from the outside of said container at the underside of said container for rotating said flow control means between a first flow-blocking position and a second position in which one end of said passage communicates with said entrance port and the other end communicates with said second channel; and
     - D. said horizontal passage of said flow control means having
       1. an uppermost surface above said lowermost interior surface of said container; and
       2. a lowermost surface below said lowermost interior surface of said container.

2. The invention defined in claim **1** wherein
   - A. said container is constructed to handle fluids at pressures greater than atmospheric pressure;
   - B. resilient sealing means compressed against said housing means rotatable supports said flow control means in said first channel; and
   - C. said flow control means is generally spherical.

3. The invention defined in claim **1** wherein
   - A. said means for rotating said flow control means comprises stem means having one end passing through said housing means and being connected to and movable with said flow control means, and an opposite end actuable from the exterior of said container;
   - B. said stem means is rotatable about the same generally vertical axis as said flow control means; and
   - C. said flow control means is generally spherical.

4. A railroad tank car comprising:
   - I. a container having a discharge opening in the bottom thereof, said container in the vicinity of said opening having the configuration of a right circular cylinder with a horizontal longitudinal axis, and said container being constructed to handle fluids at pressures greater than atmospheric pressure; and
   - II. valve means for controlling flow through said opening comprising:
     - A. housing means having
       1. a flange portion attached to the outside of said container adjacent said opening; and
       2. a conduit portion extending upwardly from said flange portion through said opening into the interior of said container beyond the lowermost interior surface of said container, there being an entrance port into said conduit portion, a substantially horizontal first channel leading from said entrance port and communicating with a generally vertical second channel which communicates with a discharge port;
     - B. flow control means mounted for rotation about a generally vertical axis in said first channel, there being a substantially horizontal passage through said flow control means;
     - C. means operable from the outside of said container for rotating said flow control means between a first flow-blocking position and a second position in which one end of said passage communicates with said entrance port and the other end communicates with said second channel;
     - D. said conduit portion being spaced inwardly from the edge of said opening so as to define a sump around said flow control means;
     - E. resilient sealing means compressed against said housing means rotatably supporting said flow control means in said first channel;
     - F. said flow control means being generally spherical;
     - G. said opening having a predetermined diameter, and said flange portion being larger in diameter than said opening;
     - H. a reinforcing ring having an inwardly extending shoulder portion being welded to the outside of said container around said opening, and said flange portion being bolted to said shoulder portion;
     - I. a protective plate member located below said housing member being bolted to said reinforcing ring;
     - J. a discharge outlet fitting adapted to be coupled to means receiving the contents of said container being secured to said protective plate member, a passage through said fitting communicating with said second channel; and

K. said means for rotating said flow control means including a vertical stem having an end connected to said flow control means and rotatable about the same generally vertical axis as said flow control means.

5. A railroad tank car comprising:

I. a container made of metal of predetermined thickness having

A. a discharge opening in the bottom thereof and a lowermost interior surface; and

B. an annular metal reinforcing ring having an inwardly extending shoulder portion welded to the outside of said container around said opening, the thickness of said ring being greater than that of said container; and

II. valve means for controlling flow through said opening comprising:

A. housing means having

1. a flange portion detachably secured to said shoulder portion within the confines of said reinforcing ring; and

2. a conduit portion extending upwardly from said flange portion through said opening into the interior of said container beyond the lowermost interior surface of said container, there being an entrance port into said conduit portion, a substantially horizontal first channel leading from said entrance port and communicating with a generally vertical second channel which communicates with a discharge port;

B. flow control means mounted for rotation about a generally vertical axis in said first channel, there being a substantially horizontal passage through said flow control means;

C. means rotatable about a generally vertical axis operable from the outside of said container at the underside of said container for rotating said flow control means between a first flow-blocking position and a second position in which one end of said passage communicated with said entrance port and the other end communicates with said second channel; and

D. said horizontal passage of said flow control means having

1. an uppermost surface above said lowermost interior surface of said container; and

2. a lowermost surface below said lowermost interior surface of said container.

6. The invention defined in claim 5 wherein

A. said container is constructed to handle fluids at pressures greater than atmospheric pressure;

B. a protective plate member located below said housing member is bolted to said reinforcing ring; and

C. a discharge outlet fitting adapted to be coupled to means receiving the contents of said container is secured to said protective plate member, a passage through said fitting communicating with said second channel.

7. A railroad tank car comprising:

I. a container made of metal of predetermined thickness having

A. a discharge opening in the bottom thereof;

B. an annular metal reinforcing ring having an inwardly extending shoulder portion welded to the outside of said container around said opening, the thickness of said ring being greater than that of said container; and

C. a protective plate member located below said housing member removably secured to said reinforcing ring; and

II. valve means for controlling flow through said opening comprising:

A. housing means having

1. a flange portion detachable secured to said shoulder portion within the confines of said reinforcing ring; and

2. a conduit portion extending upwardly from said flange portion through said opening into the interior of said container beyond the lowermost interior surface of said container, there being an entrance port into said conduit portion, a substantially horizontal first channel leading from said entrance port and communicating with a generally vertical second channel which communicates with a discharge port;

B. flow control means mounted for rotation about a generally vertical axis in said first channel, there being a substantially horizontal passage through said flow control means;

C. means operable from the outside of said container for rotating said flow control means between a first flow-blocking position and a second position in which one end of said passage communicates with said entrance port and the other end communicates with said second channel; and

D. said means for rotating said flow control means comprising:

1. a first stem segment passing through said housing means and connected to said flow control means;

2. a second stem segment passing through said plate member and connected to said first stem segment; and

3. said first and second segment being separable from each other on removal of said plate member.