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## [54] PISTON OPERATED SLIDE VALVE 6 Claims, 6 Drawing Figs.

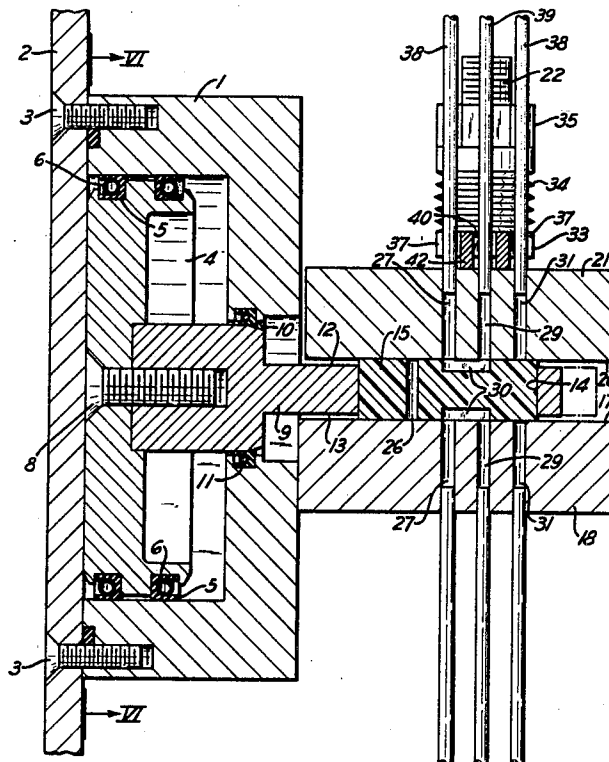
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251/62, 251/174  
[51] Int. Cl. .... F16k 11/06,  
F16k 25/00  
[50] Field of Search ..... 137/625.48,  
625.68, 625.38; 251/174, 329, 62; 277/163, 205,  
156, 157

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**ABSTRACT:** A piston has a stem projecting outwardly from a cylinder. The outer end of the stem is provided with a longitudinal slot extending through it, in which a valve slide fits and projects from the opposite sides of the stem. The exposed sides of the slide are flat and parallel. Secured to the cylinder is a stationary block that has a flat surface engaging one side of the slide. A floating block also has a flat surface engaging the other side of the slide. Mounted in the stationary block is a pair of studs that straddle the stem beside the slide and also extend through openings in the floating block. The blocks are provided with passages that register with a passage through the slide when the latter is in one of its positions. A pressure bar is slidably mounted on the studs and has a projection between them engaging the floating block in the central longitudinal plane of the slide. Springs are mounted on the studs and press the bar projection against the floating block.



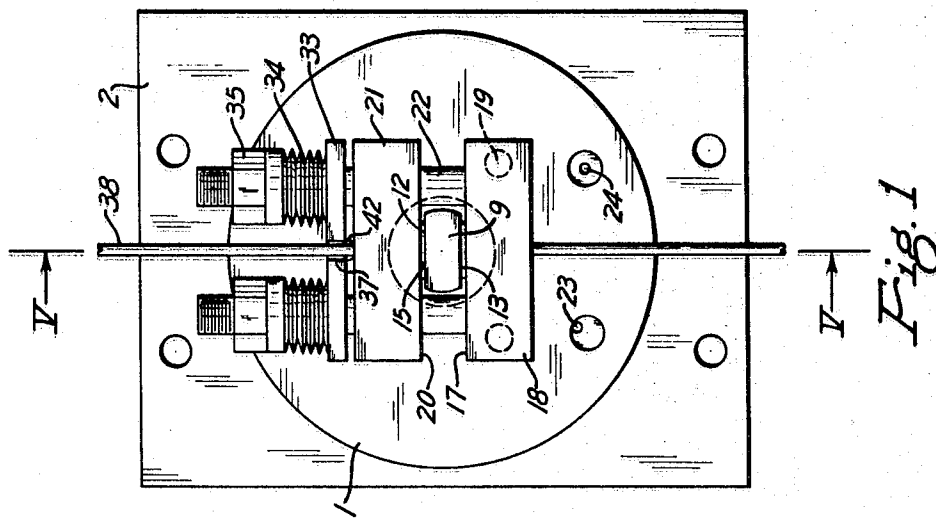


Fig. 1

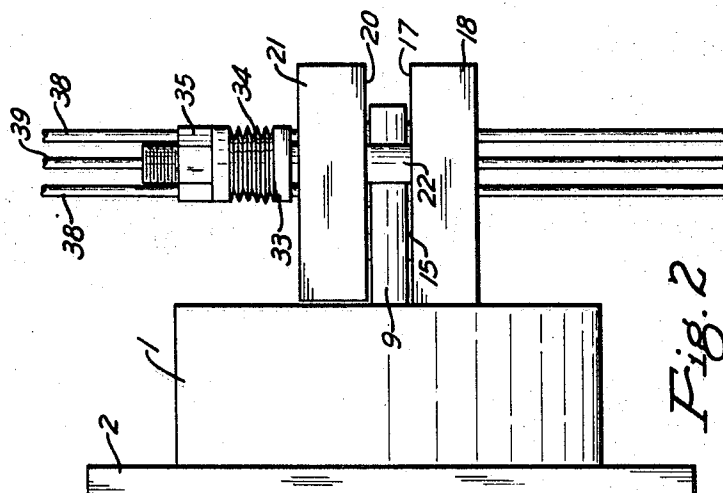


Fig. 2

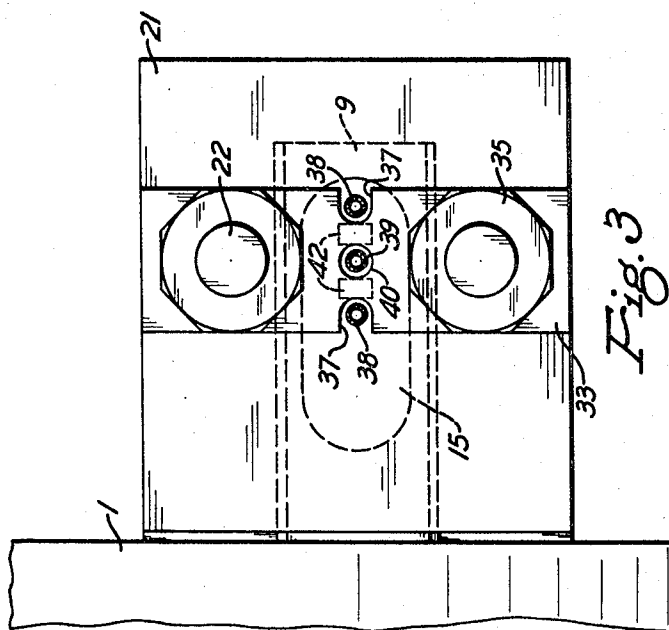


Fig. 3

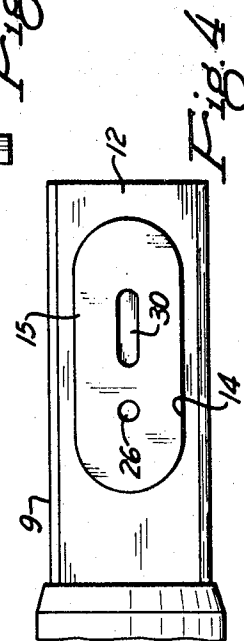


Fig. 4

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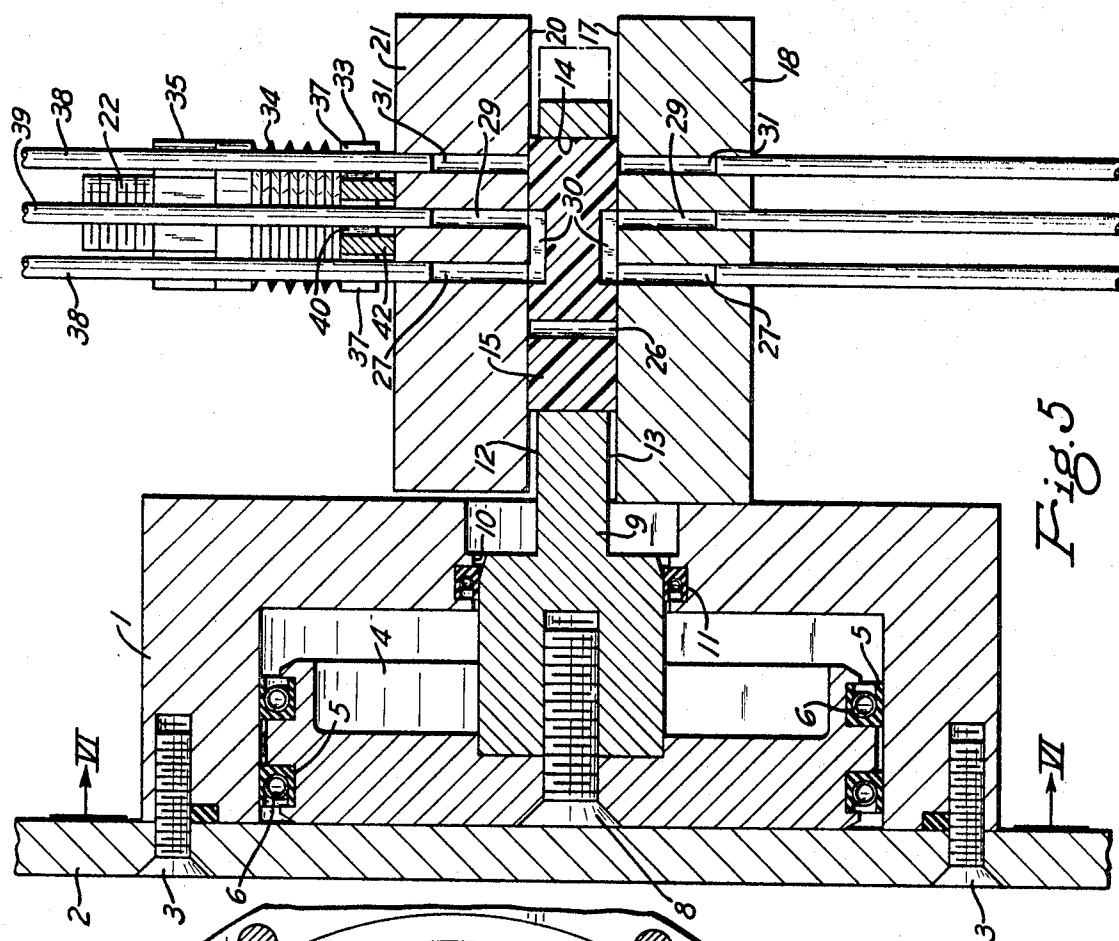


Fig. 5

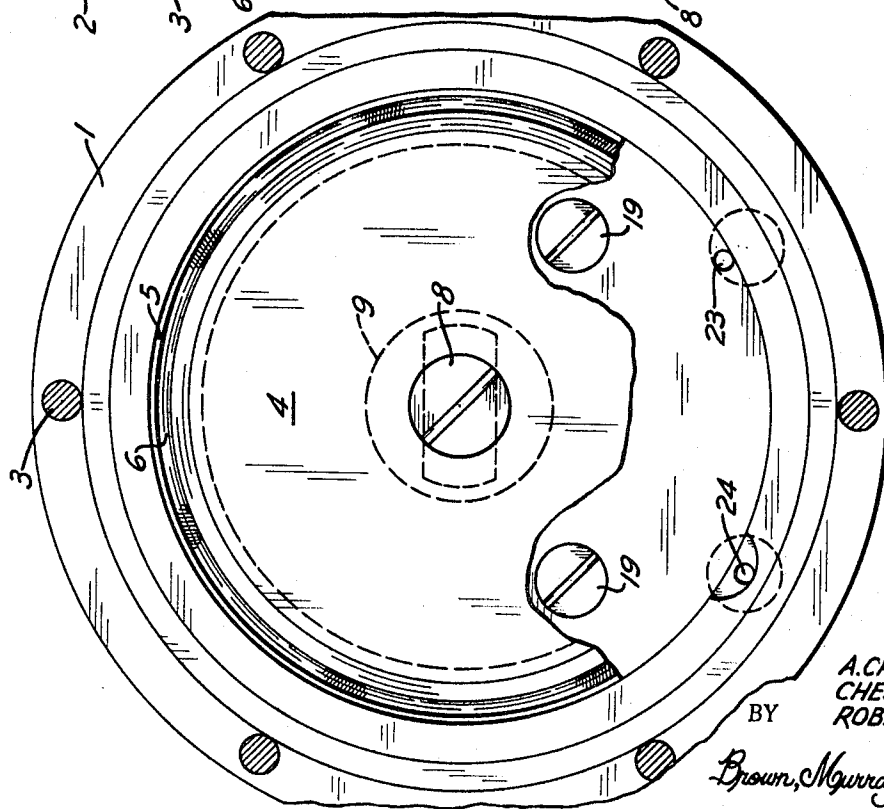


Fig. 6

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### PISTON OPERATED SLIDE VALVE

It is among the objects of this invention to provide a piston operated slide valve of simple construction, in which the slide is sealed against leakage in a simple manner.

The preferred embodiment of the invention is illustrated in the accompanying drawings in which:

FIG. 1 is an end view of the valve;

FIG. 2 is a sideview;

FIG. 3 is an enlarged fragmentary plan view;

FIG. 4 is plan view of the valve slide mounted in the piston stem;

FIG. 5 is an enlarged longitudinal section taken on the line V-V of FIG. 1; and

FIG. 6 is a cross section, partly broken away, taken on the line VI-VI of FIG. 5.

Referring to the drawings, a fluid pressure cylinder has a body 1 with an integral end wall and with a removable end wall formed by a mounting plate 2 attached to the open end of the body by means of screws 3. Inside the cylinder there is a piston 4 (FIG. 5) which is spaced slightly from the surrounding wall of the chamber by a pair of sealing rings mounted in axially spaced annular grooves in the piston. Each of these rings is formed from a flexible plastic channel 5 opening laterally toward the adjacent end of the piston. An endless coil spring 6 fits in each of the channels and holds its sidewalls firmly against the piston and cylinder. These sealing rings not only seal the piston, but also prevent it from engaging and wearing against the surrounding cylinder wall.

Secured to the center of one side of the piston by a screw 8 is a stem 9 that extends out through a central opening 10 in the integral end wall of the cylinder. The slight clearance between the stem and the wall of the opening is sealed by a ring 11 having the same construction as those just described. The portion of the stem in the cylinder is round, but it has an extension that extends away from the cylinder which is reduced in thickness to provide it with two more or less flat surfaces 12 and 13 equal distances from the stem axis. This part of the stem also is provided with a longitudinal slot 14 that extends through it and contains a valve slide 15 that projects slightly from the flat sides of the stem.

The slide is made of a slippery plastic, such as Teflon, and its exposed sides are flat and parallel. One of these sides engages the flat surface 17 of a stationary block 18 that is secured to the adjoining end wall of the cylinder by means of a pair of screws 19. The other flat side of the slide is engaged by the flat inner surface 20 of a floating block 21 that is held in place by a pair of studs 22. The studs are rigidly mounted in the stationary block at opposite sides of the piston stem, beside the slide as shown in FIGS. 1 and 3. These studs extend, with a slight clearance, through openings in the floating block, which can slide on them and engage flat against the slide when the slide is flat against the stationary block. The slide has two positions, an inner position and an outer position, which are determined by movement of the piston from one end of the cylinder to the other. The studs are located about midway between the two positions of the slide. To move the piston, fluid under pressure is delivered to the cylinder either through a passage 23 communicating with the space between the piston and the integral end wall of the cylinder, or through a passage 24 that leads into the other end of the cylinder.

The slide is provided with a passage through it connecting its flat sides as shown in FIG. 5. When the slide is in its inner position as shown in FIG. 5 the ends of this passage are closed by the two blocks, but when the slide is in its outer position the passage registers with the inner ends of a pair of aligned passages 27 extending through the blocks. All of these passages are in the central longitudinal plane of the slide and piston stem and therefore are located midway between the opposite sides of the two blocks.

Each block may also be provided with a passage 29 located not only in the plane just mentioned but also in a plane perpendicular to it and containing the axes of the two studs. When the slide is in its inner position, the inner ends of the two passages 27 and 29 in each block are put in communication

with each other by a groove 30 in the adjoining side of the slide as shown in FIG. 5. When the slide is moved to its outer position these grooves connect the inner ends of passages 29 with a third pair of passages 31 through the blocks, all the passages in each block being equally spaced.

In order to press the floating block against the slide and to press the slide against the stationary block, a stiff pressure bar 33 is slidably mounted on the portions of the studs projecting from the floating block as shown best in FIGS. 1 and 3. This bar is pressed against the floating block by means of springs 34 mounted on the studs and compressed thereon by nuts 35 threaded on the outer ends of the studs. For best results, Belleville springs are preferred. Since the width of the pressure bar generally is a little greater than the distance between the inner and outer passages 27 and 31 of the floating block, the sides of the bar are provided with openings, such as notches 37, through which loosely extend tubes 38 connected to the outer ends of the passages. A tube 39 connected to the outer end of the central passage 30 in the floating block extends loosely through a central opening 40 in the pressure bar. The tubes therefore do not interfere with movement of the bar.

It is highly desirable that the two blocks press flat against the adjoining flat sides of the slide in order to form good seals so that leakage will not occur between the slide and the blocks. Accordingly, most of the pressure bar is spaced from the floating block, but midway between its ends it is provided with projections 42 between the tube-receiving openings therein. These projections engage the outer surface of the floating block and are convex when viewed from the side of the bar so that they will have a substantially line contact with the block in the central longitudinal plane of the slide. As a result, even if the springs do not exert equal pressure against the opposite ends of the bar, all of the spring pressure will be applied to the floating block only along a line in the central longitudinal plane of the slide and therefore the block will always be pressed flat against the slide. There is slight clearance between the slide and the surrounding stem, i.e. there is a loose fit between them, so that the stem cannot interfere with the slide engaging flat against the stationary block. Consequently, the slide always fits flat against the stationary block, and the floating block is always pressed flat against the slide. This insures good seals at opposite sides of the slide.

If the pressure bar did not have its projections 42 but engaged flat against the floating block, it would apply pressure unequally across the slide if the spring pressure on the two slides were not uniform. If four studs and two pressure bars were used, the likelihood of unequal pressure on the slide would be increased further. The single bar with the central projections disclosed herein assures uniform pressure of the blocks throughout the areas of the flat sides of the slide.

I claim:

1. A piston-operated slide valve comprising a cylinder having an end wall provided with a central opening therein, a piston disposed in the cylinder, a piston stem secured to the piston and slidably mounted in said opening, said stem extending outwardly away from said end wall and provided outside of the cylinder with a longitudinal slot extending through the stem, a valve slide fitting in said slot and projecting from the opposite sides of the stem, the exposed sides of the slide being flat and parallel, the piston being movable back and forth in said cylinder to move said slide between two fixed positions, a stationary block secured to said end wall and having a flat surface engaging one of said flat sides of the slide, a floating block having a flat surface engaging the other flat side of the slide, a single pair of studs mounted in the stationary block and straddling said stem beside the slide, the floating block being provided with openings therethrough slidably receiving said studs, the slide having a passage therethrough connecting its flat sides, said blocks having aligned passages therethrough registering with said slide passage when the slide is in one of said fixed positions, a pressure bar slidably mounted on the portions of said studs projecting from the floating block and, having a projection between the studs engaging the floating block

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in the central longitudinal plane of the slide, springs mounted on the studs in engagement with the outer surface of said bar, and nuts screwed on the studs and compressing the springs to press said bar projection against the floating block.

2. A slide valve according to claim 1, including a tube connected to the outer end of the passage in the floating block, and said pressure bar being provided with an opening for said tube.

3. A slide valve according to claim 1, in which each of said blocks is provided with a plurality of passages in said longitudinal plane, and tubes are connected to the outer ends of all of the passages in the floating block, said pressure bar being provided with a plurality of openings through which said tubes extend.

4. A slide valve according to claim 3, in which there are three of said tubes and said openings in the pressure bar are at opposite sides thereof and at its center, there being two of said bar projections with one of them located between each side opening and the center opening.

5. A slide valve according to claim 1, in which said springs are Belleville springs.

6. A slide valve according to claim 1, including axially spaced sealing rings encircling said piston and spacing it from the surrounding wall of said cylinder, each of said rings consisting of a laterally opening flexible plastic channel, and an endless coil spring fitting in the channel.

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