United States Patent

Armstrong, Jr.

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[54] DUST VALVE

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[73] Assignee: **United States Steel Corporation**

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[52] **U.S. Cl.**.....**251/62,** 251/176, 251/326

[51] **Int. Cl.**.....**F16k 3/16,** F16k 25/00

[58] **Field of Search**.....251/326, 176, 62

[56] **References Cited**

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[57] **ABSTRACT**

A dust valve for use between the hopper of dust catching equipment and the dust disposable system includes two spaced plates having a slide plate therebetween. The slide plate has an opening which is movable into and out of alignment with the dust conveying conduits. The opening walls are so shaped as to provide a shearing action across the bottom of the top plate to prevent or lessen dust build up. The height of the space is greater than the thickness of the slide plate which is held against the bottom of the top plate by means of spring biased rollers extending into the space. The longitudinal edges of the slide plate are in contact with roller guides. The slide plate is actuated by means of two air cylinders having their piston rods attached to opposite sides of the slide plate.

11 Claims, 7 Drawing Figures

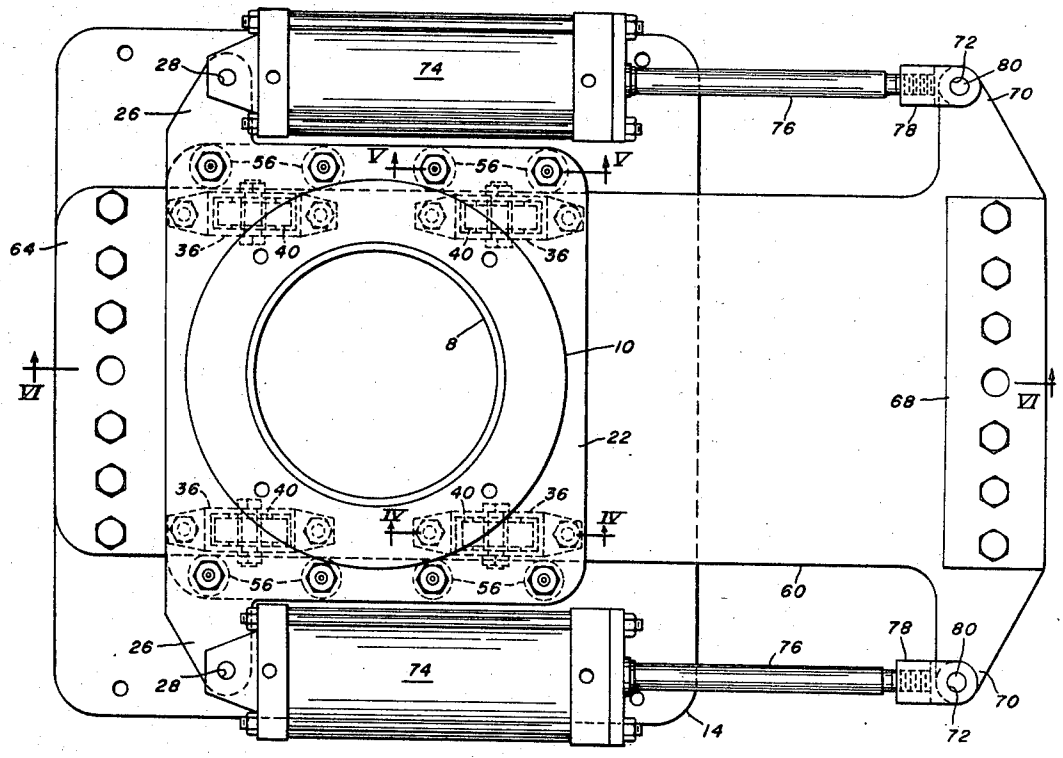


FIG. 1.

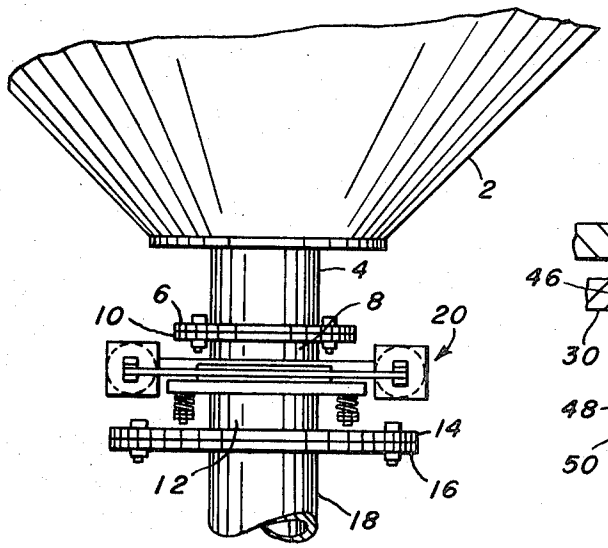


FIG. 4.

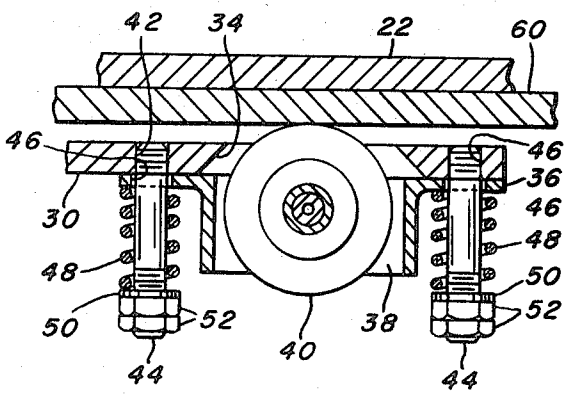


FIG. 5.

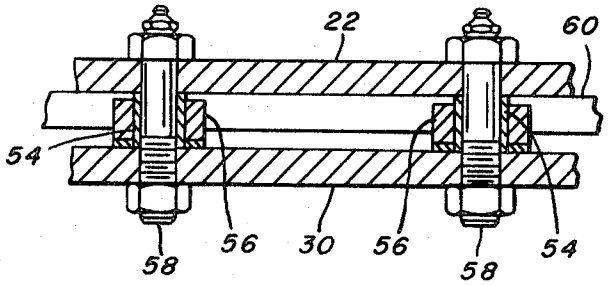
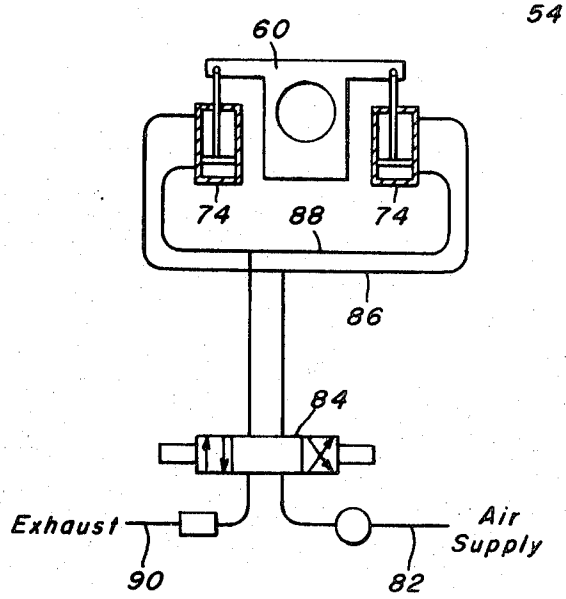
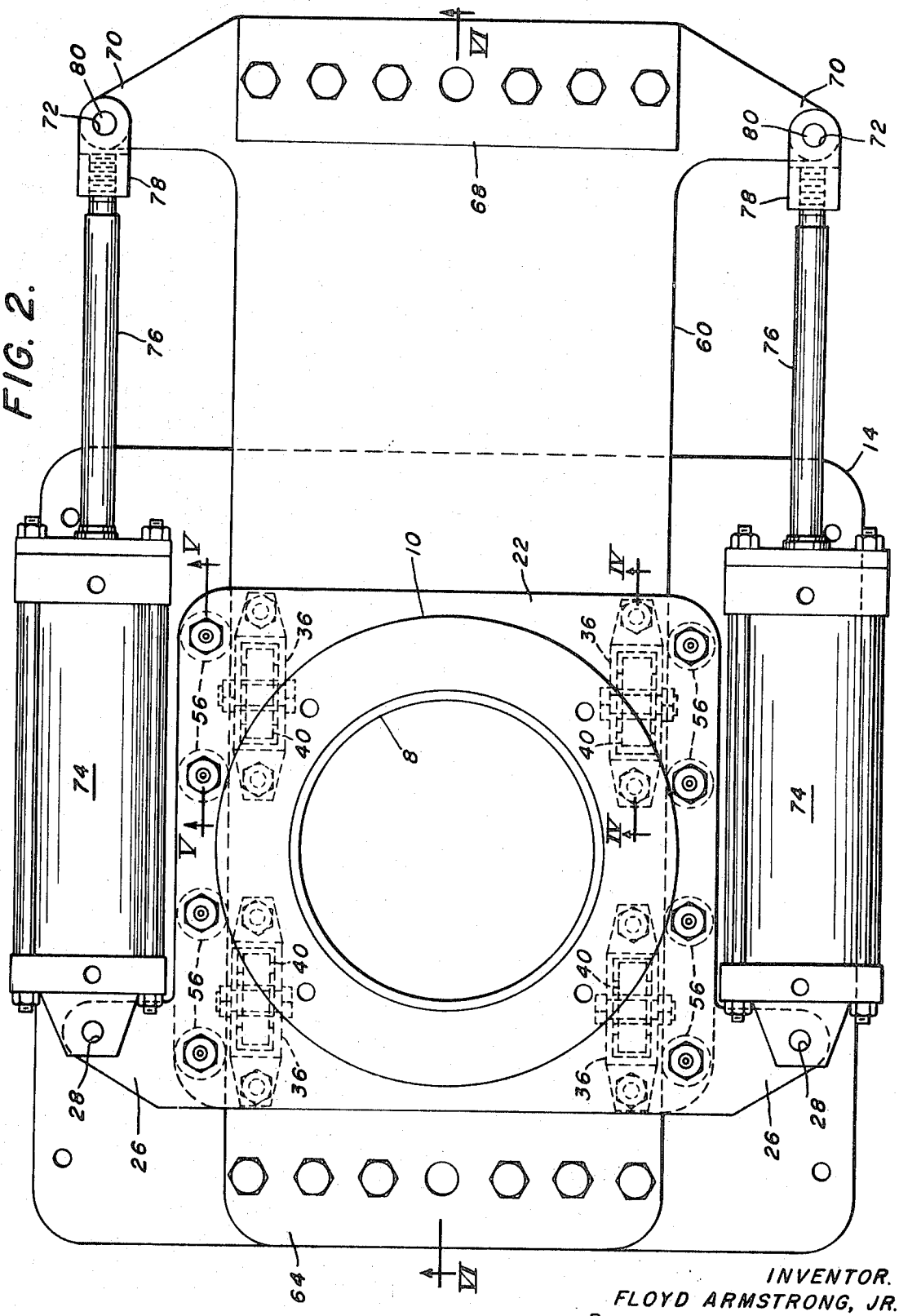


FIG. 7.



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FIG. 2.



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FIG. 3.

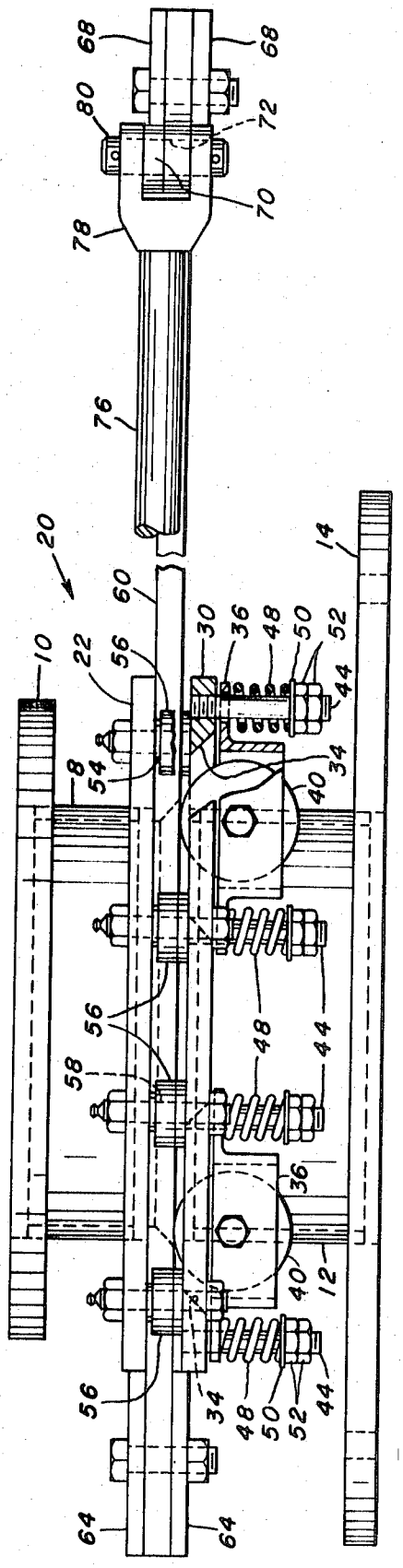
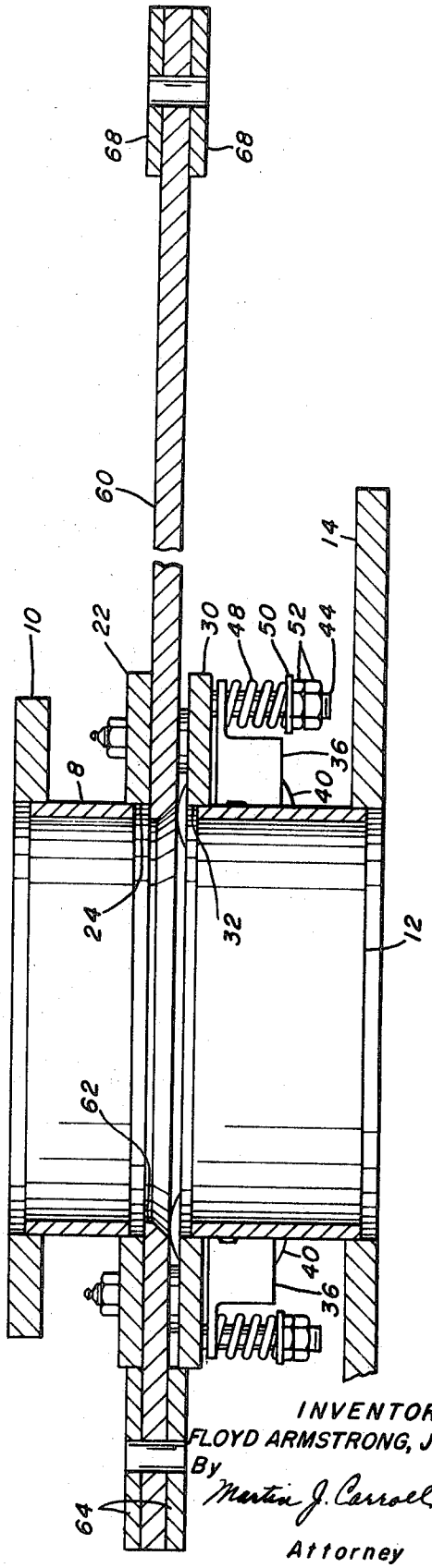


FIG. 6.



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DUST VALVE

This invention relates to a valve for controlling flow of solids and more particularly to controlling the flow of fines and small particles collected in the hoppers of dust catching equipment which separates the dust from hot exhaust gases from a blast furnace. These valves are opened and closed periodically to permit outflow of the hot dust and other granular material from the collector hopper to the conduit leading to dust disposal means. Prior to my invention the valves of which I have knowledge were standard gate valves having a horizontal slidable closure plate mounted between closure plates. These valves were either manually or motor operated. The material handled tended to adhere to the valve seats and closure plates causing sticking of the plate. When manually operated valves were used the operator then had to loosen the valve plate by hammer blows against the valve lever arm before the valve could be actuated. This same difficulty was present in the motor operated valve. In addition, material accumulated within the housing, particularly along the edges of the slide ways which build-up further tended to freeze movement of the slide plate. Maintenance cost was high and sealing of the slide plate against the valve seat was poor.

It is therefore an object of my invention to provide a valve for controlling flow of solid material which decreases the build-up of material on the valve parts and facilitates movement of the valve plate.

Another object is to provide such a valve which is easier to operate and which requires relatively little maintenance.

These and other objects will be more apparent after referring to the following specification and attached drawings, in which:

FIG. 1 is an elevation showing the valve of my invention inserted in a conduit or pipe between the dust catcher hopper and disposal system;

FIG. 2 is a plan view of the valve;

FIG. 3 is a side elevation of the valve with the air cylinder removed;

FIG. 4 is a view taken on the line IV—IV of FIG. 2;

FIG. 5 is a view taken on the line V—V of FIG. 2;

FIG. 6 is a view taken on the line VI—VI of FIG. 2; and

FIG. 7 is a schematic view of the pneumatic system used to operate the valve.

Referring more particularly to FIG. 1 of the drawings, reference numeral 2 indicates a dust hopper having a conduit or pipe 4 at its lower end with a flange 6 at the free end of the pipe 4. A short section of pipe 8 has a flange 10 at its upper end which is secured to flange 6 in the usual manner. Spaced from and in axial alignment with pipe 8 is a second short section of pipe 12 having a flange 14 at its lower end which is secured to a flange 16 attached to pipe 18 forming part of the dust disposal system.

Valve 20 of my invention is positioned between the pipes 8 and 12. The valve 20 includes a top housing plate 22 welded to the bottom of pipe 8. The housing plate 22 has a hole 24 therein so as to closely receive the pipe 8. For example, if the pipe 8 is a 12 inch standard pipe the opening 24 will be 12¾ inches in diameter. As best shown in FIG. 2, the plate 22 has a lug extension 26 at each side of one end of plate 22 with a vertical hole 28 therethrough for a purpose which will appear later. A bottom housing plate 30 is welded to the top of pipe 12 in spaced relationship with plate 22. Plate 30 has a hole 32 therethrough of the same size as hole 24 for receiving the end of pipe 12. Plate 30 has a rectangular opening 34 at each corner, the ends of which taper downwardly and outwardly as best shown in FIG. 4. It will be seen that the openings 34 on one side of the plate are arranged in alignment with one another and parallel to the openings 34 on the opposite side of the plate. Attached to the underside of plate 30 are four roller brackets 36 having an opening 38 therethrough. Each of the brackets 36 has its opening 38 in alignment with one of the openings 34. A roller 40 is rotatably mounted in each bracket 36 and extends upwardly through the associated openings 34 above the top of plate 30. Threaded holes 42 are provided in plate 30, one a short distance from each end of each opening 34. Studs 44 pass upwardly through holes 46 in brackets 36 and are threaded into the openings 42. A spring 48 surrounds each stud 44 with its top end bearing against the associated bracket 36 and its lower end bearing against a washer 50 held in position by means of nuts 52.

As best shown in FIG. 5 the plates 22 and 30 are held in spaced apart relationship by means of bushings 54, each of which rotatably supports a roller 56. A bolt 58 passes through aligned holes in plates 22 and 30 and bushing 54. Four such bushings 54 and rollers 56 are provided along each of two parallel sides of the plates 22 and 30 with the rollers on each side being in alignment. A slide plate 60 is received between plates 22 and 30 with its bottom resting on rollers 40 and its longitudinal sides received between rollers 56. A hole 62 of substantially the same size as the inside diameter of pipes 8 and 12 is provided in the slide plate 60 intermediate its ends. The hole 62 tapers downwardly and outwardly so that the bottom is slightly greater in diameter than the inside diameter of pipe 8. A stop 64 is secured to the top and bottom sides of plate 60 at one end. Similar stops 68 are provided at the other end. Lug extensions 70, similar to lug extensions 26 are provided on the same end of plate 60 as stops 68. Vertical holes 72 are provided in lugs 70. The holes 28 and 72 are equally spaced from the longitudinal center of the plate 60. An air cylinder 74 is pivotally secured at one end in each of the holes 28. A piston rod 76 associated with each cylinder 74 has a clevis 78 at its free end which is connected to the associated lug 70 by means of a pin 80 passing through hole 72. As shown in FIG. 7, flow of air to cylinders 74 is provided from air supply 82 through a rotor type four-way three-position valve 84. Conduits 86 are connected to the forward ends of cylinders 74 and conduit 88 to the rear end thereof. An exhaust pipe 90 connected to the valve 84 discharges air from cylinders 74.

To open the valve 20, the valve 84 is positioned so that air supply conduit 82 is connected to conduit 86 and the exhaust 90 is connected to conduit 88. This supplies air to the left or forward end of cylinders 84 to move the slide plate 60 to the open position shown with stops 64 abutting the left ends of plates 22 and 30. When it is desired to close the valve 20, the operator positions the valve 84 to supply air through conduit 88 to the right or rear end of cylinders 74 so as to move the piston rod 76 to the left. This movement continues until stop plate 68 engages the right ends of plates 22 and 30. During this movement the side rollers 56 rotate freely in contact with the longitudinal edges of slide plate 60. The rollers 40 which are biased by the springs 48 against the bottom of plate 60 also freely rotate and maintain the slide plate 60 in tight sealing pressure against the top plate 22. Because of the taper of opening 62 a shearing action results across the bottom face of top plate 22 during opening and closing movement of slide plate 60. Due to this shearing action the mating valve surfaces are generally free from contamination of dust particles. Because of the smooth rolling action, consistent good performance, and effective sealing results which in turn greatly decreases maintenance.

While one embodiment of my invention has been shown and described, it will be apparent that other adaptions and modifications may be made without departing from the scope of the following claims.

I claim

1. A valve for controlling flow of solid materials through a conduit comprising a valve housing having two parallel surfaces with a fixed space therebetween, a slide plate mounted for longitudinal slidable movement in said space, said slide plate having a hole therein movable into and out of alignment with the opening in said conduit, a plurality of rolls mounted on said housing on the exit side of said space with their axes in a plane normal to the axis of said hole and a portion thereof extending into said space, means individually biasing said rolls toward the inlet side of said valve, and means for moving said slide plate in contact with said rolls into and out of alignment with the opening in said conduit.

2. A valve according to claim 1 including a plurality of rollers mounted in said housing with their axes substantially parallel to the axis of the hole in said side plate, said rollers being arranged in two lines one along each longitudinal edge of said slide plate so as to guide the slide plate in its movement.

3. A valve according to claim 1 in which said housing includes a first plate at the inlet side of said valve, a second plate at the exit side of said valve spaced from said first plate, the adjacent sides of said plates forming the said two parallel surfaces, and means holding said plates in assembled relationship.

4. A valve according to claim 3 in which said means biasing said rolls toward the inlet side of said valve includes a bracket for rotatably supporting each roll, each bracket having a hole therethrough on each end thereof, a threaded opening in said second plate in alignment with each hole in said bracket, a threaded member passing through each bracket hole into the associated plate hole, a spring surrounding each threaded member with one end bearing against the associated bracket, and means on each threaded member for supporting the other end of said spring.

5. A valve according to claim 3 including a plurality of rollers mounted in said housing with their axes substantially parallel to the axis of the hole in said side plate, said rollers being arranged in two lines one along each longitudinal edge of said slide plate so as to guide the slide plate in its movement.

6. A valve according to claim 5 in which said means holding said plates in assembled relationship includes a plurality of axially aligned holes in said first and second plates, a bushing for supporting each roller extending between the adjacent surfaces of said plates in alignment with each set of axially aligned holes, and a threaded member extending through each set of aligned holes and bushing.

7. A valve according to claim 6 in which said means biasing said rolls toward the inlet side of said valve includes a bracket for rotatably supporting each roll, each bracket having a hole therethrough on each end thereof, a threaded opening in said second plate in alignment with each hole in said bracket, a threaded member passing through each bracket hole into the associated plate hole, a spring surrounding each threaded member with one end bearing against the associated bracket, and means on each threaded member for supporting the other end of said spring.

8. A valve according to claim 7 in which the opening in said slide plate tapers outwardly away from the entry end thereof.

9. A valve according to claim 8 in which said means for moving said slide plate includes a pair of fluid cylinders one mounted on each longitudinal side of said housing, a piston rod for each cylinder, means connecting each cylinder to said housing, means connecting the free end of a piston rod to said side plate, and an abutment on each end of said slide plate adapted to contact the opposite ends of said first and second plates to limit movement of said slide plate.

10. A valve according to claim 1 in which the opening in said slide plate tapers outwardly away from the entry end thereof.

11. A valve according to claim 3 in which said means for moving said slide plate includes a pair of fluid cylinders one mounted on each longitudinal side of said housing, a piston rod for each cylinder, means connecting each cylinder to said housing, means connecting the free end of a piston rod to said slide plate, and an abutment on each end of said slide plate adapted to contact the opposite ends of said first and second plates to limit movement of said slide plate.

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