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SLIDE VALVE FOR REGULATING THE FLOW OF SOLIDS

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FIG. 1.

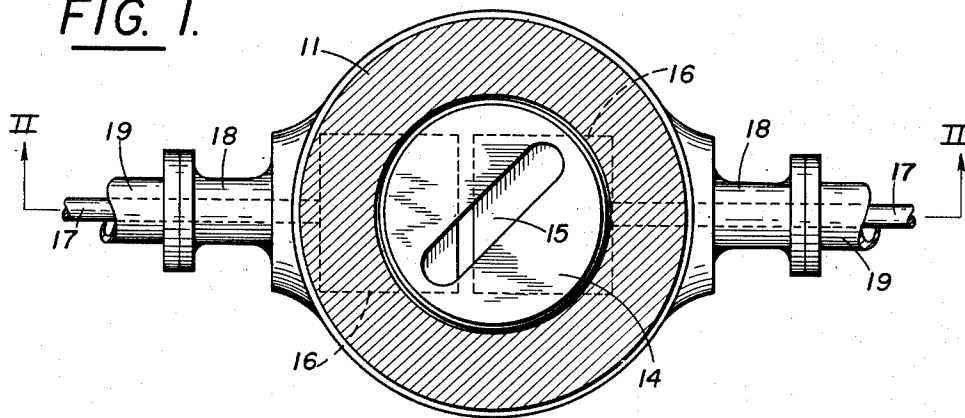


FIG. 2.

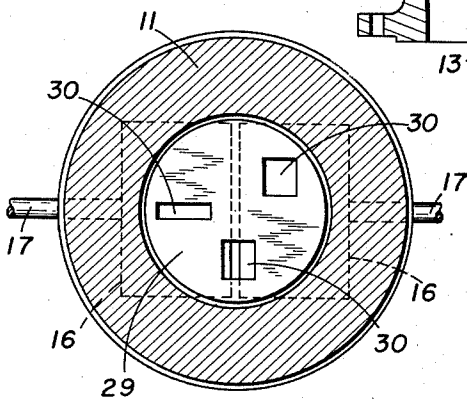
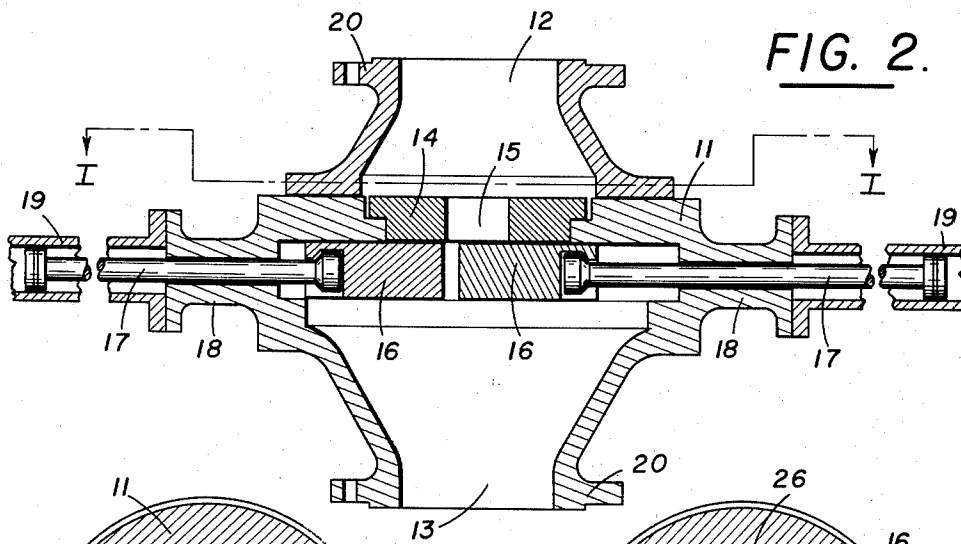
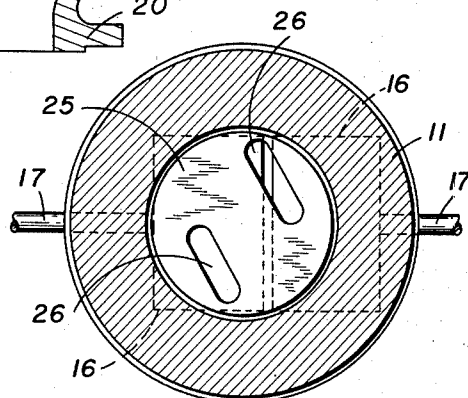


FIG. 4.

FIG. 3.



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1 Claim. (Cl. 251—51)

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The present invention is directed to an improved slide valve for controlling the flow of finely divided solids. In its more particular aspects, the invention is directed to apparatus for controlling the flow of a suspension of finely divided solids in a fluidized condition.

In the petroleum industry, and particularly in catalytic cracking of hydrocarbons when employing the "fluidized solids technique," it is necessary to move large quantities of finely divided catalyst of a particle size from 0 to 200 microns. In moving the finely divided powdered catalyst, it is usually agitated with air or other vaporous medium and suspended therein so that it behaves much like a fluid.

It has been customary in the past to use slide valves in which a slide may move past an orifice and thus regulate the flow of solids moving there-through. The impingement of the particles on the metallic surfaces of the orifice and on the slide restricting the orifice has been such to cause the orifice and the slide to be eroded away to the extent that within a short period of operating time the slide and the orifice itself become deteriorated to the extent that the valve is inoperable and control of flow is lost.

The problem is not restricted to catalytic cracking but may be encountered in operations in which suspensions of finely divided solids are caused to flow past a restricted area.

The slide valves presently used on fluid catalytic units to control the flow of catalyst into and out of the various vessels and lines consist of a renewable slide which operates against a single seat. The flow of catalyst through the valve is regulated by the position of the slide in relation to an opening in the seat. The slide is moved through its travel limits by a hydraulic cylinder located on the bonnet of the valve. When a new valve is installed in a line and the hydraulic cylinder adjusted to set the slide to provide an area of flow through the valve of a given number of square inches, it will allow a certain number of pounds of catalyst to pass through the valve in a given unit of time. However, as the slide and the seat become worn due to the constant impingement of solid particles against them the open area becomes greater in number of square inches than originally and the amount of catalyst which passes through this larger area per unit of time accordingly becomes greater than that originally contemplated. To regulate the flow of catalyst through the valve at substantially the original rate, it is customary to advance the original slide by means of the hydraulic cylinder to

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reduce the area of flow to approximately the original area. However, this is impractical because the single slide and the orifice which are exposed to the impingement of abrasive particles become worn to the extent that the valve is merely an obstruction of flow in the line with no control at all.

It is the main object of the present invention to provide an improved valve which is resistant to ravages of erosion by virtue of its construction and operation.

Another object is to provide a valve which allows positive control of flow of finely divided solids.

A still further object is to provide a valve with a plurality of adjustable orifices exposing a minimum area of metal to erosion.

The present invention provides an improved slide valve which includes a valve body defining an inlet and an outlet. Located intermediate the inlet and the outlet is an orifice plate defining at least one orifice through which the finely divided solid passes from the inlet to the outlet of the valve body. Arranged in juxtaposition to the orifice plate and sliding thereunder are two slides which are designed to move in relation to each other to define with the orifice in the orifice plate a plurality of adjustable orifices. The slides are connected to stems, which protrude through the valve body into bonnets, and are attached to hydraulic cylinders located on the outside of the bonnets for control of the slide.

The invention will be further illustrated by reference to the drawing in which:

Fig. 1 is a view looking down on a valve in accordance with the present invention embodying two slides;

Fig. 2 is a cross-sectional view of the device of the present invention taken along lines II—II of Fig. 1;

Fig. 3 is a similar view to Fig. 1 with parts omitted showing a different arrangement of the diagonal slot of Fig. 1; and

Fig. 4 is a similar view to that of Figs. 1 and 3 showing a further arrangement of the orifice plate of Figs. 1 and 3.

In the several figures of the drawing identical numerals will be employed to designate identical parts.

Referring now to the drawing, numeral 11 defines a valve body including an inlet 12 and an outlet 13. Arranged intermediate the inlet and outlet is a valve seat 14 defining an orifice 15. In juxtaposition to seat 14 and slidable thereunder are two slides 16 to which are attached

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stems 17 which protrude through valve body 11 into bonnets 18 and which are connected to hydraulic cylinders 19 for introduction of hydraulic fluid thereto. Valve body 11 may be attached to suitable conduits, not shown, by bolting flanges 20 thereto thus allowing a fluidized suspension of solids passing through such conduits to be controlled by the valve of the present invention.

The embodiment of Fig. 3 is similar to that of Figs. 1 and 2 with the difference that orifice plate 14 has been replaced with a modified orifice plate 25 in which are located diagonal slots 26 which are arranged so that the same portion of slides 16 will not be exposed to contact with particles flowing through the slots 26.

The embodiment of Fig. 4 is different from that of Figs. 1 to 3 to the extent that orifice plate 29 defines slots 30 which are in staggered relationship to each other and may be of different sizes to define different areas of flow. It will be seen from Figs. 1, 2, 3 and 4 that the same portions of slides 16 are not employed to control the flow through the several orifices.

In employing the device of the present invention as illustrated by the several embodiments of the drawing, the two slides 16 may be operated to move in unison to define an area of flow, with the orifices in the orifice plates 14, 25 and 29, to give the desired rate of flow through the orifices in the several respective orifice plates mentioned. As the two slides 16 and the orifice plates become worn only in the area where catalyst has flowed therethrough, the slides are then moved across the slots together maintaining a predetermined distance between the slides to give the desired area of flow so that new, unworn metal of both the slides and the orifice plates is exposed to the erosive action of the catalyst.

It is important in the practice of the present invention that the two slides move together across a given orifice so that the only part of the slide exposed is that part defining the adjustable orifice and the only part of the orifice plate that is exposed to the erosive action of the solid particles is that part which is not covered by the slide. In short, by providing a valve in accordance with the present invention with two slides moving in relationship to each other it is possible to reduce the amount of erosion, to control the flow of finely divided particles and maintain the desired rate of flow at all times. A valve in accordance with the present invention may allow a slide valve to have double the life of the conventional slide valve of the prior art.

Although the orifice and the orifice plates have been shown to be roughly rectangular in shape, it is possible to have these orifices of any size or shape provided they are located in the orifice plate so that different portions of the slides are exposed to the flow of solids through the particular orifice. In short, the orifices in the orifice plates may be rectangular, circular, triangular or any desired shape as long as the foregoing provision is met.

While the present invention has shown the slide stems being actuated hydraulically, other power means may be substituted therefor. The valve stems may be operated by electric motors, air motors and the like. It is preferred, however, to use a hydraulic cylinder.

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From the foregoing description and the description taken with the drawing, it is apparent that the present invention provides an improved valve in which, during the operation of the valve, a plurality of new orifices or apertures thereof, through which the catalyst passes, are presented continuously and, by moving the slides in relationship to each other across a single orifice or a plurality of orifices, it is possible to expose fresh, uneroded surfaces to allow control of flow of solids. From a single or a plurality of orifices in an orifice plate of a slide valve of the present invention, it is possible to define with the two slides a plurality of other orifices for control of catalyst flow.

While the apparatus of the present invention has been described with respect to the two slides moving in unison, it will be apparent that the same desirable effects may be obtained by moving one slide to a first position and then controlling flow by moving the other slide in relation to the slide in its first position. Thereafter, the slide in the first position may be moved to additional positions to expose fresh surfaces of the slide and to allow full control of the operation.

The nature and objects of the present invention having been completely described and illustrated, what I wish to claim as new and useful and to secure by Letters Patent is:

A slide valve adapted for controlling the flow of fluidized solids which comprises, in combination, a valve body having a central passage connected by an inlet and an outlet, a pair of slides mounted on the valve body arranged to move in a plane perpendicular to the axis of the central passage and the valve with the adjacent edges of the pair of slides the leading edges and parallel to each other, an orifice plate mounted in the valve body between the inlet and outlet and in juxtaposition with said slides and parallel thereto, the flow opening of the orifice plate having at least two parallel boundaries which make an acute angle with the parallel leading edges of said pair of slides whereby the maintenance of a fixed distance between said leading edges while moving them along their plane of movement from one position to another sequentially changes the portion of said leading edges and the portion of the boundary of said opening in the orifice plate which form the flow opening through the central passage of the valve.

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