Sept. 30, 1941. V. WILLOUGHBY 2,257,212

OUTLET VALVE AND OPERATING MECHANISM

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Fig. 1.

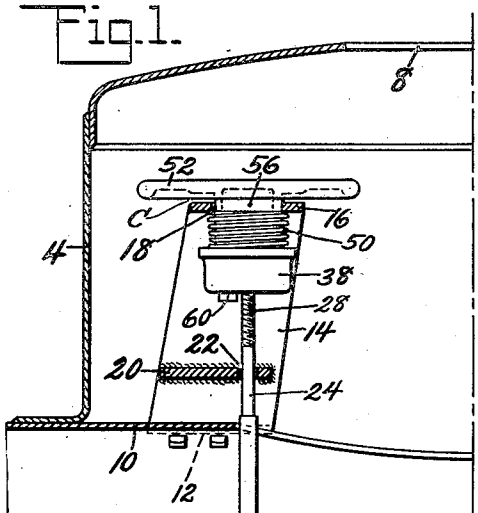


Fig. 2

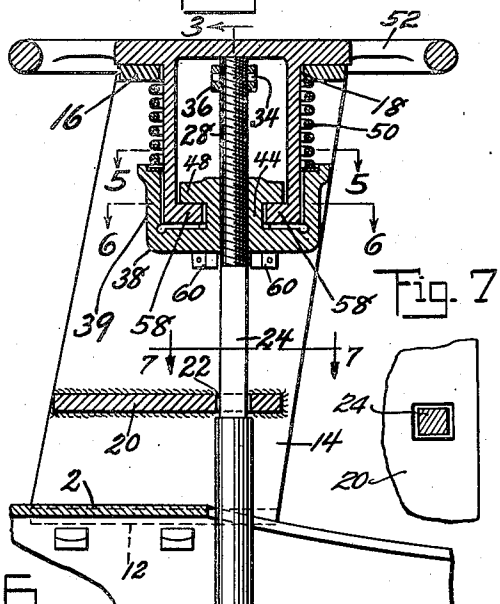
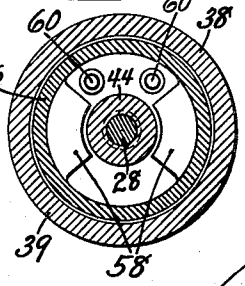
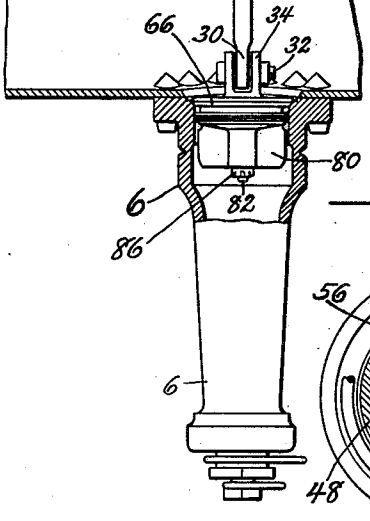


Fig. 7

Fig. 6.





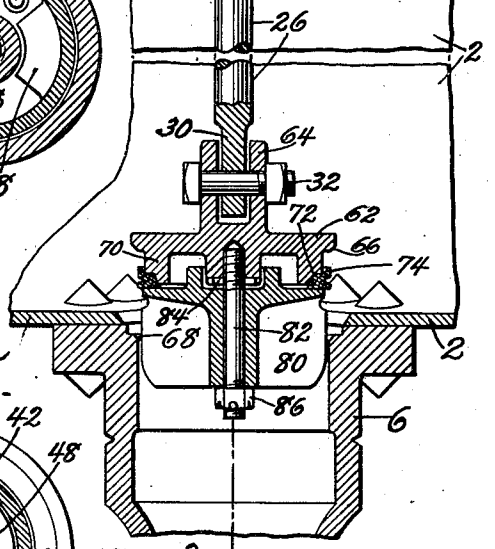
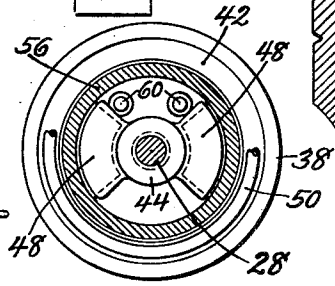


Fig. 5.



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OUTLET VALVE AND OPERATING MECHANISM

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Fig. 3.

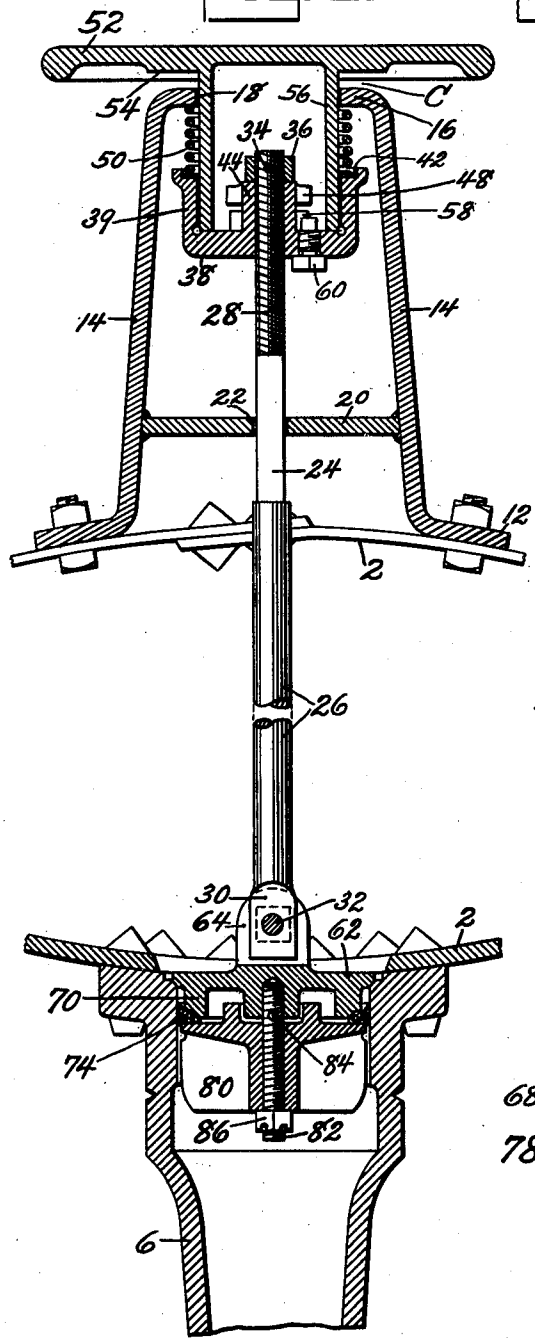
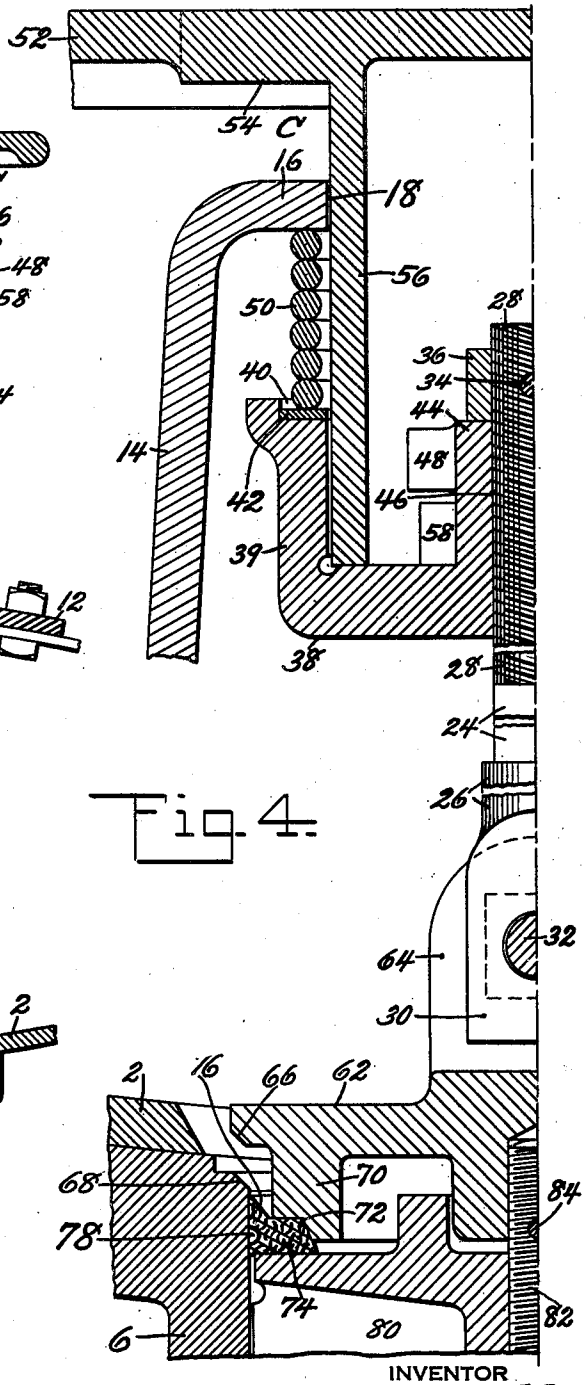


Fig. 4.



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OUTLET VALVE AND OPERATING MECHANISM

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Application June 29, 1938, Serial No. 216,451

12 Claims. (Cl. 137—21)

This invention relates to valves in general and in particular to outlet valves for use on railway tanks or other large vessels.

In the past valves have been constructed for railway tank cars with the valve so related to the operating mechanism as to permit a slight breathing of the tank due to temperature changes, surges, etc., but these valves have often developed leaks or it has been possible for unauthorized persons to lift the valve from its seat and remove part or all of the liquid cargo. It is an object, therefore, of the present invention to provide an outlet valve which is resiliently held upon the valve seat to permit the so-called breathing of the tank, yet which cannot be forced to an open position by unauthorized persons.

A further object of the invention is the provision of an outlet valve having a double seal with the sealing surfaces so related as to prevent passage of liquid cargo, unless the operating mechanism has been moved by a person authorized to do so.

A still further object of the invention is the provision of an outlet valve and operating mechanism with the parts so related as to permit only a definite predetermined vertical movement of the valve independently of the operation of the operating mechanism.

These and other objects of the invention will be apparent to persons skilled in the art from a study of the following description and accompanying drawings, in which

Figure 1 is a partial sectional view showing the valve applied to a tank car;

Fig. 2 is an enlarged sectional view similar to Figure 1, but showing the valve in open position;

Fig. 3 is a sectional view taken on line 3—3 of Fig. 2 with the valve in closed position;

Fig. 4 is an enlarged partial sectional view similar to Fig. 3 and showing the position of the valve if its movement has been attempted by unauthorized persons;

Fig. 5 is a sectional view taken substantially on line 5—5 of Fig. 2, and

Fig. 6 is a sectional view taken substantially on line 6—6 of Fig. 2.

Referring now to the drawings in detail, it will be seen that the valve and its operating mechanism have been illustrated as applied to a more or less conventional tank formed by a shell 2 to which is attached the conventional surge dome 4 at the upper portion and the conventional outlet casting 6 at the lower portion beneath the dome. The dome is, of course, provided with the customary manhole 8 through which access may be had to the interior of the dome and car. As is customary, the tank shell projects a considerable distance into the surge dome as at 10 and is provided, in the present instance, with a support bracket which, in the present instance, is of substantially inverted U form, having lower flanges 12 secured to the shell extension and having legs 14 directed upwardly to be connected at their upper ends by the web portion 16. The web portion is provided with an enlarged opening 18, while the legs of the U-shaped support are joined together by a plate 20 having a rectangular opening 22 formed therein substantially in vertical alignment with the center of the opening in the web portion. This rectangular opening is adapted to receive a similar shaped rectangular portion 24 formed intermediate the ends of a valve operating rod, having a lower portion 26 and an upper threaded portion 28. The lower extremity of the operating rod is flattened as at 30 and provided with an opening through which a bolt or other securing means 32 may be inserted for attachment of the valve, later to be described. The upper or threaded end of the operating rod is provided with an opening adapted to receive a pin or cotter 34 which will lock the nut 36 in the desired position upon the upper end of the rod.

The operating mechanism consists of a lower bowl-like member 38, having an outer rim 39 terminating at its upper edge in a widened portion formed with a recessed area 40 adapted to receive a washer or other means 42. A projection 44 is provided substantially at the center of the bowl-like member and this projection is formed with a bore 46 internally threaded to cooperate with the threads formed on the operating rod previously referred to. The projection is also formed adjacent its upper end with one or more lugs 48 extending outwardly therefrom toward the rim of the bowl. In the present instance the lugs are two in number and each formed to occupy approximately one-fourth of the area between the projection and the rim of the bowl-like member. In order to constantly urge the bowl-like member and operating rod downwardly, a spring or other resilient means 50 is provided having the lower end bearing upon the washer 42, while the upper end bears upon the under surface of the web 16, and this spring is so proportioned as to go solid after a predetermined upward movement of the bowl-like member. The bowl-like member, in the present instance, is adapted to be rotated by a hand wheel 52 formed with a lower bearing surface 54 adapted to rest under certain conditions upon the web 16 and is

also formed with a centrally located cylindrical projection 56 extending downwardly from the hand wheel. This cylindrical projection is formed of such a diameter as to fit within the flange of the bowl-like member and is provided adjacent its lower edge with inwardly directed lugs 58, which lugs are so formed and arranged as to be insertable between the lugs 48 of the bowl-like member. It will be seen that by lowering the cylindrical projection of the hand wheel into the bowl-like member, the lugs 58 will pass down between the lugs of the bowl member, after which a quarter turn of the hand wheel will place the lugs 58 beneath the lugs 48 and that their movement from this position may be prevented by any suitable securing means, such as plain end bolts 60, extending upwardly through the base of the bowl-like member into the path of movement of the lugs 58.

The valve in the present instance is formed by an upper member 62, having upwardly projecting ears 64 adapted to embrace the flattened end of the operating rod and be secured thereto by the bolt or other means 32 previously referred to. The rim of this upper member is ground to provide a valve seat 66 adapted to cooperate with a ground valve body seat 68 formed on or attached to the outlet casting. Adjacent the rim of the upper valve member an annular projection 70 is formed extending downwardly and provided on its outer lower edge with a recess 72 adapted to receive an auxiliary sealing member 74. This sealing member is preferably made of some resilient or flexible material, having an upwardly directed flange 76 and formed with a groove 78 therebeneath in order to provide a plurality of sealing surfaces for cooperation with the bore of the outlet casting as clearly shown in Fig. 4. In order to clamp the auxiliary sealing member in position a lower valve member is provided formed with guiding wings 80 and a flat upper surface adapted to engage the sealing member. This lower valve member is held in position by means of bolt 82 threaded into the upper valve member and locked against movement relative thereto by a pin 84 and extending downwardly through the lower valve member to receive a nut 86, by means of which the lower member may be drawn toward the upper member, thus clamping the auxiliary sealing member in position.

The valve and operating mechanism are readily assembled within the tank by passing the operating rod upwardly through the rectangular opening 22, after which the bowl-like member may be threaded on the upper end of the operating rod and the nut 36 screwed into position and locked to retain the bowl against removal and also to provide a check preventing excessive rotation of the bowl. The spring 50 may now be placed in position and the hand wheel with its integral cylindrical projection lowered into position within the spring and bowl. With the hand wheel lowered into position, a slight rotation thereof will engage the lugs 58 beneath the lugs 48 of the bowl member and insertion of the locking bolts 60 will prevent the removal of the hand wheel, while at the same time insuring rotation of the hand wheel and bowl substantially in unison. The valve may be attached to the operating rod at any time subsequent to insertion of the rod through the opening 22 as is obvious. It is to be noted that with the valve and operating mechanism assembled a clearance C is provided between the hand wheel and the web of the support when the valve is closed and the bowl jammed against the retaining nut 36, preventing further rotation of the hand wheel in a valve closing direction (Fig. 3). With the valve in this fully closed position the spring is under a certain compression sufficient to insure the seating of the valve, but has not been forced solid, therefore, there is a clearance between the hand wheel and the upper surface of the web as well as between the bowl and the lower surface of the web, the latter being due to the spaces between coils of the spring. It will thus be seen that relative vertical movement may be had between the support and the valve operating mechanism when the valve is in closed position. The spacing between the ground valve seat 66 and the sealing member 74 is slightly greater than the sum of the clearances available in the operating mechanism, thus preventing under any circumstance an opening of the valve independently of the operating mechanism (Fig. 4).

The operation of the valve is as follows, assuming the valve in closed position as shown in Figs. 1 and 3: A rotation of the hand wheel in valve opening direction first causes a lowering of the hand wheel into engagement with the top surface of the web, after which this will serve as a reaction point and cause lifting of the operating rod pulling the valve out of the outlet casting and permitting discharge of liquid cargo from the tank (Fig. 2). Reverse operation of the hand wheel will cause the rod to be lowered due to the thrust of the compression spring which will, under most circumstances, force the valve into position into the outlet casting. If for any reason an obstruction is present preventing at least the auxiliary seal from entering the outlet casting, the spring will go solid forming a reaction point and permitting pressure to be applied to force the seal into the outlet casting, at least until the projection of the bowl member comes into engagement with the nut 36, which will prevent further rotation of the hand wheel. Under normal operation, however, the spring is always sufficient to return the valve to its seated position and the parts will then assume the positions shown in Fig. 3 in which further rotation of the hand wheel in a valve seating direction is prevented, while clearances are provided permitting relative movement between the support and operating mechanism without any movement of the valve. In case an unauthorized person attempts to remove cargo from the tank by insertion of a rod in the outlet casting and lifting the valve, such unauthorized removal will be prevented since the spring will go solid with all clearances taken up prior to the time of the removal of the auxiliary seal from the outlet casting (see Fig. 4). It will be obvious that the auxiliary seal, due to its peculiar form, will act in a manner similar to a pump cup in that increased pressure will increase the seal, thus preventing any discharge of cargo if the valve is lifted or if any slight leakage occurs at the ground valve surfaces.

While the invention has been described more or less in detail, it is obvious that various modifications, rearrangements and reproportioning of parts will suggest themselves to persons skilled in the art and all such modifications rearrangements and reproportioning of parts are contemplated as fall within the scope of the following claims.

What is claimed is:

1. A discharge valve assembly for a tank comprising, a valve body secured to the tank, a valve having sealing portions spaced apart in the direction of movement of said valve for cooperation with the valve body, a valve rod connected to the valve, a supporting bracket carried by the tank, valve control mechanism connected to the valve rod and supported by said bracket and rod, said mechanism comprising a bowl-like member threaded upon said rod, a hand wheel connected to said member to rotate the same and guided by said supporting bracket, and a coil spring interposed between said bracket and bowl-like member, said spring permitting a predetermined vertical movement between said bowl-like member and bracket.

2. A discharge valve assembly for a tank comprising, a valve body secured to the tank, a valve having sealing portions spaced apart in the direction of movement of the valve for cooperation with the valve body, a valve rod connected to the valve, a supporting bracket carried by the tank, valve control mechanism connected to the valve rod and supported by said bracket and rod, said mechanism comprising a bowl-like member threaded upon said rod, a hand wheel connected to said member to rotate the same and guided by said supporting bracket, and a coil spring interposed between said bracket and bowl-like member, said spring permitting a predetermined vertical movement between said bowl-like member and bracket, and said permissive vertical movement being less than the spacing of said sealing portions of the valve whereby said valve when closed cannot be opened except by the control mechanism.

3. A discharge valve mechanism for a tank including a valve and valve seat, said valve having spaced sealing surfaces movable consecutively out of engagement with said seat, a reciprocable valve operating rod, a spring cooperating with said operating rod normally seating said valve, said rod and valve being shiftable to unseat only one of said sealing surfaces from said valve seat against the tension of said spring, actuating means for unseating all of the sealing means from said seat to open said valve independently of the spring tension, and means independent of the tank structure for limiting the movement of said actuating means.

4. A discharge valve mechanism for a tank comprising a valve and valve seat, said valve having spaced seating surfaces movable in sequence out of engagement with said seat, a valve actuating rod, spring means cooperating with said operating rod to normally seat said valve, said actuating rod and valve being vertically shiftable under control of the spring means to move only one of the seating surfaces out of engagement with the valve seat, means for positively actuating said rod irrespective of the tension of said spring to open said valve and means independent of the tank for limiting the movement of the positive actuating means in one direction.

5. A discharge valve mechanism for a tank comprising a valve and valve seat, said valve having spaced seating surfaces movable in sequence out of engagement with said seat, a valve actuating rod, a cup threaded on the upper end of said rod, said cup being formed with an upwardly facing annular recess, a coiled spring seating in said recess and abutting an adjacent tank wall portion, said rod and cup being vertically shiftable against said spring to unseat one of said seating surfaces, an operating wheel having a depending cylindrical portion housing the upper end of said rod and extending into and operably engaging said cup, said operating wheel having a bearing portion for engagement with an adjacent tank wall for limiting the movement of the same whereby a reactance point is established to create thrust for positive movement of the valve in one direction, said cylindrical portion of the operating wheel being closed at its upper end and operating to limit said positive movement in the one direction.

6. A discharge valve mechanism for a tank car including a valve and a valve seat, an operating rod for said valve, a cup shaped member threaded on the upper end of said valve rod, a coiled spring interposed between said cup and an adjacent wall portion of said tank to normally urge said valve on its seat, a hand wheel having a cylindrical extension cooperating with said cup to provide a housing for the threaded end of the operating rod, means for locking said cylindrical extension and cup together whereby the rotation of said hand wheel will shift said cup on the threaded end of said rod for movement of said valve, means for securing the hand wheel against axial movement with respect to said rod at a predetermined point during opening of said valve, and additional means for securing said hand wheel against axial movement relative to the rod at a predetermined point during closing of said valve, said last named means and additional means being so formed and arranged as to permit at all times limited vertical movement of said rod and hand wheel relative to said tank.

7. A discharge valve assembly for a tank comprising, a valve body including valve seating portions carried by the tank, a valve having sealing portions spaced apart in the direction of movement of the valve for cooperation with said seating portions, a valve rod connected to said valve and extending through a wall fixed to said tank, said valve being shiftable by movement of said valve rod to remove the sealing portions from their respective seats in sequence, coil spring means for retaining said sealing means in contact with the valve seating portions, the sum of the spaces between the coils of the spring being less than the spacings of the sealing portions of the valve whereby at least one sealing portion of the valve will remain in engagement with its seat upon compression of the spring, and means for shifting the valve rod after said spring has gone solid whereby both sealing portions may be removed from their seat for discharging the contents of said tank car.

8. A discharge valve assembly for a tank comprising, a valve body connected to said tank and including a valve seating portion, a valve having sealing portions spaced apart in the direction of movement of the valve for cooperating with the said body seating portion, a valve rod connected to the valve and extending through a wall fixed to the tank body, said rod being shiftable to move said valve between open and closed position, a spring supporting member on said valve rod at one side of said wall portion, a compression spring between said support and said wall portion for retaining said valve sealing portions in cooperation with said valve seat, the sum of the spaces between the coils of said springs being less than the spacing of said sealing portions of said valve whereby at least one sealing portion of said valve will remain in engagement with said

seat upon compression of said spring, and means carried by the valve rod for moving the latter with respect to the spring supporting member for moving the valve sealing portions from the seat after compression of said spring.

9. A discharge valve assembly for a tank comprising, a valve body connected to said tank and including a valve seating portion, a valve having sealing portions spaced apart in the direction of movement of the valve for cooperating with the said body seating portion, a valve rod connected to the valve and extending through a bracket fixed to the tank body, said rod being shiftable to move said valve between open and closed position, a spring supported member on said valve rod positioned below said bracket, a compression spring between said support and said bracket for retaining said valve sealing portions in cooperation with said valve seat, a valve actuating member fixed to the valve rod above said wall portion, the sum of the spaces between the coils of said springs and the clearance between said bracket and the valve actuating member being less than the spacing of said sealing portions on said valve whereby at least one of said sealing portions of said valve will normally remain in engagement with said seat upon compression of said spring or movement between said bracket and said operating member, an operative connection between the actuating member and the spring support for moving the latter to shift said valve rod after compression of said spring whereby said sealing members may be shifted from their seat for discharging lading from said tank.

10. A valve discharge mechanism for a tank including a valve body having a seating portion carried by said tank, a valve for cooperation with said valve seat, a valve rod, a bracket carried by said tank, a portion of said bracket engaging said rod to prevent rotation thereof, a spring support threaded on said valve rod, a spring interposed between said spring support and said bracket for holding said valve in closed position on its seat, said rod and valve being normally movable against said spring for partial movement of said valve with respect to the seating portion, stop means for limiting the movement of said rod and valve against said spring, and means for rotating said spring support to cause a continued opening movement of said valve.

11. A valve discharge mechanism for a tank including a valve body having a seating portion carried by said tank, a valve for cooperation with said valve seat, a valve rod, a bracket carried by said tank, a portion of said bracket engaging said rod to prevent rotation thereof, a spring support threaded on said valve rod, a spring interposed between said spring support and said bracket for holding said valve in closed position on its seat, said valve being normally movable against said spring for partial movement of said valve, stop means for engaging the spring support to limit the opening movement of said valve against said spring and means for rotating said spring support after its engagement with said stop means to shift said valve rod to move said valve to fully open position.

12. A discharge valve assembly for a tank including a valve body secured to the tank, a valve having sealing portions spaced apart in the direction of movement of said valve, a valve rod connected to the valve, a supporting bracket carried by the tank, a valve control mechanism connected to the valve rod including elements spaced above and below said bracket, said control mechanism including a spring support in threaded engagement with said rod below said bracket, a coiled spring interposed between the spring support and bracket, a collar carried by a hand wheel, said collar being detachably connected with said spring support to rotate same on said valve rod, whereby said valve rod may be elevated to unseat said valve by continued rotation of said spring support after compression of said spring between said spring support and said bracket.

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