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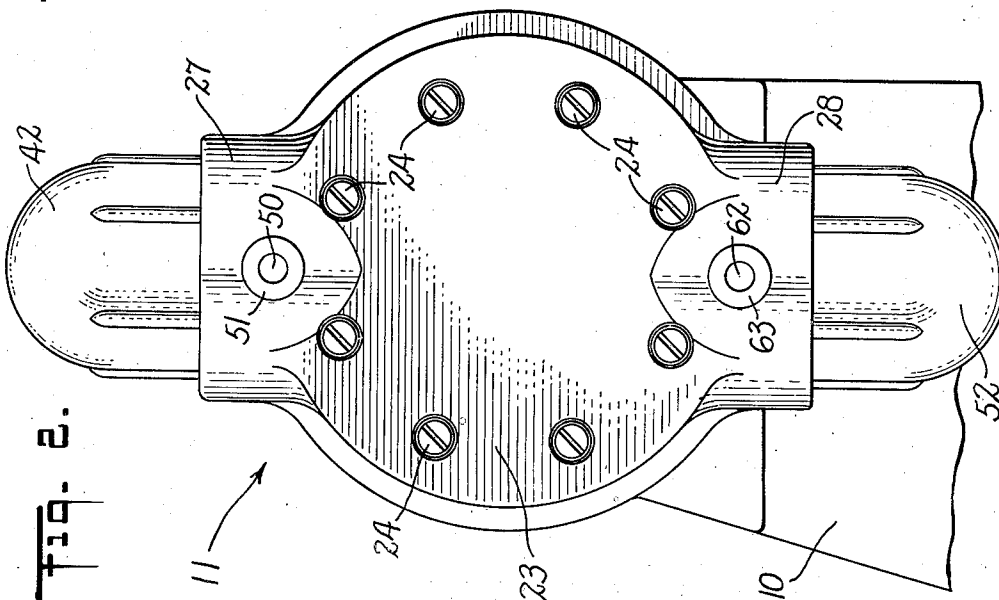
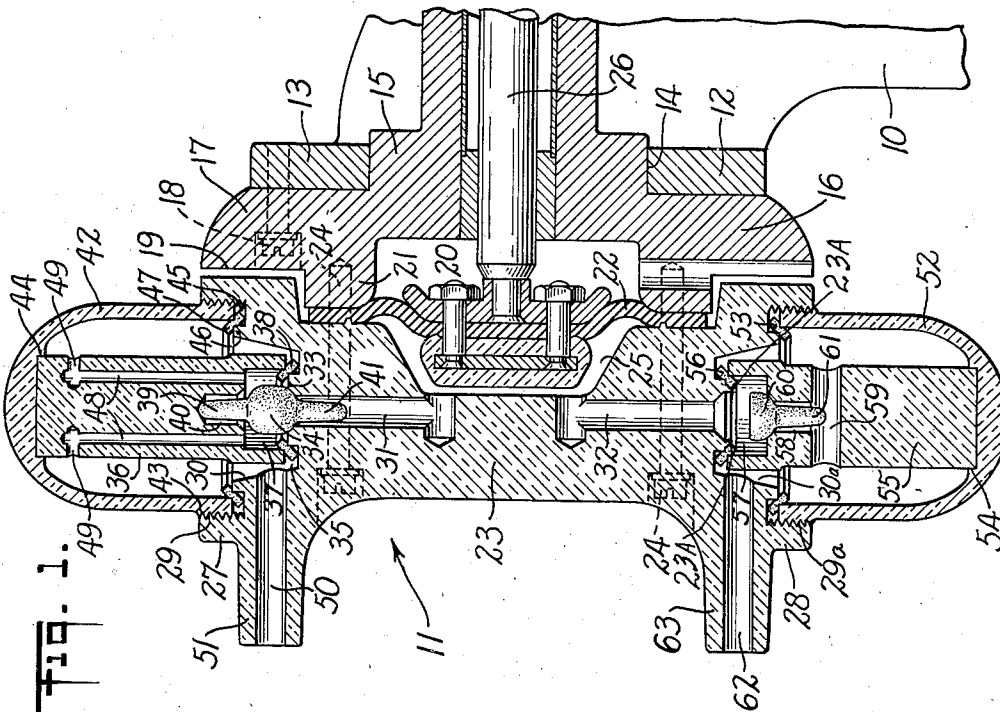
J. CORYDON ET AL

2,295,774

PUMP VALVE

Filed Feb. 26, 1941

2 Sheets-Sheet 1



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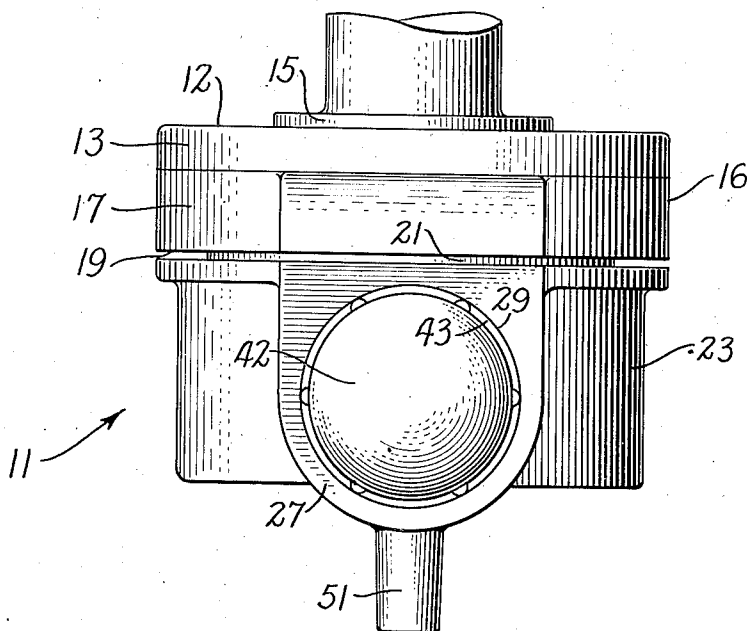
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Fig. 3.



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PUMP VALVE

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7 Claims. (Cl. 251-144)

Our invention relates generally to valves for pumping devices adapted for the handling of corrosive fluids and more particularly to pumping devices of the character fully disclosed in United States Patent No. 2,145,566, dated January 31, 1939, to which reference may be had for a complete disclosure of mechanical features not forming part of this invention.

As is well understood in the art, the pumping of corrosive reagents, such as hypochlorite, caustic, ammonia and the various commercially employed acids and salts have necessitated the use of extremely expensive alloys in the several parts of the reagent head, or feeder, of the pump. Not only is the use of these alloys objectionable from the view point of the expense involved, but they additionally present extreme difficulties in all machining operations.

Furthermore, although the use of the non-corrosive material such as rubber, for example, was resorted to in the beforementioned Patent No. 2,145,566, with a view to overcoming the problem of corrosion, it will nonetheless be obvious that this material is characterized by physical limitations which preclude recourse to conventional methods of attachment of one part to another. Thus, although rubber resists corrosion, the advantages realized by its use are in large measure offset by the necessity of resorting to non-conventional structural and assembly procedure.

It is accordingly one object of the present invention to provide a new and improved apparatus of the character described, the respective parts of which shall be formed of a non-corrosive material characterized by structural properties permitting the use of conventional metal work forms of attachment and connection.

A more specific object of the invention resides in the provision of apparatus of the character described, the parts of which can be molded from a non-corrosive transparent plastic material, such, for example, as the commercial product known as "Lucite."

It is yet a further object of the invention to provide chemical feeding apparatus of the character described, including a valve cage and a sight feed dome, the valve cage and dome being formed of a transparent plastic material to permit visual inspection of the action of the valve, the displacement pump, and movement of the chemical under operating conditions.

Yet another object of the invention consists in providing a new and improved method of and means for effecting a fluid tight connection be-

tween removable elements of a device of the character described and more particularly between a valve cage and its seat.

Still a further object of the invention is the provision of a valve and a sight feeder construction for a chemical feeder of the character described which provides visual proof of the performance of the feeder, as well as sight feed of the chemical itself, and which said construction is readily accessible for purposes of cleaning and repair.

Other objects and advantages will become apparent from the following description taken in connection with the accompanying drawings, in which:

Figure 1 is a side elevation, partly in section, or a preferred embodiment of the invention.

Figure 2 is an end elevation of the device shown in Figure 1.

Figure 3 is a top view of the device shown in Figures 1 and 2.

In the form of the invention chosen for illustration herein, the machine frame is fragmentarily indicated at 10. It will be understood that the frame 10 may take the form of that shown in the beforementioned Patent No. 2,145,566 and that, as is additionally shown in the patent of reference, the frame may be utilized to support an electric motor or other type of driving mechanism effective to reciprocate a reagent pump or feeder generally designated 11.

Provision is made for mounting the feeder 11 on the base 10 by forming the later part with an upstanding end wall 12 which is defined by a substantially annular flange 13 having a central circular opening 14.

The beforementioned opening 14 is arranged to receive a sleeve-like extension 15 of a metallic or "Bakelite" mounting member 16 which forms part of the feeder 11. Mounting member 16 includes an outwardly extending securing flange 17, substantially co-extensive with the base flange 13 and arranged to be rigidly secured thereto by means such as screws 18.

The outer (lefthand in Fig. 1) end face of mounting member 16 is provided with a flat peripheral surface 19 separated from a large axial bore 20 by a circular rib 21.

A flexible diaphragm 22 is clamped between the end face of circular rib 21 and the main body 23, of feeder 11, by means of spaced screws 24 which extend through the body 23 to engage suitably threaded bores in the rib 21. The body portion 23 of feeder 11 is formed with a bore 25 which is concentric with the bore 20 of mounting

member 15 and provides in conjunction with the latter, a pumping chamber, the volume of which may be alternately increased and decreased by reciprocation of the diaphragm 22 by means such as an actuating rod 26, slidably supported by the member 15.

Now referring to body member 23 of feeder 11: As shown in Fig. 2, the central section of the body member is generally circular in contour, its peripheral surface being formed with merging circular bosses 27 and 28 which, in the present embodiment of the invention, lie at the extremities of vertically disposed radii.

The bosses 27 and 28 are formed with similar, stepped concentric bores consisting of outer circular portions 29 and 29a, and inner portions 30 and 30a respectively, the portions 30 and 30a being of lesser diameter than the circular bores and providing communication with axial passages 31 and 32 formed in the body of the feeder.

It will be seen that the inner ends of passages 31 and 32 communicate with the chamber defined by the bore 25 in the inner (righthand end) face of the body member. Thus the passages 31 and 32 are in communication with the pumping chamber in which the diaphragm 22 is arranged to be reciprocated by rod 26.

Reverting now to the internal structural features of boss 27, which will be seen to be identical with those of boss 28: passage 31 opens into inner bore 30 through a port formed by an annular shoulder 33, the internal edge of which is bevelled to provide a seat for a discharge valve 34. It will be noted that the shoulder 33 defines a shallow well 35 surrounding the shoulder and extending radially outwardly to merge with the tapered, vertical sidewall of bore 30. A valve cage 36 is utilized to normally maintain the discharge valve 34 in closed position on the seat provided by shoulder 33.

Valve cage 36, like the body portion 23 of the feeder, is constructed of a transparent plastic material, one of whose characteristics is a tendency to yield somewhat under pressure. This lack of rigidity in the valve cage ordinarily precludes the use of such material because distortion of the body of the valve might be communicated to its gasketed seat and thus give rise to leaking. We have accordingly provided new and improved means of establishing a leak proof engagement between the valve cage and the body of the feeder.

As will be apparent from Figure 1, the lower end of the valve cage is formed with a bore 37, the diameter of which is substantially equal to that of the external surface of shoulder 33. A washer 38, locked between the external edge of shoulder 33 and the lower internal edge of bore 37 will be seen to provide a continuous knife edge contact between the lower end of the valve cage and shoulder 33.

When the valve cage is forcibly held in its assembled position, as shown in the drawings, any pressures which might otherwise tend to distort its body and thus destroy the tightness of its engagement with its seat, will only serve to increase the area of its contact with washer 38, as a consequence of which a leak-proof engagement is provided.

The valve 34 is arranged to be loaded without recourse to springs or other metallic means which would necessarily be susceptible to corrosion in use. To this end the valve consists of a rubber body portion of substantially spherical contour, with an integral, radially extending arm

39 which projects upwardly into proximity with the inner end of an axial bore 40, formed in the cage 36. When the valve is raised from its seat as an incident to a discharge action of diaphragm 22, the upper end of its arm 39 engages, and is consequently arrested, by the inner end wall of bore 40, with the result that further displacement of the valve is yieldably resisted by its arm.

The diameter of the arm 39 is such as will provide a sufficient degree of resiliency to permit displacement of the valve during the discharge action of the diaphragm. The use of a plastic material in the valve cage 36, coupled with the structural features disclosed, produced further advantage of great flexibility in the amount of tension which may be placed upon the valve itself without recourse to difficult machining operations. In this latter connection it will be apparent that when it is desired to exert a greater seating force upon the valve, it is only necessary to shorten the skirt 37 of the valve cage so as to cause the arm 39 to engage the inner end of bore 40 with increasing pressure. This operation is readily effected by a very light surface grinding operation and may even be satisfactorily accomplished by hand with the aid of a file or fine sand or emery paper.

The valve is guided for movement into and out of engagement with its seat, by the additional action of an integrally formed arm 41 which extends radially from the body of the valve on a diameter common to the arm 39. As will be seen, the arm 41 is freely received in the discharge passage 31 so as not to interfere with the flow of reagent therethrough, but is of sufficient diameter to guide the valve back into engagement with its seat after completion of a discharge cycle.

With a further view to visual inspection of operation of the device, provision is made for viewing the effect of each stroke of the diaphragm 22. To this latter end, the valve cage 36 is maintained in operative position by a cap or dome 42, which, like the cage itself, is formed of a transparent plastic material. More specifically, the open end of dome 42 is formed with an external thread 43 arranged to engage a similar thread provided on the inner cylindrical surface of bore 29 in boss 27. To provide for guiding of the cage 36 into engagement with its seat, the closed inner surface of the dome is provided with a circular recess 44 of such size as to snugly receive the outer end of the cage.

The dome itself is threaded into engagement with a circular seat similar to that provided for the cage. As shown in the drawings, the cylindrical bore 29 terminates in a shallow annular well 45 formed by the wall of the bore and an annular rib 46 which defines the upper end of the bore 30. A washer 47 is clamped between the inner edge of the open end of dome 42 and the outside edge of the rib 46 to form a knife edge engagement of the parts, such as was described in connection with the seat of the cage 36. The construction of the dome and cage seats obviates extreme precision in the manufacturing of parts because either is adapted to yield sufficiently to insure the formation of a liquid-tight seal in the other.

This feature will now be understood by a reference to the cage 36 and dome 42. Thus, when the dome is screwed into position, pressure will be exerted upon its associated cage, which in turn is communicated to the flange formed by

the bore 37. Since this flange is bearing against its washer on the line of its inner edge, there will be a tendency for the flange to expand as the pressure upon its edge is increased. Since the material of the cage, as well as that of the washer, is capable of yielding somewhat, it will be obvious that the construction employed will permit considerable downward adjustment of the cage even after its edge has contacted washer 38. Similarly, the depth of the well 45 is such that the dome may be screwed downwardly beyond the point where its inner edge first contacts the surface of the washer 47. It will be noted in this connection that the diameter of the external vertical surface of shoulder 46 is somewhat less than the internal diameter of the dome so as to provide for wedging the washer between those surfaces. Thus, the construction permits of sufficient latitude to insure seating of the inner edge of the dome against its washer 47 without extremely fine control of the dimensions of the parts.

It is now possible to trace the flow of reagent discharged through the passage 31: As will be understood, the discharge stroke of the diaphragm 22 will force reagent upwardly through passage 31, thus unseating the valve 34 against the resiliency of its arm 39. Liquid thus passing the valve, enters bore 37 of the cage 36 and then passes upwardly through similar internal passages 48 formed in the cage, and is discharged from ports 49 into the space defined between the cage and dome 42. The discharged reagent flows downwardly through the space between the dome and the valve cage to the well 35, formed by the bottom of bore 30, and thence outwardly through a passage 50 which communicates at its inner end with the bore. The passage 50 is formed in an integral portion 51 of the body 23 of the feeder, and may be utilized for attachment to a hose, or other type of connection, leading to the point at which the reagent is to be employed.

As shown in the lower portion of Fig. 1, a transparent dome 52 is threaded into the boss 28 to seat against a washer 53 similar in all respects to the washer 47. Washer 53 coacts with the inner open edge of dome 52, and a shoulder similar to the corresponding part of the construction described in connection with the discharge valve, to form a liquid-tight seal between the dome and body member 23. Dome 52 is further provided with a shallow recess 54 to guide a valve cage 55 into engagement with a seat formed by a washer 56 which acts between the inner edge of a bore 57 in the inner end of the cage, and a shoulder similar in all respects to the corresponding part previously described in connection with the cage 36.

In addition to the bore 57, the cage 55 is provided with an axial passage 58 which communicates at its upper end with bore 57 and at its lower end with a transverse passage 59 extending through the body of the cage. A check valve 60 is adapted to rest in the port defined by the opening between passage 58 and bore 57 and is guided for movement by an integrally formed, downwardly extending arm 61 which is guided by the passage 58.

A passage 62 formed in a boss 63 similar in all respects to the boss 51, communicates at its inner end with the bore 30—A and thus with the space lying between dome 52 and cage 55. The outer end of passage 62 is connected by any suitable means to a source of reagent to be pumped.

Now considering the action of the device during a suction stroke of the diaphragm 22. As the latter moves to the right, as viewed in Fig. 1, a partial vacuum is created which extends downwardly through passage 32 into the bore 57 of cage 55, resulting in the valve 60 being raised from its seat. When valve 60 is thus elevated, reagent is permitted to flow from the space between cage 55 and dome 52 through passage 59, thence upwardly through passage 58 and finally into passage 32 from where it flows into the chamber in which the diaphragm 22 operates. A pair of diametrically opposed fins or bosses 23—A formed integrally with the body portion 23, or if desired as part of a washer, prevents the upper surface of valve 60, as viewed in Figure 1 from seating in the lower end of passage 32, thus insuring a free flow of reagent into the pump chamber. It will be obvious that when the suction stroke of the diaphragm is completed, the valve 60 will again drop into engagement with its seat, thus preventing a reversal in the flow of the reagent. Hence, when the diaphragm commences a discharge stroke, reagent collected in its chamber will be forced upwardly through the cage 36 from where it is discharged through ports 49 into the space between cage 36 and dome 42 as previously described.

Since the body 23 of the feeder, as well as its valve cages 36 and 55, and domes 42 and 52, are formed of a transparent plastic material, the action of the device will be visible in all of its phases. Furthermore, the provision of passages 48 in the cage 36 will insure an intermittent spurting of the reagent from ports 49, so as to provide a striking visual proof of satisfactory operation of both valves 60 and 34. If for any reason either valve fails to function, that failure will be instantly apparent through the body of the device and the nature of its failure can be studied before any attempt at remedying the condition is made. The construction of the domes 42 and 52, as well as the manner of their connection with the body 23, is such that they may be readily unscrewed for the purpose of replacing either the valve cages or the valves and reassembly of the device can be accomplished with a minimum of time loss and without the necessity of the services of a skilled mechanic.

In addition to its properties of ease of assembly, disassembly adjustment, and visual evidence of operation, the construction illustrated possesses the added property of being readily cleaned, as might become necessary in the use of chemicals inclined to form precipitates on the internal surfaces of the feeder and its associated parts.

We claim as our invention:

1. In a valve construction for a device of the character described, the combination of a transparent body member, a valve, a valve seat in said body member, a valve comprising a spherically shaped rubber body portion with an integrally formed rubber arm extending normally to the plane of the valve seat, a transparent valve cage formed with a bore adapted to receive the arm on said valve, said arm being arranged to engage the inner end of said bore when the body portion of said valve is in seated position, so as to yieldably restrain said valve against movement, and means to maintain said valve cage in effective position, said last mentioned means permitting visual inspection of said valve through said valve cage.
2. In a valve construction for a device of the

character described, the combination of a transparent plastic body member, a valve comprising a spherically shaped rubber body portion with an integrally formed rubber arm extending normally to the plane of the valve seat, a transparent plastic valve cage formed with a bore adapted to receive the arm on said valve, said arm being arranged to engage the inner end of said bore when the body portion of said valve is in seated position so as to yieldably restrain said valve against movement and transparent plastic means to maintain said valve cage in effective position.

3. In a valve construction for a device of the character described, the combination of a valve formed of flexible material, a flexible arm formed integrally with said valve and extending radially therefrom in a direction normal to the plane defined by the line of contact of the valve with its seat, a valve cage formed of transparent material to guide said valve into and out of engagement with said valve seat, said valve cage having an axial bore to receive the arm on said valve, and means to maintain said valve cage in valve supporting position including a transparent molded dome arranged to be screwed into position to exert a compressive force on said cage.

4. In a device of the character described, the combination of a body member, a valve seat in said body member, a valve on said seat, a circular shoulder co-axial with said valve seat, a valve cage arranged to guide said valve for movement into and out of engagement with said seat, said valve cage including a circular skirt, of substantially the same internal diameter as said before-mentioned shoulder, a washer adapted to be wedged between an edge of said skirt and an edge of said shoulder to provide a liquid tight seal between said cage and said body member, a second circular shoulder concentric with and relatively larger than said first shoulder, a dome arranged to be threaded into said body member on a body thread formed concentrically with said last mentioned shoulder to maintain said cage in valve guiding position, and a washer arranged to be wedged between an edge of said last mentioned shoulder and an edge of said dome to provide a liquid tight joint between said dome and said body member.

5. In a device of the character described, the combination of a transparent body member, a valve seat in said body member, a valve on said seat, a circular shoulder co-axial with said valve seat, a transparent valve cage arranged to guide said valve for movement into and out of engagement with said seat, said valve cage including a circular skirt, of substantially the same internal diameter as said beforementioned shoulder, a washer adapted to be wedged between an edge of said skirt and an edge of said shoulder to pro-

vide a liquid tight seal, a second circular shoulder concentric with and relatively larger than said first shoulder, a transparent dome arranged to be threaded into said body member on a body thread formed concentrically with said last mentioned shoulder; and a washer arranged to be wedged between an edge of said last mentioned shoulder and an edge of said dome to provide a liquid tight joint between said dome and said body member.

6. In a device of the character described, the combination of a transparent plastic body member, a valve seat in said body member, a rubber valve on said seat, a rubber arm formed integrally with said valve, a circular shoulder co-axial with said valve seat, a valve cage arranged to guide said valve for movement into and out of engagement with said seat, said cage having a bore to receive the arm on said valve and a circular skirt, of substantially the same internal diameter as said beforementioned shoulder, a washer adapted to be wedged between the internal edge of said skirt and the external edge of said shoulder to provide a liquid tight seal, a second circular shoulder concentric with and relatively larger than said first shoulder, transparent plastic dome arranged to be threaded into said body member on a body thread formed concentrically with said last mentioned shoulder; and a washer arranged to be wedged between the external edge of said last mentioned shoulder and the internal edge of said dome to provide a liquid tight joint between said dome and said body member.

7. In a device of the character described, the combination of a transparent plastic body member, a valve seat in said body member, a flexible valve on said seat, a flexible arm on said valve, a circular shoulder co-axial with said valve seat, a valve cage having a co-axial bore to receive said arm to guide said valve into and out of engagement with said seat, said valve cage including a circular skirt, of substantially the same internal diameter as said beforementioned shoulder, a washer adapted to be wedged between the internal edge of said skirt and the external edge of said shoulder to provide a tight liquid seal, a second circular shoulder concentric with and relatively larger than said first shoulder, a transparent plastic dome arranged to be threaded into said body member on a body thread formed concentrically with said last mentioned shoulder; and a washer arranged to be wedged between the edge of said last mentioned shoulder and the edge of said dome to provide a liquid tight joint between said dome and said body member.

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