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Iguchi et al.

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[54] **PLUNGER PUMP CYLINDER FOR USE IN TREATING HIGHLY CORROSIVE FLUID**

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[30] **Foreign Application Priority Data**

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Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 796,454, Feb. 4, 1969, abandoned.

[52] **U.S. Cl.**.....**417/454,** 417/571

[51] **Int. Cl.**.....**F04b 21/02,** F04b 39/10

[58] **Field of Search**.....417/454, 558, 569–571

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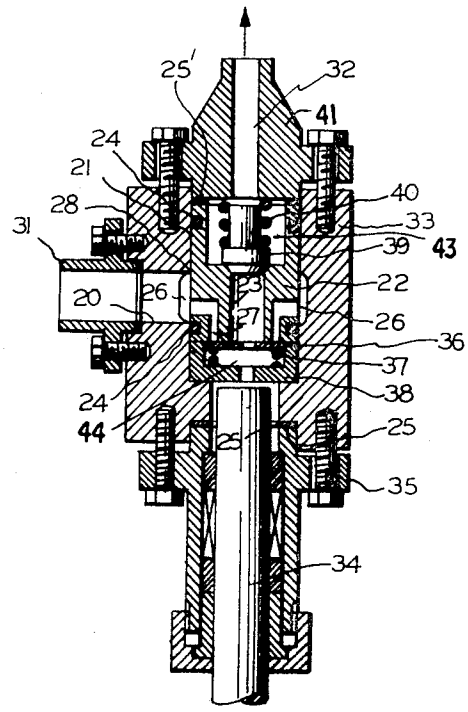
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[57] **ABSTRACT**

A plunger pump cylinder for use in treating highly corrosive fluid. The pump is composed of two parts, a cylinder body and a valve seat body. The valve seat body has a central longitudinal bore formed therein, and it is fitted within a bore formed in the cylinder body. At the respective ends of the bore in the valve seat body are an inlet valve and a delivery valve.

1 Claim, 2 Drawing Figures



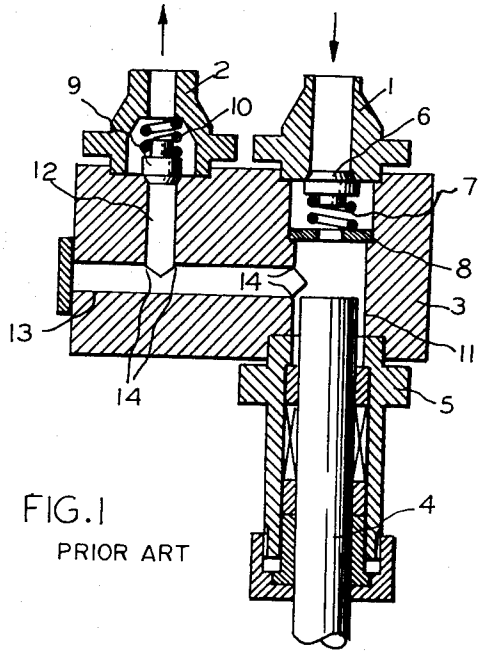


FIG. 1
PRIOR ART

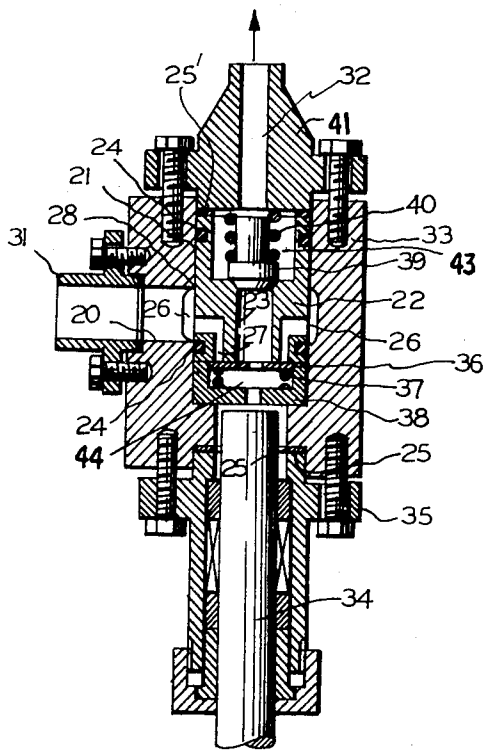


FIG. 2

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PLUNGER PUMP CYLINDER FOR USE IN TREATING HIGHLY CORROSIVE FLUID

This is a continuation-in-part application of Ser. No. 796,454 filed Feb. 4, 1969 now abandoned.

BACKGROUND OF THE INVENTION

This invention relates to a plunger pump cylinder, and more particularly to a plunger pump cylinder which is used for handling highly corrosive fluid.

With the progress of the chemical industries and the development of new processes, the conditions under which pumps used in these industries must operate have become more and more severe.

The corrosiveness, pressure and temperature of fluids being handled have become more severe. This is especially true for plunger pumps which handle such fluids. These pumps are subject to a repetitive load due to suction and delivery pressures, and, accordingly, when they handle a highly corrosive fluid, cracks often occur in the cylinder within a relatively short period of time due to corrosive fatigue caused by the concentration of stress therein. Such cracks grow, and the pump eventually becomes unusable. This is a defect inherent in conventional plunger pumps used for highly corrosive fluids.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide an improved pump for handling highly corrosive fluids which does not have these deficiencies.

In order to prevent a plunger pump cylinder for handling corrosive fluid from developing cracks due to corrosive fatigue, the present invention provides a new cylinder construction in which the intersecting portions of various bores in the cylinder are, when in use, subject only to suction pressure and are not subject to delivery pressure.

According to the present invention, this is achieved by a construction of the cylinder in which the cylinder body having a suction port in one of its sides has a separate valve seat body having a central longitudinal bore fitted within a central longitudinal bore formed in the cylinder body. Said bore in the valve seat body is placed in fluid communication with the suction port through an annular groove formed in the central longitudinal bore of the cylinder body and fluid passages formed in the valve seat body. By this means the inlet valve and the delivery valve are arranged on a line so that they lie at opposite ends of the longitudinal bore of the valve seat body.

Thus, in the pump cylinder according to the present invention, only a low load due to suction pressure is applied to the portions formed by the intersection of bores in the cylinder, so that no fatigue due to a repetitive load is caused at these portions.

Therefore, according to the present invention, even when the plunger pump handles highly corrosive fluid, the cylinder is prevented from developing cracks due to corrosive fatigue, and hence the life of the pump cylinder can be greatly increased.

Other object and advantages of this invention will become apparent from the following description taken with the accompanying drawings, wherein are set forth, by way of illustration and example, a conventional plunger pump cylinder and an embodiment of this invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a longitudinal sectional view of a conventional plunger pump cylinder; and

FIG. 2 is a longitudinal sectional view of an embodiment of the pump of the present invention.

In a conventional plunger pump, as shown in FIG. 1, a suction port 1 and a delivery port 2 are arranged side by side on one side of a cylinder 3, and on the other side is provided a plunger 4 slidable in a stuffing box 5. In suction port 1 there is a suction valve 6 which is urged against its seat by a coil spring 7 disposed on a spring support 8. In delivery port 2 there is a delivery valve 9 which is urged against its seat by a coil spring 10. In the inside of cylinder 3, there are longitudinal bores 11 and 12 and a transverse bore 13 for placing suction valve 6 in communication with delivery valve 9. It will be seen that, in the portions of the inner surfaces of cylinder 3 contacted by fluid, as shown in FIG. 1, there are sharp edge portions 14 at the intersections between longitudinal bores 11 and 12 and transverse bore 13, which, when the inner surface of cylinder 3 is subject to a repetitive load due to the alternating suction pressure and delivery pressure, is subjected to a repeated concentrated stress. In a corrosive atmosphere, the fatigue limit of the material of the cylinder is reduced, and the more severe the corrosive conditions, the greater the reduction of the fatigue limit of the material.

Therefore, in the plunger pump cylinder as shown in FIG. 1, cracks start from the edges formed at the bore intersecting portions 14 within a relatively short period of time due to corrosive fatigue coupled with the concentration of stress there. This tendency is greater the greater the corrosiveness of the fluid, and the higher the pressure. This can make even an expensive plunger pump unusable.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Now, referring to FIG. 2 which shows one embodiment of the present invention, on one side of cylinder body 33 there is secured by any suitable means, such as bolts, a suction port 31, and on the longitudinal axis of the cylinder body 33 at a right angle to the axis of the suction port 31 there are arranged a delivery port 32 provided in an outlet flange 41 and plunger 34 in opposed relation to each other. Suction port 31, delivery port 32 and plunger 34 are placed in communication with each other by a transverse hole 20 and a cylindrical bore 21 formed in the cylinder body 33.

Fitted within the cylindrical bore 21 of the cylinder body 33 is a valve seat body 22 which has a generally cylindrical form and a central round longitudinal bore 23. The diameter of bore 23 is enlarged at the upper portion of the valve seat so as to form a cylindrical delivery chamber 43 in which delivery valve 39 is pressed against the valve seat formed at the upper end of central round longitudinal bore 23 by coil spring 40 which is disposed between valve 39 and the bottom of the outlet flange 41. The valve seat body 22 rests on suction valve support member 38, which is positioned within cylinder body 33 on the bottom of cylindrical bore 21 with a clearance between the peripheral surface of body 33 and bore 21. Valve seat body 22 is sealed in cylinder body 33 by a pair of O-rings 24, one

near each end of valve seat body **22**. The valve seat body **22** is held in place by outlet flange **41** and stuffing box **35**, which are aligned with cylinder body **33** and secured thereto by any suitable means such as bolts and sealed by packings **25** and **25'**.

A suction chamber is formed between the bottom of valve seat body **22** and suction valve support member **38** and is in fluid communication with suction port **31** through transverse hole **20**, an annular groove **26** in the wall of cylindrical bore **21** into while hole **20** which and several fluid passages **27** which extend through valve seat body **22** from annular groove **26** to the suction chamber **44**. The exit ends of fluid passages **27** at the suction chamber are normally closed by suction valve **36**, which is urged against the suction valve seat formed at the underside of valve seat body **22** by coil spring **37** disposed between valve **36** and member **38**.

Thus, according to the present invention, suction valve **36** and delivery valve **39** are positioned in cylinder **33** in such a way that during a suction stroke, the fluid is fed from inlet port **31** to longitudinal bore **23** of valve seat body **22** through transverse hole **20**, annular groove **26** and fluid passages **27**, while during a delivery stroke it is fed from longitudinal bore **23** to delivery port **32** through delivery valve **39**.

It will be appreciated that in the present invention the plunger pump cylinder is so constructed that at the portion **28** where the transverse hole **20** intersects the annular groove **26** in cylinder body **33** only suction pressure is exerted, and this point is not affected by delivery pressure. Therefore, the cylinder body **33** of the plunger pump is subjected to only a definite low load due to the suction pressure at said intersecting portion **28** within cylinder body **33**, and fatigue owing to the repeated load is not created at the intersection portion **28**.

While there has been described and illustrated herein a preferred embodiment of the invention, it will be understood that modifications may be made without departing from the spirit of the invention. For example, the valve seat body can be divided into two or more parts, or the stuffing box can be made integral with the cylinder body.

What is claimed is:

1. A plunger pump adapted for pumping corrosive fluids comprising a cylinder body having a cylindrical bore with a first section of uniform diameter and a second section of a smaller diameter than said uniform diameter, said cylinder body further having an inlet port perpendicular to said first section; a valve seat body mounted within said first section of said cylindrical bore and having a longitudinal bore therethrough; a delivery flange attached to said cylinder body; a first packing disposed between said delivery flange and said valve seat body; a delivery valve urged against a seat on said valve seat body, a stuffing box attached to said cylinder body; a second packing disposed between said stuffing box and said cylinder body; a plunger positioned within said stuffing box and adapted to move into said second section of said cylindrical bore; a suction valve support member mounted within said first section of said cylindrical bore of said cylinder body; a suction valve above said suction valve support member; means to urge said suction valve toward said valve seat body; said suction valve having an opening therethrough less than the diameter of said longitudinal bore of said valve seat body; at least one fluid passage through said valve seat body from said suction valve support member to said inlet port; and an annular groove around the inner periphery of said cylinder body and communicating between said inlet port and one end of said at least one fluid passage; said valve seat body and said suction valve support member being dimensioned to slidingly fit within said first section of said cylindrical bore.

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