Feb. 28, 1933 L. C. KARRICK 1,899,154

VALVE

Filed Sept. 5, 1928

Fig. 1

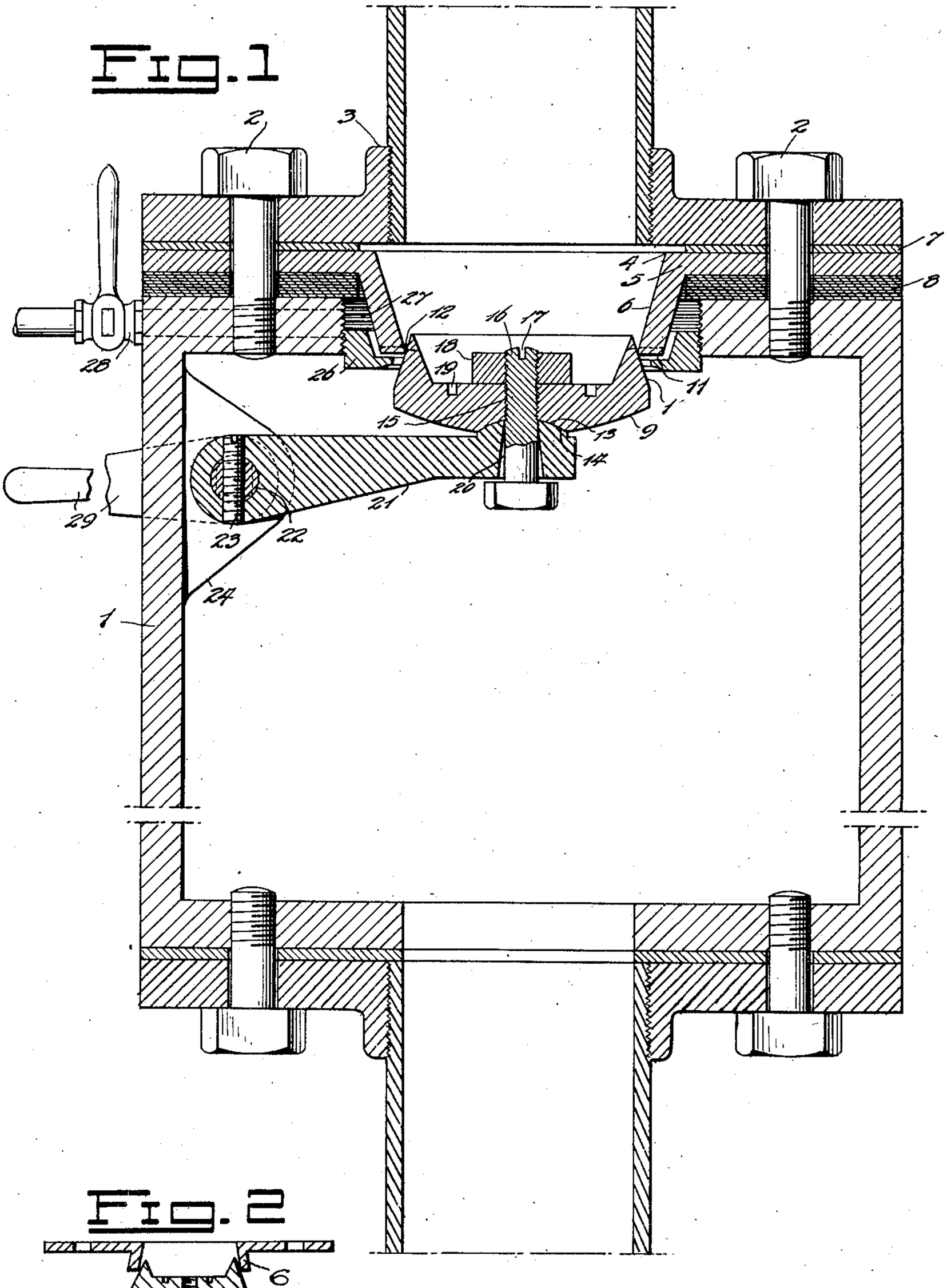

Fig. 2

INVENTOR

Louis C. Karrick

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LEWIS C. KARRICK, OF NEW YORK, N. Y.

VALVE

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This invention relates to an apparatus comprising a gas-tight valve for conduits or chambers in which pulverized coal, gypsum or other solid materials are handled.

The valve is advantageously applied to processes which I have invented for heat-treating pulverized coal and gypsum in which the material is stored in and delivered from one pressure magazine into another magazine immediately below preparatory to feeding the material continuously therefrom to the heat-treating process. The valve provides a gas-tight charging closure (not shown) for the top magazine and a gas-tight valve between the two magazines which is opened while the new charge flows from the top to the lower magazine and is closed while the upper magazine is opened and is receiving a new charge.

This form of valve has the advantage over the common types of valves used for liquids and fluids in that I use contacting knife edges to form a gas-tight seal instead of contacting surfaces of metal or metal and composition washers against which the pulverized material is found to build up and prevent perfect closing. Furthermore, I use no recessed valve seats or openings in which the materials handled can be built up but in all parts I provide tapered openings and sloping walls so as to insure continuously clean contacting surfaces and free-moving parts. Also the contacting parts are designed to facilitate easy removal and renewal of the knife edge contacts by means of simple tools and with minimum of labor. The parts are of simple form and therefore inexpensive to manufacture.

The invention is further described by reference to the accompanying drawing in which in Fig. 1 all parts are shown in section at their center, and

Fig. 2 is a cross-sectional view of a modified form of the valve and valve seat.

The valve body 1 is shown in vertical position connected by bolts 2 to flange and pipe conduit 3 which deliver the pulverized materials through the valve.

The valve seat 4 comprises a one-piece flange 5 and conical ring or collar 6, the latter projecting in a downward direction through the top of the valve body. The flange portion 5 has gaskets 7 and 8 on each side thereby making a gas-tight connection with the valve body. Holes are provided at proper positions to receive the cap screws 2 when the valve seat 4 is centered. The conical ring element or collar 6 is machined and ground on its inner surface to a perfect cone surface and the lower face 11 is ground perfectly flat thereby making the knife edge 12 a perfect circle. The valve seat 4 is preferably made of hardened steel.

The valve gate 9 comprises a disc of metal with a portion at its circumference extending upward. The outer face 10 of the upwardly extending portion is machined to a perfect conical surface in order that it will make a gas-tight contact with the upwardly extending portion 12. The inner face of the upwardly extending portion is also conical in order to readily dislodge any coal which might tend to pack in the top of the gate, and also to reduce the thickness of metal forming the upwardly extending portion and facilitate its repair, as will be described hereinafter. The bottom of the valve gate 9 contains a spherical depression 13 which cooperates or moves on a similarly shaped raised portion 14 of the actuating arm 21. In the center of the gate is a tapped hole 15 containing swivel bolt 16 with lock-nut 18. The swivel bolt 16 contains a slot 17 by which it is screwed into gate 9 until it produces a loose sliding contact between spherical surfaces 13 and 14. The gate 9 is held rigid while adjusting the bolt 16 and lock-nut 18 by a spanner wrench or other suitable tool which fits into the holes 19.

The actuating arm 21 raises and lowers the gate 9. It contains a tapered swivel bolt hole 20 at its outer end, the taper permitting free shifting of the valve gate, either by rocking or rotation, while cooperating with the valve seat. The taper also prevents coal dust from packing and preventing free movement of the bolt 16. The other end of the actuating arm contains a hole drilled at right angles to the axis of hole 20, through which a shaft 22 passes and to which it is keyed by

screw 23. The shaft passes through suitable bearings 24 and stuffing boxes (not shown) in the walls of the valve body 1 and engages with a valve handle 29 on the outside by which the gate is raised and lowered.

The valve gate and seat should be of hardened steel to resist wear but maintenance of a fairly sharp contact is desirable, and this is accomplished by grinding down the surface 11. The grinding may be quickly and accurately done by removing the valve seat 4 from the valve body and grinding it by hand with carborundum in contact with a polishing wheel or table. To insure uniform depth of grinding on all parts of the circular surface 11, I prefer to use a ring of metal into which the element 6 fits loosely. The metal ring should contain tapped holes which cooperate with the bolt holes in the flange 5 of valve seat 4. Gaskets 8 are bolted in place between the ring and valve seat, a sufficient number being used to permit the collar element 6 to project the necessary distance through the ring which collar, when ground off smoothly, will give a new sharp knife edge 12. The valve gate 4 and gaskets used in grinding are then replaced on the valve body while the remaining gaskets removed from the valve in dismantling and not used in the grinding operation are placed at 7 above the flange 5 of the valve seat. The entire assembly will then have the same overall length as originally. It will frequently prove necessary to shift one or more thin gaskets from position 8 to position 7 after grinding in order to compensate for the increased diameter of element 6 which otherwise will require raising gate 9 higher to make contact and possibly prevent improper functioning of the valve.

The gate will not require regrinding of its surface, because by grinding of the valve seat the diameter of the ring of contact between the gate and seat is increased and this in turn brings a new and unusued part of the gate into use. It may prove desirable, however, while grinding the valve seat, to grind off with an emery wheel part of the conical edge of the gate which extends above plane 11, thereby reducing the V-space between collar 6 and face 10 in which the pulverized material can lodge. The grinding of the two parts should be in accordance with the dotted lines shown on 6 and 10. In assembling the valve the proper number of gaskets should be used at 8 to insure that when a gas-tight contact is made between 9 and 4 the swivel bolt 16 is substantially centered in tapered hole 20.

When the valve is used as a gas-tight closure between two coal magazines or as an entrance valve to the top magazine as referred to above, and the system is operating under pressure, I find it desirable to scavenge with gas or steam the contacting surfaces. This is conveniently accomplished by inserting a movable threaded ring 26 into the top opening of the valve body in such position that it leaves a communicating channel 27 around and under the valve seat element 6. Connecting with this channel is a pipe and cock 28 by which the scavenging fluid is introduced as the valve is being closed. The fluid is preferably a type used in the process and it may be either steam or gas if coal or gypsum are being processed, and its pressure should be substantially equal or slightly above the magazine pressure during normal operating conditions. If the fluid pressure is equal to the operating pressure of the magazine, the cock may be left open while the valve is closed so as to provide a uniform balancing pressure inside the magazine while its contents are being withdrawn. It should be noted that in the installations described the valve is under pressure tending to seal it tightly. If the valve does not seal perfectly immediately on closing, it can be remedied by lightly tapping the handle in a direction tending to open it, by which action it rebounds against the elastic fluid pressure and simultaneously releases enough fluid under pressure to clean the surfaces. In no case should excessive external pressure be applied tending to force the contacting surfaces together as the contacts will be dulled or grooved.

I do not limit the form of gate described to a disc containing a circular knife edge. The device will operate equally well with a thick disc having a flat upper surface and a conical circumference.

As shown in Fig. 2 the conical collar 6 may taper outwardly instead of inwardly as illustrated in Fig. 1 so that the outer conical surface of the valve will contact with the line edge of the valve seat and the functioning of the parts as illustrated in Fig. 1 will not be changed.

I claim:

1. Sealing means for a valve comprising a stationary valve seat having a conical opening tapering smaller in the direction of flow and a knife edge formed from a flat surface intersecting the wall of the conical opening at right angles to the axis, and a movable valve gate having a substantially continuous outer sloping surface engageable with said knife edge.

2. Sealing means for a valve comprising a valve body, a stationary valve seat having a circular knife edge, a movable valve gate having a conical outer surface engageable with said knife edge, means for moving said valve gate into and out of contact with said valve seat, and removable gaskets between said valve seat and valve body for adjusting the position of said valve seat.

3. Sealing means for a valve comprising a stationary valve seat having a circular knife edge, a valve gate having a concave under surface to permit tilting movement of said gate

and a peripheral raised portion with a conical outer surface engageable with said knife edge, a convex support for the under surface of said valve gate, and a swivel bolt loosely coupling said valve gate to said support to permit said valve gate to rotate.

4. Sealing means for a valve comprising a flanged stationary element and a movable element, said stationary element having a longitudinal hole therethrough, a conical collar disposed in said hole and having one end planed off parallel with said flange and forming a circular knife edge of acute angle between its flat surface and its inner conical surface, and said movable element comprising a disc having a circumferential raised portion of such diameter as to fit part way into said valve seat and providing therewith a conical surface of contact with said circular knife edge.

5. A sealing means for a valve comprising a stationary valve seat and a movable element, the stationary element having a conical collar and a conical hole therethrough and terminating at opposite ends in parallel surfaces at right angles to the axis of said conical hole, a movable conical element of such diameter as to overlap with the said conical collar and contact therewith at the extremity of said collar, the conical parts of said stationary and movable elements being of such slope and dimensions that contacting of said elements may be caused to take place at any position between the ends of the conical surface of said movable element as in changing the diameter of the collar of the stationary element by grinding off the plane surface of said collar and reducing thereby the length of said collar.

6. Sealing means for a valve comprising a stationary valve seat having a circular knife edge surrounding the small aperture of a conical opening in said valve seat, and a movable valve gate having a conical outer surface engageable with said knife edge, the smallest diameter of said conical valve gate being less than the smallest diameter of the conical opening in the valve seat and the largest diameter of the conical gate member being greater than the smallest diameter of the conical opening in the valve seat, said knife edge in the valve seat being formed at the junction of the wall of the conical opening and another wall of the valve seat which extends at an angle to the longitudinal axis of the valve seat.

7. Sealing means for a valve comprising a stationary valve seat having a conical opening through its center and a circular knife edge surrounding the small end of the seat opening, an outer adjustable ring surrounding the small end of said valve seat so as to form a narrow circular channel between said valve seat and said ring, a movable valve gate having a conical outer surface engageable with said knife edge, and means for passing fluid at high velocity through said channel to clean said knife edge and the corresponding surface of said valve gate.

8. A valve structure comprising a member forming a seat and a closing member for engaging with the seat to obstruct passage therethrough, said seat member and said closing member being movable relative to each other to effect obstructing of or opening of the passage, said members overlapping each other with the inner wall of one of the members being tapered and the outer wall of the other of the members being tapered and having a line contact therebetween, and a wall of one of the members extending in a plane from the line contact perpendicular to the longitudinal axis of the member.

9. Sealing means for a valve comprising a valve seat with a circular opening and a cooperating valve gate relatively movable with respect to each other to effect a closing and opening of the valve, the valve seat and the valve gate each having a smooth conical surface converging in the direction of the other, the valve seat having at its opening a line edge adapted to contact with the conical surface of said valve gate which line edge is formed at the intersection of the conical surface of the valve seat and a wall thereof extending at an angle to the longitudinal axis of the circular opening.

Signed at New York in the county of New York and State of New York this 5th day of September, A. D. 1928.

LEWIS C. KARRICK.