

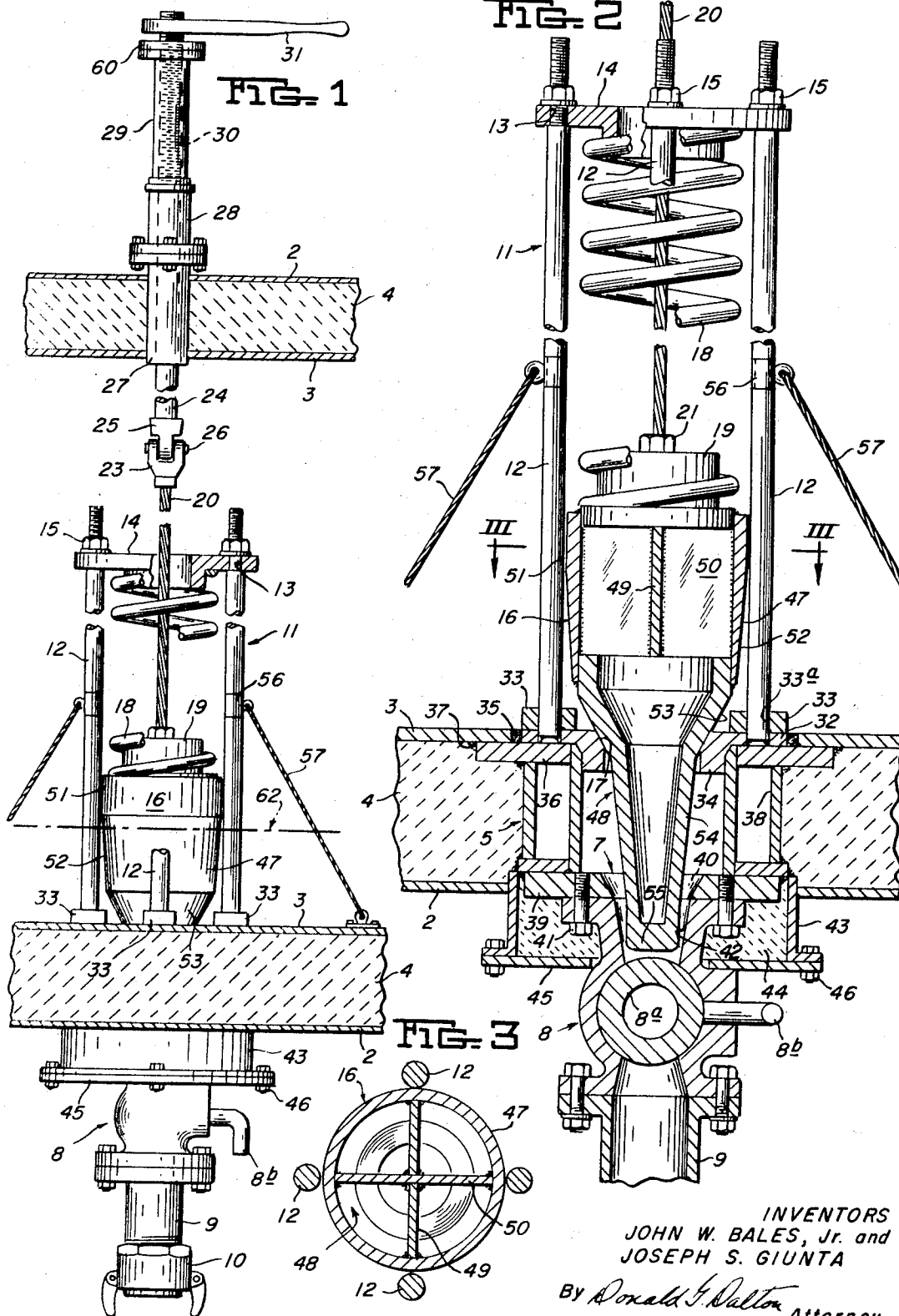
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J. W. BALES, JR., ETAL
DRAIN VALVE FOR TANK BOTTOM

3,448,771

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Sheet 1 of 2



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FIG. 5

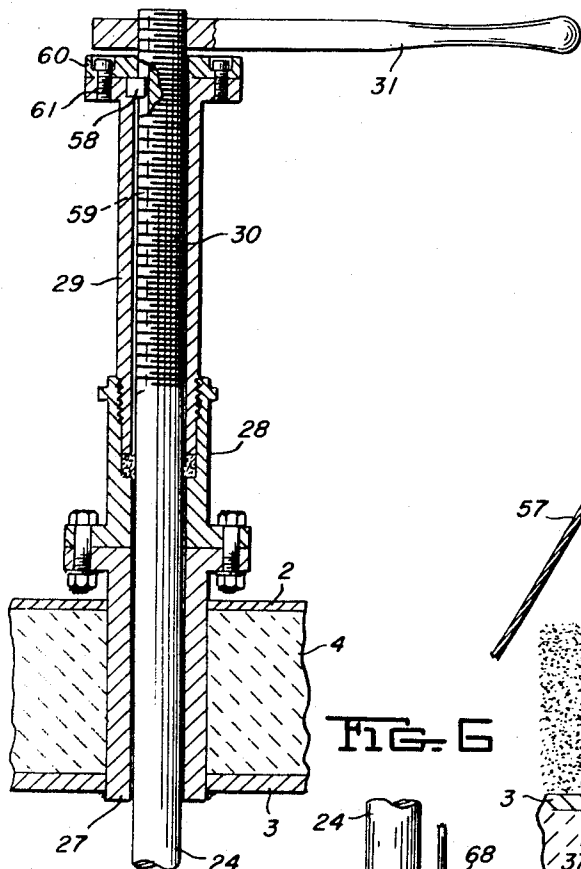


FIG. 6

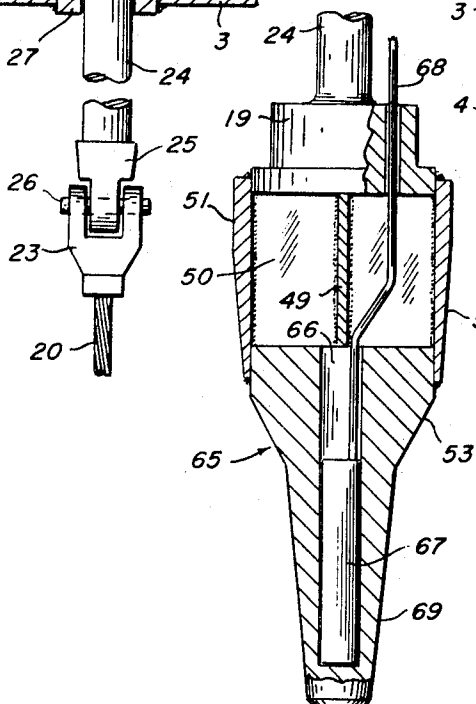
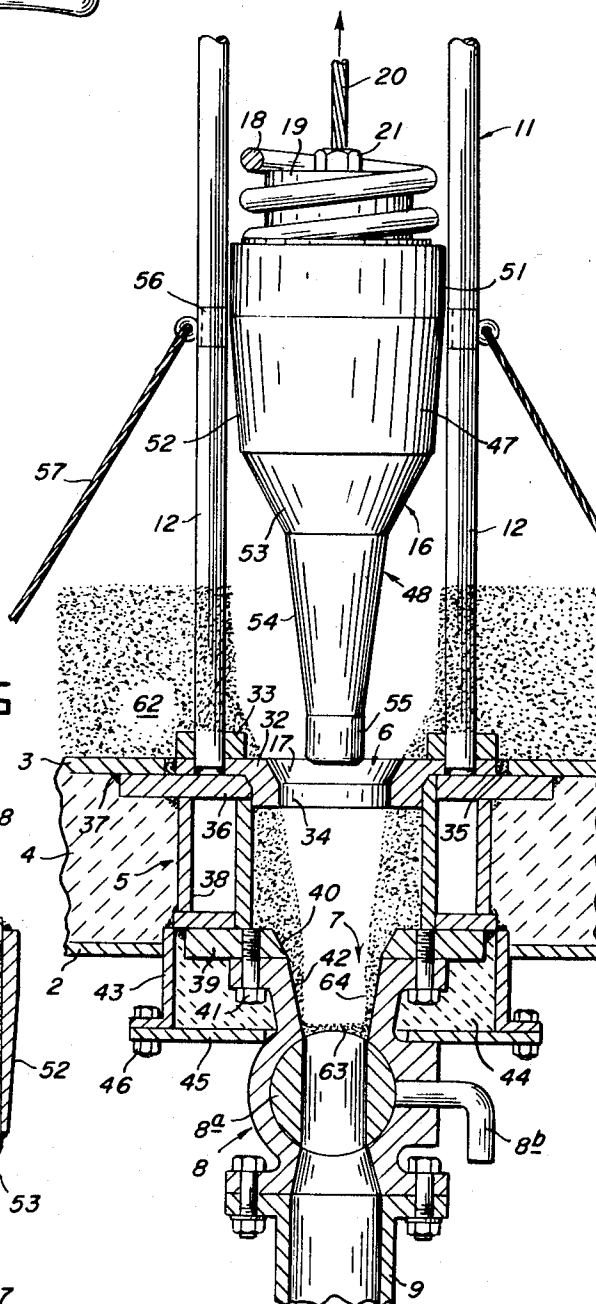


FIG. 4



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DRAIN VALVE FOR TANK BOTTOM

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3 Claims

ABSTRACT OF THE DISCLOSURE

A plug-type valve comprising a casing having fluid intake and discharge openings, a seat on the intake opening, a housing on the seat having openings therein permitting fluid to enter the housing, a plug having a working fit in the housing adapted to be moved towards and away from the seat, means for moving the plug away from the seat and spring means for urging the plug against the seat to close the valve.

This invention relates to a drain valve for a tank bottom. More particularly, it relates to a plug-type valve for a tank or tank car that is useful for handling fluid materials containing suspended solids, such as molten pitch.

Certain materials are solid at ambient temperatures and molten or liquid at elevated temperatures. One such material is pitch, recovered from coke-oven tar or the like. One means of delivering pitch to customers is in railroad tank cars heated-in-transit that transport the pitch in molten condition. At the destination, a valve in the bottom of the car is opened and the molten pitch is pumped to heated storage means for subsequent use. When a valve cannot be opened, the pitch must be pumped from the top of the car at additional expense.

A known valve for tank cars heated-in-transit is a plug-type comprising a casing mounted between the inner and outer shells of the car. The intake opening has a seat therein to receive a reciprocable plug having a stem operated from the top of the car by turning means. The stem is threaded for a short distance above its junction with the plug. It passes through a threaded yoke mounted on the inner shell. The seating force of the plug to close the valve results from the force of the threaded stem on the threaded yoke.

This conventional valve has a number of disadvantages. Pitch contains suspended solids as finely divided insoluble material which settles to the bottom of the car during transit. The resulting layer of solid material may build up to be as much as 6" thick, thereby covering both the plug and the threaded portion of the stem. It then becomes very difficult, if not impossible, to turn the valve stem and raise the plug, because the plug must break through the layer of solid material thereabove. Even if the valve can be opened the solid material remains in the area of pitch flow to retard the flow of pitch from the car. Also, if the valve is not closed after unloading while the valve stem is still hot and the pitch is still fluid, it is difficult to close the valve.

It is accordingly an object of the present invention to overcome the foregoing disadvantages of such valves and to provide a valve which is simple in design and easy to use.

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It is a further object of the present invention to provide a plug-type valve having a plug-supporting housing on the valve casing, means for moving the plug away from the valve seat and spring means for urging the plug against the seat.

It is another object of the present invention to provide a plug-type valve having a plug that in closed position extends above a layer of solid material and an opposite end thereof that telescopes into the discharge opening of the valve casing.

The foregoing and further objects will be apparent from the following specification when read in conjunction with the attached drawings, wherein:

FIGURE 1 is a vertical elevational assembly view, partly in section, of a portion of a tank car mounting a plug-type valve and operating means embodying this invention;

FIGURE 2 is a vertical elevation, partly in section, of the valve assembly;

FIGURE 3 is a sectional view taken on the line III—III of FIGURE 2;

FIGURE 4 is a view similar to FIGURE 2 showing the plug in raised position;

FIGURE 5 is a vertical elevation, partly in section, of means for moving the plug away from the valve seat; and

FIGURE 6 is a vertical sectional view of a modified form of the valve plug.

Referring more particularly to the drawings, the numerals 2, 3 designate respectively the outer and inner shells of a tank car having insulation 4 therebetween. The car has the conventional support structure for the shells, heating coils and means for heating and circulating a heating fluid such as an organic fluid, not shown.

In spaced openings in shells 2, 3, in the bottom of the car, a valve casing 5 is mounted on and between shells 2, 3. Casing 5 has a fluid intake opening 6 and a fluid discharge opening 7. Mounted on and outwardly of opening 7 is a conventional closure means 8, such as a ball-type valve or a stop cock that may be opened or closed by properly rotating ball 8a by means of a valve handle 8b. Mounted on and outwardly of valve 8 are a conventional unloading means such as a nipple 9 and a coupling 10 for attaching thereto a hose (not shown) to unload the pitch. Mounted on casing 5 is a housing 11, comprising circumferentially spaced vertical rods 12, the threaded upper ends thereof extending through holes 13 in the flange of an outwardly flanged collar 14, held in place on rods 12 by nuts 15. Rods 12 provide a working fit or guides for an elongated, multitapered plug 16, adapted to be reciprocable and to close the valve when seated on the beveled seat 17 of casing 5. Plug 16 is urged against seat 17 by a compression spring 18, the respective ends thereof engaging collar 14 and a shouldered abutment 19 mounted on the upper end of plug 16.

Means for moving plug 16 away from seat 17 preferably comprise flexible means such as a wire rope or cable 20, the respective ends thereof being anchored in a fitting 21 inserted in abutment 19 and a clevis 23. A valve stem 24 is threadedly attached to a fitting 25 pivotally held in clevis 23 by a pin 26. Stem 24 is surrounded by and is reciprocable in a vertical series of outwardly flanged sleeves 27, 28, 29. Sleeve 27 at its lower end is welded to the inner shell 3. The upper end 30 of stem 24 is threaded to receive a threaded handle 31 adapted to raise and lower the plug.

As best shown in FIGURES 2, 3 and 4, valve casing 5 comprises a number of units welded to each other and to inner shell 3. A disc 32 has circumferentially spaced washers 33 welded thereto. Holes 33a drilled therein and in ring 32 receive rods 12 welded therein. An axially spaced beveled seat 17 is machined in the upper portion of discs 32 and with inside and downwardly extending flange or lip 34 comprises fluid intake opening 6. Disc 32 is welded at 35 to inner shell 3 and is flush therewith. A disc 36 is fitted against the underside of disc 32 and shell 3 and is welded at 37 to the latter. Disc 36 has welded thereto a chamber 38 which is rectangular in cross-section and is adapted to be supplied with heated fluid from a source not shown. A disc 39 having an axially beveled hole 40 therein is welded to chamber 38. Bolts 41 fasten valve 8 to disc 39. Axially, beveled hole 42 in valve 8 and beveled hole 40 are contiguous and comprise fluid discharge opening 7 in casing 5. A cylindrical shell 43, outwardly flanged at its lower end, is welded at its upper end to chamber 38. Insulation 44 is held in place by a plate 45, attached to shell 43 by spaced bolts 46.

Elongated, multitapered plug 16 preferably comprises an upper, generally cylindrical shell 47, having inserted therein at its lower end a generally conical shell 48. The inside of shell 47 is braced by vertical plates 49, 50, spaced at right angles to each other, the respective ends thereof engaging abutment 19 and shell 48. The working fit of plug 16 with spaced rods 12 is provided by an outwardly cylindrical surface 51 on the upper portion of shell 47. The remaining lower portion of shell 47 has an outwardly conical portion or surface 52, connected to surface 51. Shell 48, from top to bottom, has outwardly conical portions 53, 54 and a closed-end cylindrical portion 55 machined thereon. Surfaces 51, 52, 53, 54, 55 are serially connected. Conical surfaces 52, 53, 54 have decreasing mean diameters respectively. Portion 53 is adapted to seat plug 16 on seat 17. Conical portion 54 and more particularly cylindrical portion 55 are adapted to telescope into discharge opening 7, adjacent the inlet to ball 8a of valve 8. Additional support means for rods 12 against car impact may comprise a ring 56, mounted on and flush with a rod 12 about the mid-point thereof, and one or more cables or wires 57, the ends thereof being secured to ring 56 and shell 3, respectively.

Turning now to FIGURE 5, valve stem 24 is prevented from turning by a removable key 58, which slides in a vertical slot 59 milled in threaded portion 30. Key 58 is held in place by an internally threaded ring 60, which is held in place on the upper, flanged end of sleeve 29 by cap screw 61. The serially arranged sleeves 27, 38, 29, extending well above the outer shell 2 makes it easily evident when threaded portion 30 of the stem is in its raised or lowered position. Additionally, they elevate threaded portion 30 from inside the car and also provide for easy lubrication thereof. The arrangement permits stem 24 to reciprocate during thermal expansion and contraction of a car or a storage tank. In addition to threaded handle 31, other means may be employed to reciprocate stem 24, for example, a rack and pinion, a hydraulic piston or a system of levers operable from ground level.

Turning now to FIGURES 2 and 4, the finely divided, insoluble material which has settled is shown as a layer 62 and is assumed to be about 6" thick. While our valve provides a better seal than conventional valves due to constant pressure on plug 16 by spring 18, it is assumed for illustration, in FIGURE 4, that there has been leakage of pitch and solid material beyond seated plug 16 into discharge opening 7. With the elongated plug 16 of the invention, the top of the plug or abutment 19 need not break through any portion of layer 62 when the plug is raised from its seat. The serially connected, outwardly conical surfaces 52, 53, 54 need only break the sticking force between these surfaces and the solid material to permit hot pitch to flow through the openings in housing 11 between rods 12 into fluid intake opening 6. It is

evident that conical shell 48 telescoping into discharge opening 7 and terminating adjacent the opening to ball 8a has reduced the large volume of solid material which would be solidified in a conventional casing-valve combination to a very thin layer 63 which is easily penetrated by the hot pitch. In addition, section 48 conducts heat from the molten pitch in the car to the opening 7. This tends to heat any material in this area. Initial hot pitch volume is greater, hence, this penetration is assisted by providing a cylindrical surface 55 which with the decreasing internal diameter of conical surface 42 of valve 8 gradually reduces the thickness of a ring 64 of solid material to a minimum at its junction with layer 63. It is to be understood the layer 62 of solid material acts as insulation and is "washed out" or removed by the flow of pitch during unloading to a limited extent. It gradually builds up in a car or tank to a permissible maximum, for example, about 6". It must then be removed manually to maintain pitch capacity and to avoid useless freight charges. For preferred results, abutment 19 and preferably cylindrical outer surface 51 should be positioned above layer 62.

Turning now to FIGURE 6, a modified form of plug shown therein may include means for heating a solid, lower conical end 65 of a plug. A vertical, axial hole 66 therein accommodates a conventional electrical tubular heater 67 to melt pitch around the plug. The heater is supplied with power by leads 68 from a power source, not shown. Where preferred, a single, outwardly conical surface 69 may extend respectively between the lower end of the plug and conical seating surface 53 thereby eliminating cylindrical surface 55. Abutment 19 may be attached to or made integral with valve stem 24, thereby eliminating cable 20 or attaching the latter intermediate the upper and lower stub ends of a stem 24.

It will be evident from the above description that our invention has a number of novel features and advantages. Compared to a conventional valve, previously described, our elongated valve plug opens or may be raised easily and provides ready pitch flow. The plug reduces the volume of material which may leak into a valve casing and permits ready pitch flow. The coil spring provides a constant valve seating force regardless of thermal expansion. Pitch deposited in the threads of a conventional valve stem makes turning to move a plug very difficult. On the other hand, it has been found that solidified pitch has little strength in bending and when deposited on spring 18 cracks off very easily. The lifting means is free to move vertically during thermal expansion and contraction thus eliminating bending of solid valve stems. Our valve is effective in any tank car or tank where a solid layer of material forms on the bottom of the tank.

We claim:

1. A plug-type valve comprising a casing having fluid intake and discharge openings, a seat on said intake opening, a housing on said seat having openings therein permitting fluid to enter the housing, a plug adapted to be moved towards and away from said seat, means for moving the plug away from said seat, spring means for urging the plug against said seat to close said valve, one end of said plug being outwardly cylindrical to provide a working fit in said housing and serially connected thereto three outwardly conical portions having successively decreasing mean diameters, the second conical portion being adapted for engagement with said seat, and an outwardly cylindrical portion connected to the third conical portion being adapted to telescope into said discharge opening when said valve is closed.

2. A valve as defined in claim 1 characterized by a closure means for said fluid mounted on and outwardly of said discharge opening, said telescoping cylindrical portion on said plug terminating adjacent the inlet to said closure means.

3. A valve as defined in claim 1 characterized by an externally threaded valve stem mounted in a position

spaced apart from said plug, an internally threaded handle adapted to reciprocate said stem and flexible connecting means having its ends engaged by said stem and said plug, respectively.

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