April 21, 1931. R. W. FOX ET AL 1,802,205

VALVE

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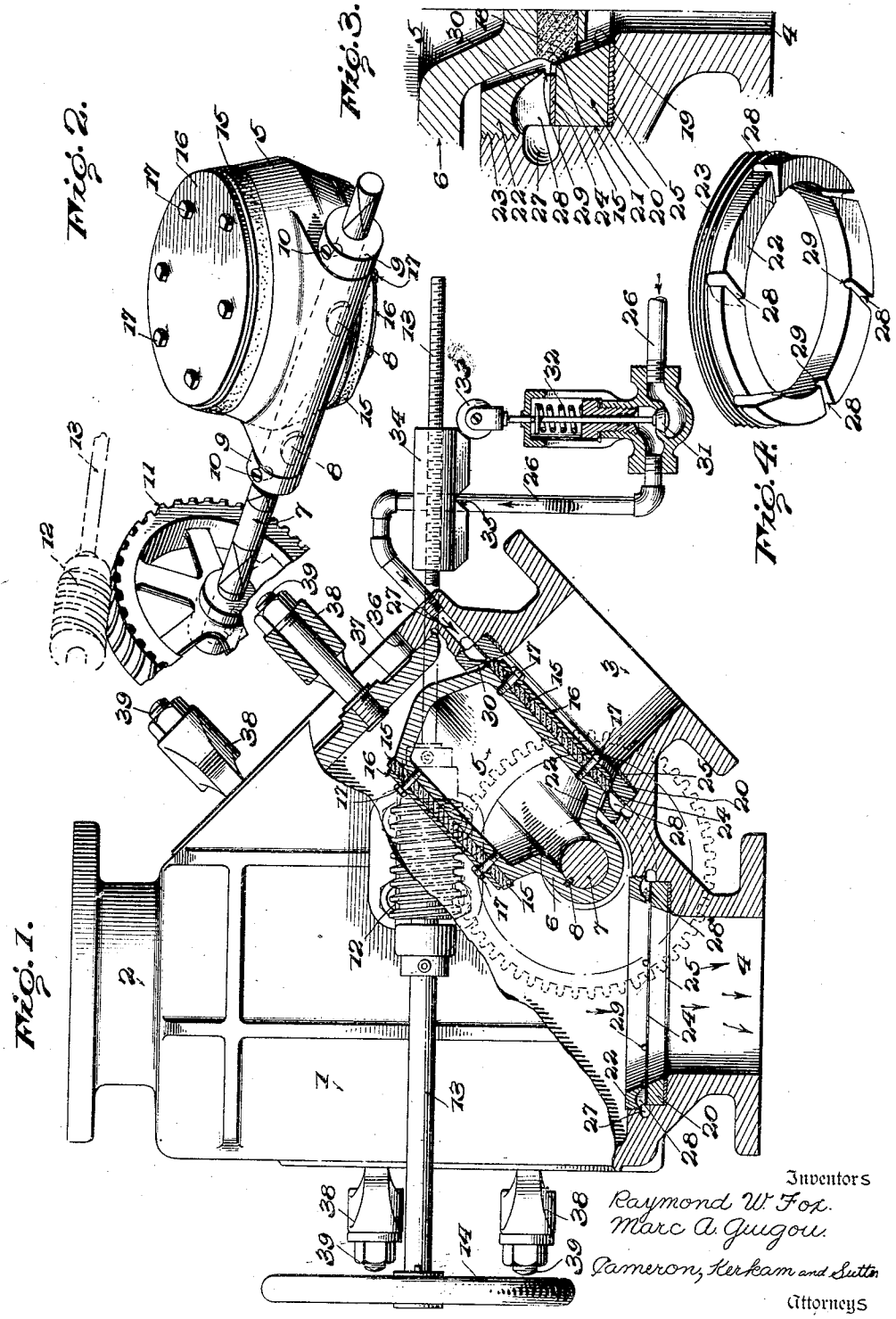


Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

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Fig. 6.

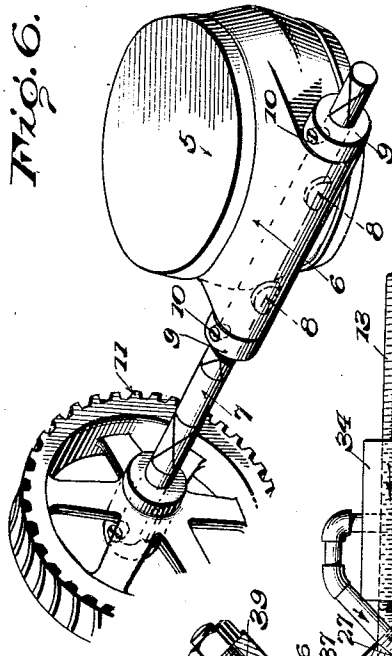


Fig. 7.

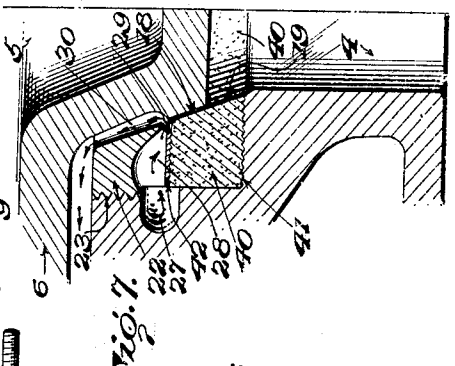


Fig. 5.

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Fig. 9.

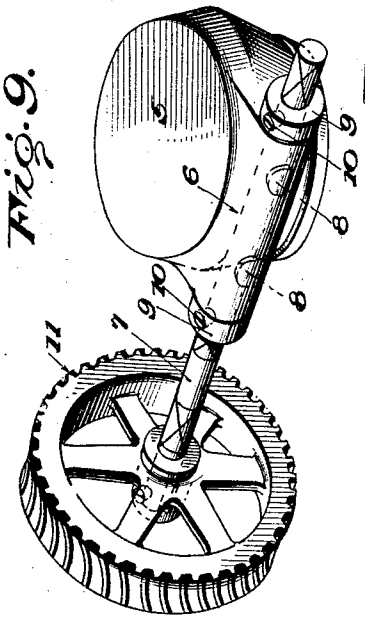


Fig. 10.

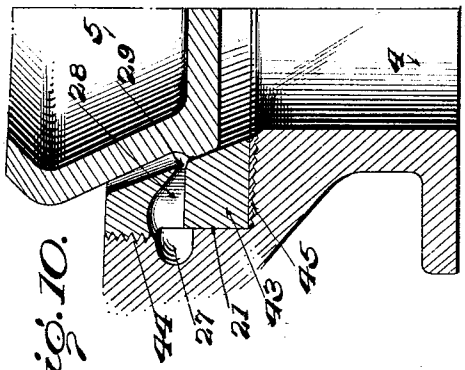


Fig. 11.

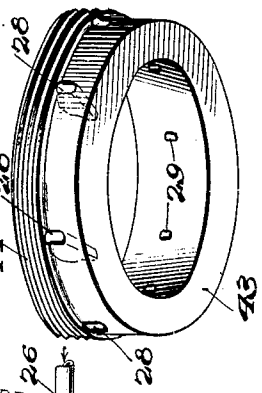
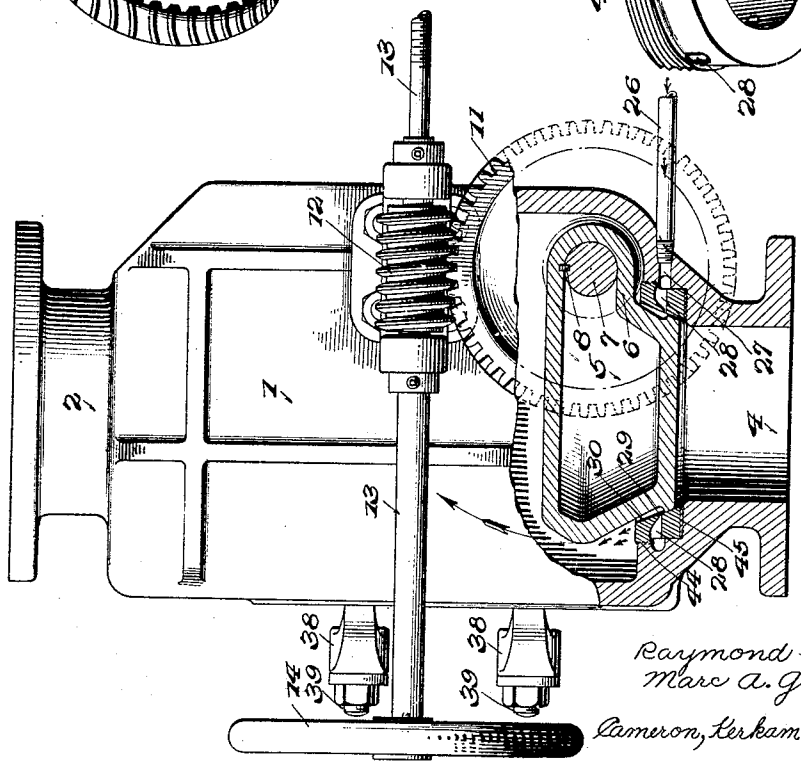


Fig. 8.



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UNITED STATES PATENT OFFICE

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VALVE

Application filed May 22, 1928. Serial No. 279,739.

This invention relates to valves, and more particularly to cut-off or switching and distributing valves in lines for the transportation of finely divided materials carried by air or other fluid.

Great difficulty has heretofore been experienced in providing suitable valves for such purposes. For example, the common practice in plants where pulverized or finely divided coal is stored ready for firing, as in a bin and feeder system or in a unit system with a stand-by storage, is to transport the pulverized coal to the storage bin through a transport line by using a suitable fluid as a carrying medium. In such systems the transport lines are fitted with cut-off valves to stop the flow when the storage bin is full, or with switching and distributing valves to direct the coal into other bins when one bin has become full. Due to the deposit of the comminuted coal around the valve seat and on the moving parts of the valve, it has been found that valves heretofore used in such systems do not seat properly and leakage results. If the storage bin overflows, the pulverized coal will sift down through the surrounding air and produce explosive mixtures, and as such storage bins are of necessity located near or over the place of firing, a very dangerous explosion may result. At best the distribution of the material is faulty and unreliable; leaks of this kind cause losses in the pressure and velocity of the transporting air stream; and the resultant waste, lack of economy and efficiency, and unreliability are very objectionable.

One of the objects of the present invention is to provide a novel and improved valve capable of seating tightly under any and all conditions, thus obviating the above disadvantages.

Another object is to provide novel means, for installation with new valves or for application to existing valves, for effectively clearing off all deposits from the valve, valve seat, and all moving parts and thus to insure proper operation.

A further object is to provide means for producing a turbulent, swirling stream of a suitable fluid around the valve and valve seat.

A still further object is to provide means for controlling the flow of such a fluid in accordance with the movement of the valve itself.

A further object is to provide means of the character described which are efficient and reliable in operation, and are simple to construct and economical to manufacture.

With the above objects in view, the invention, broadly stated, consists in a novel form of valve for use in systems for distributing comminuted materials, including means for producing a fluid current or stream so directed and controlled as to effectively clear off all of the parts of the valve mechanism. Preferably the clearing fluid, such as air, is applied to the valve and valve seat so as to produce a turbulent swirl around and along the conveying conduit. To this end, the clearing fluid is admitted through ports which direct fluid streams substantially tangent to the valve seat and oblique thereto and to the direction of flow of the comminuted materials. If desired, means are likewise provided for controlling the supply of clearing fluid to these ports so that it is supplied only when the valve approaches or leaves its seat during its opening and closing movement. In the preferred form, the clearing fluid ports are formed in stationary parts forming the valve seat itself, and are so designed that the fluid stream clears not only the seat, but the cooperating valve face and all moving parts of the valve mechanism as well.

Several embodiments of the invention have been illustrated in the accompanying drawings, but it is to be expressly understood that the drawings are for purposes of illustration only and are not to be construed as a definition of the limits of the invention, reference being had to the appended claims for this purpose.

In the drawings,

Fig. 1 shows an elevation, partly in section, of a distributing valve constructed according to the invention;

Fig. 2 shows the moving parts of Fig. 1 in perspective;

Fig. 3 is a detail of the valve, valve seat and clearing fluid ports;

Fig. 4 is a detail of a valve seat holding ring;

Fig. 5 is an elevation, partly in section, of a different form of distributing valve embodying the invention;

Fig. 6 is a perspective view of the moving parts of Fig. 5;

Fig. 7 is a detail of the valve and valve seat;

Fig. 8 is an elevation, partly in section, of a stop valve embodying the invention;

Fig. 9 shows the moving parts of Fig. 8 in perspective;

Fig. 10 is a detail of the valve and valve seat; and

Fig. 11 is a detail showing the valve seat provided with ports for the clearing air.

Referring now to the drawings, wherein like reference characters indicate like parts throughout the several views, Fig. 1 shows a valve body 1 which may be suitably connected at 2 to a transport line conveying comminuted material, and is provided with a plurality of outlet openings 3, 4 for conducting said material to any one of a plurality of destinations. In the form shown, each of said outlet openings is provided with a suitable valve seat, and a valve 5 is rotatably mounted in the valve body so as to cooperate alternately with one of said valve seats. Preferably, said valve 5 is of the plug type, and is supported in the valve body by means of a bearing support or extension 6 through which passes a short shaft 7 which is keyed to the support 6 at 8. Collars 9 and set screws 10 may be employed to prevent movement of the plug longitudinally of the shaft 7. Shaft 7 is preferably supported at one end in the valve body 1, and at its other end passes through the valve body and is provided with any suitable means for rotating the same, which, as shown, comprise a worm wheel 11 fast on the shaft 7, and a worm 12 engaging the wheel 11 and mounted on a shaft 13 which may be rotated by a hand wheel 14 or other suitable means.

The valves should preferably be capable of an air-tight closure, and in practice it is therefore desirable to employ a metal to rubber or composition seating. Either the stationary or the moving valve part may be of metal and the other of composition or other suitable material. Preferably, however, and in the form shown in Fig. 1, the two opposite faces of the plug 5 are provided with rubber or composition disks 15, which may be secured in place by means of metal plates 16 and bolts 17 extending into the faces of the plugs. The outer peripheries 18 of the disks 15 are preferably inclined to conform to the inclined faces 19 of valve seat rings 20 with which they engage when the valve is in either closed position. The rings 20 may be secured in the valve body in any suitable way, and as shown each is seated in a recess 21 and is held in place by means of a holding ring 22 which is threaded at 23 in the valve body 1. Preferably, a gasket 24 is interposed between the holding ring 22 and the ring 20, and a gasket 25 is interposed between the ring 20 and the body 1, in each case.

The danger of the deposit of dust, etc., on the valve seat so as to interfere with the operation of the valve is obviated to a considerable extent by the provision of the inclined seat having a flush surface without ledges or pockets. But in order to positively prevent this happening, means are provided for directing a fluid stream on the valve parts, in such manner as to cause a turbulent swirl or eddy adjacent these parts. The clearing fluid for the valve parts may be supplied through a supply line 26, communicating with a suitable port or ports designed to control the flow of the clearing fluid to produce this result. Preferably these ports are formed in the stationary parts of the valve mechanism, and in this case the supply line 26, as shown in Fig. 1, delivers the fluid to annular channels 27 formed in the valve body 1 in the rear of the holding rings 22 and valve seat rings 20. Preferably the fluid is delivered to said channels tangentially so as to create a circulation around the same. The clearing fluid ports may be formed in the holding ring 22, or valve seat ring 20, or both. In the form shown, a plurality of radially disposed ports 28 are cut in the bottom of the holding ring 22, said ports having restricted inner end openings 29 through which the clearing fluid passes at relatively high velocity into the interior of the conduits 3 and 4. Preferably, the shape of such ports is such as to impart to the clearing fluid a component of motion in the direction of flow of the comminuted material through the conduits, and said ports are likewise inclined with respect to the radii of the holding ring, as shown in Fig. 4, in such a direction that the clearing fluid impinging on the sides of the ports tends to tighten the holding ring in its threads. A sort of helical swirl of the clearing fluid is created immediately adjacent the valve seat, and this swirl passes around and down the inclined face of the valve seat, as shown in Fig. 3, and also strikes against the face 18 of the disk 15 as the latter approaches closed position, thereby cleaning off the faces of the valve and valve seat and insuring a tight closure. When the valve reaches the closed position shown in Fig. 3, the air passes upwardly through the space 30 between the valve plug and the holding ring 22 and then around the support 6 and the ends of the shaft 7, thereby preventing the accumulation of the material at these points and the clogging of the valve operation.

The supply of clearing air through the line 26 may be controlled either manually at the

option of the operator, or automatically through the movement of the valve plug 5. To this latter end, a valve 31 of any suitable type is interposed in the line 26, and is normally held in closed position by means of a spring 32. The outer end of the valve stem carries a roller 33 which engages a cam member 34 threaded on the shaft 13, but prevented from rotating therewith by any suitable means, not shown. As soon as the hand wheel 14 is rotated to open the valve 5, the cam member 34 is therefore advanced longitudinally of the shaft 13, thereby depressing roller 33 and opening valve 31, and admitting clearing air through the pipe 26 to the ports 28. Preferably, the cam member 34 is provided with a notch 35 in its center, whereby the valve 5 may be left in an intermediate position with both outlets 3 and 4 open, and the clearing air be shut off. In all positions between the two closed positions of valve 5 and the intermediate position, however, the valve 31 is open and clearing air is admitted to the ports.

When the plug is in its intermediate position, it may readily be reached for purposes of repair or replacement of disks 15, etc., by the provision of openings 36 in the valve body, which openings are normally closed by the plates 37 held in place by clamps 38 and bolts 39.

Figs. 5 and 6 show a distributing valve provided with a somewhat different form of valve and valve seat. In these figures, the moving parts of the valve are all of metal, formed integrally with the plug 5. The valve seat ring 40 in this case is formed of rubber or composition, and is held in place by the holding ring 22 as in Fig. 1, being clamped between corrugations 41 in the casting and a corrugated metal ring 42. These corrugations grip the composition ring 40 and prevent any slipping or displacement of the same. The arrangement of the valve operating parts, the clearing fluid supply, and the ports for admitting the latter to the valve seat, is preferably the same as above described in connection with Fig. 1.

Figs. 7 to 9, inclusive, illustrate a stop or cut-off valve constructed according to the invention. In these figures, the valve body 1 is provided with but a single outlet, and the valve plug is single-faced to cooperate with the seat in said outlet. As shown, the operation of the valve mechanism is the same as that heretofore described in connection with Figs. 1 to 6, inclusive, except that the automatic control of the clearing fluid is omitted. In same cases, however, as shown in this form of the invention, it may be desirable to combine the valve seat ring and valve seat holding ring in a single member 43, having an upper threaded portion 44 for engagement with the valve body. The ring 43 is seated in a recess in the valve body as shown in Fig. 8, preferably on a suitable gasket 45, and the ports 28 for the admission of the clearing fluid are cut through the ring from the annular channel 27 to the valve seat, as shown in Figs. 10 and 11. The ring 43 is preferably of metal, and the cooperating face of the plug may be of metal, or may be provided with a suitable rubber or composition facing as heretofore described.

The valve and clearing mechanism above described is simple and economical in construction and operation, and insures a positive movement of the plug, a clean seat, and therefore a tight valve in any closed position. The rapidly swirling clearing fluid wipes off cleanly all the surfaces with which it comes in contact and causes the dislodged material to pass out the open side of the valve. In the case of the distributing valve shown in Fig. 1, the clearing fluid which is admitted to the valve seat in the closed outlet 3 passes up through the channel 30 and around the supporting shaft and trunnions of the valve plug, forcing any material deposited in these spaces out into the open side of the valve body and into the outlet 4. When the hand wheel 14 is rotated to reverse the valve, the plug may therefore rotate without danger of clogging, and as the face of the plug approaches the seat in the outlet 4, the swirling fluid in the latter clears the seat for the plug. The valve closure is therefore perfectly tight, and there is no leakage through the valve when once it has been closed.

While the invention has been described in connection with a system for conveying pulverized coal, it will be obvious that it is equally applicable to any transport system where any finely divided material, such as cement, gypsum, or dust, etc., is transported by air or other gas, or by water or other liquid. As a general rule, the clearing fluid to be employed will correspond with the fluid which acts as a carrying medium, whether gas, liquid, etc. It is not required, however, that the same medium be employed for both purposes. It will also be observed that the invention may be applied to existing valves in actual operation, with greatly improved results and efficiency and with comparatively little added cost.

While several embodiments of the invention have been illustrated in the accompanying drawings, it is to be expressly understood that the invention is not limited thereto, but is capable of a variety of mechanical expressions, many of which will now readily occur to those skilled in the art, and that changes may be made in the form, details and arrangement of the various parts without departing from the spirit of the invention. Reference is therefore to be had to the appended claims for a definition of the limits of the invention.

What is claimed is:

1. In apparatus of the class described, a

conduit, a valve seat therein, a valve cooperating with said seat, and means for directing a fluid stream obliquely to the direction of flow through said conduit and tangentially to said seat, whereby a fluid swirl is created adjacent the periphery of said valve seat.

2. In apparatus of the class described, the combination of a valve seat, a valve cooperating therewith, means for directing a stream of clearing fluid across said seat, and valve means controlled in accordance with the movement of said first named valve for controlling said fluid directing means.

3. In apparatus of the class described, the combination of a valve seat, a valve cooperating therewith, means for directing a stream of clearing fluid across said seat, a valve controlling said fluid stream, and valve operating means controlled in accordance with movements of said first named valve.

4. Apparatus of the class described comprising valve seat means and valve means cooperating therewith, one of said means being provided with a fluid channel directed obliquely and tangentially to said seat.

5. Apparatus of the class described comprising valve seat means, valve means cooperating therewith, one of said means being provided with a fluid channel directed toward said seat, and means controlled in accordance with movements of said valve for conducting fluid to said channel.

6. Apparatus of the class described comprising valve seat means and valve means cooperating therewith, said valve seat means having a fluid channel directed obliquely and tangentially to the valve seat.

7. Apparatus of the class described comprising valve seat means and valve means, said valve seat means having a fluid channel directed toward the valve seat, and means controlled in accordance with movement of said valve means for conducting fluid to said channel.

8. Apparatus of the class described comprising a valve body, a valve seat therein having a face inclined relative to the direction of flow therethrough, a valve having a face inclined to engage said seat, and means directing a stream of clearing fluid across the inclined face of said seat oblique to the direction of flow through the valve.

9. Apparatus of the class described comprising a valve body, a valve seat member therein, and a valve member cooperating with said seat, one of said member having a face of yielding material, and one of said members having a fluid port directing a stream of clearing fluid across the face of said seat and toward its outlet end.

10. Apparatus of the class described comprising a valve body, valve seat means therein, and valve means cooperating with said seat means, one of said means having a face of yielding material, said valve seat means having a fluid port directing a stream of clearing fluid across said seat and toward its outlet end.

11. Apparatus of the class described comprising a valve body, a valve seat therein, a valve, and a member of yielding material secured to said valve to engage said seat, said valve seat having a plurality of ports directing air streams across the cooperating faces of said seat and said member.

12. Apparatus of the class described comprising a valve body, a valve seat ring therein, a valve seat holding ring, and a valve having a face of yielding material to engage said seat ring, said valve face and seat ring having cooperating faces inclined relative to the direction of flow through the valve.

13. Apparatus of the class described comprising a valve body, a valve seat ring therein, a valve seat holding ring, a valve cooperating with said seat ring, said valve and ring having cooperating faces inclined relative to the direction of flow therethrough, said holding ring having a plurality of ports directing fluid streams tangentially against the inclined face of said seat ring, and means for conducting fluid to said ports.

14. Apparatus of the class described comprising a valve body, a recess therein, a valve seat ring in said recess, a valve seat holding ring clamping said seat ring in place, said valve body having a fluid passage adjacent said holding ring, said holding ring having a plurality of ports for directing fluid streams on the valve seat, and a valve cooperating with said seat ring.

15. In apparatus for directing the flow of comminuted material transported by a fluid carrying medium, a valve body having an admission opening and a pair of emission openings, a plug adapted to close either of said emission openings, means for moving said plug, and means automatically actuated by operation of said first named means for clearing off deposits from the plug and body.

16. In apparatus for directing the flow of comminuted material transported by a fluid carrying medium, a valve body having an admission opening and a pair of emission openings, a plug for closing either of said emission openings while permitting flow through the other emission opening, plug moving means, means for clearing off deposits from the plug and body, and means operated by said plug moving means for actuating said clearing means.

17. In apparatus of the class described, a valve seat, a valve cooperating therewith, means for directing a fluid stream across said valve seat, means for operating said valve, a second valve controlling the supply of fluid to said fluid directing means, and means operatively connecting said valve operating means and said second valve to actuate the

latter in conformity with the movement of said first valve.

18. In apparatus of the class described, a valve comprising a valve seat and a movable valve member cooperating therewith, means for directing a fluid stream across said valve seat, means for operating said valve member, a second valve controlling the supply of fluid to said directing means, and a cam actuated by said valve operating means and operatively connected with said second valve.

19. In apparatus for directing the flow of comminuted material transported by a fluid carrying medium, a valve body having an admission opening and a pair of emission openings, a plug adapted to close either of said emission openings, means for moving said plug, means for directing a fluid stream into said openings to clear off deposits from the plug and body, and means actuated by said plug moving means and controlling said fluid stream, said last named means being adapted to supply fluid to said directing means when said plug is out of closing position.

20. In an apparatus for directing the flow of comminuted material transported by a fluid carrying medium, a valve body having an admission opening and a pair of emission openings, a plug for closing either of said emission openings while permitting flow through the other emission opening, plug moving means, means for blowing off deposits from said plug and body, a valve for said blowing means, and a cam actuated by said plug moving means and controlling said last named valve, said cam being shaped so that said valve is closed when said plug is in closing position and is open when said plug occupies a position intermediate its closing positions.

In testimony whereof we have signed this specificaiton.

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