

- [54] **FLUID MIXER-DISPENSER**
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- [73] Assignee: **The United States of America as represented by the Secretary of the Navy**, Washington, D.C.
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- [52] U.S. Cl. .... **222/137, 222/145, 222/541, 259/4, 128/218 M, 137/68**
- [51] Int. Cl. .... **B67d 5/52**
- [58] Field of Search ..... **222/135, 136, 145, 222/252, 323, 372, 386, 402, 129, 565, 564, 542, 424.5, 309, 385, 387, 137, 541; 138/37; 128/218 M; 137/68; 259/4**

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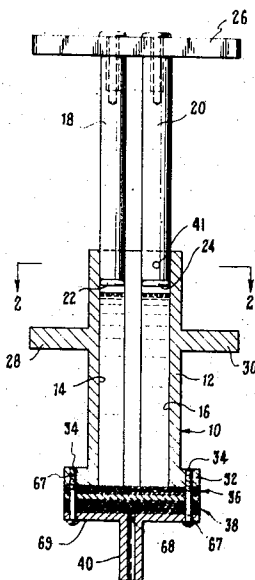
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[57] **ABSTRACT**

A fluid mixer-dispenser for use with two component adhesives including a generally cylindrical body having a pair of adjacent parallel cylindrical bores within which a pair of pistons are slidably mounted. A valve system fluidly seals the end of the bores and comprises three thin circular discs, one of which is a solid rupture disc and the remaining two flanking discs have appropriately shaped cutouts therein to prevent premature rupture due to backpressure when used in an underwater environment and to provide rupture at the appropriate internal pressure due to depression of the pistons. A mixing chamber is provided and includes a plurality of discs having appropriately formed cutouts such that when stacked, form passages for the fluids to flow through.

**3 Claims, 4 Drawing Figures**



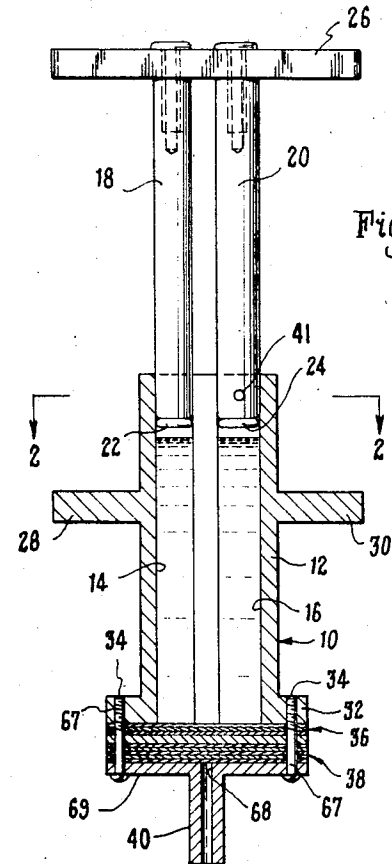


Fig. 1

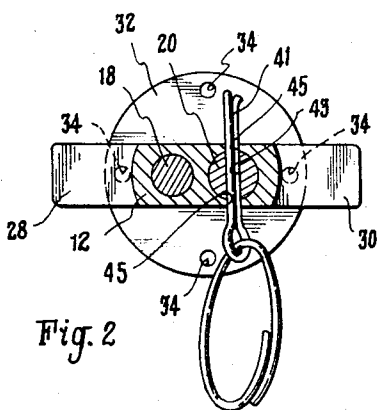


Fig. 2

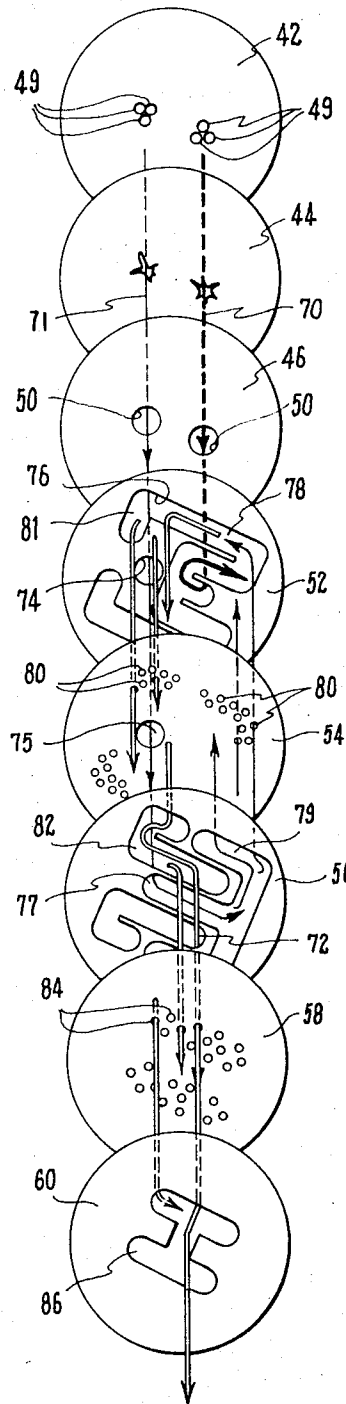


Fig. 4

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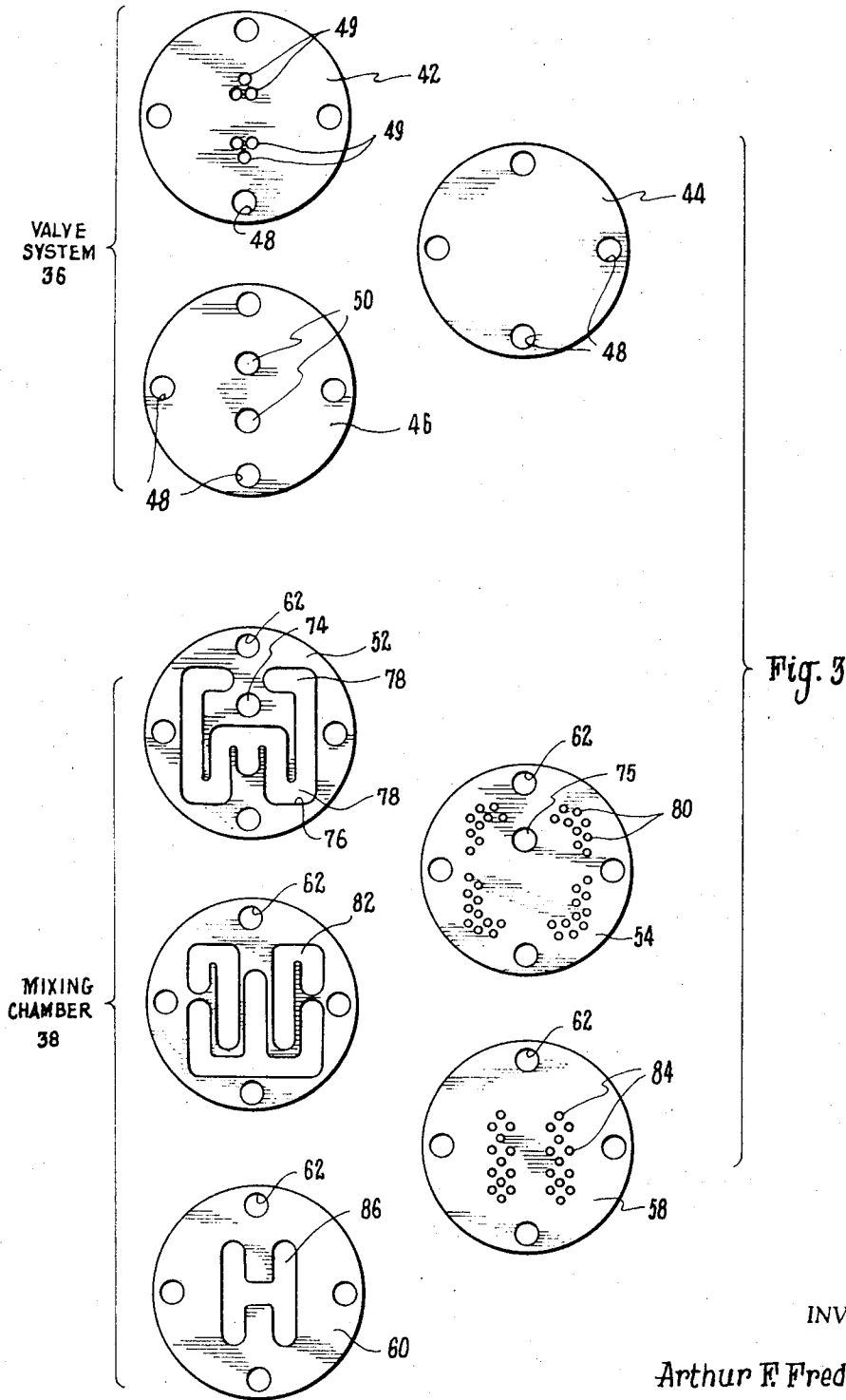


Fig. 3

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## FLUID MIXER-DISPENSER

### BACKGROUND OF THE INVENTION

This invention relates generally to a dispenser, and more particularly, to a two component adhesive mixer-dispenser.

Two component adhesive systems are oftentimes the optimum adhesive system for use in various applications, such for example, as in underwater use. Various problems arise, however, in the use of two component adhesive systems in that, not infrequently, the two components are difficult to mix thoroughly and use before solidification commences. To overcome this difficulty the use of various types of mixer-dispenser configurations have been considered and developed. For example, a mixer-dispenser was developed wherein a cylinder was divided into two chambers by a piston-valve system wherein each chamber contains one adhesive component. In operation, the valve is opened, the piston moved fore and aft, the piston valve subsequently closed and the nozzle valve opened. The piston is then moved forward forcing the adhesive out. The use of configurations such as this, however, resulted in only partial mixing and consequently produced only a low joint strength. Further, many times the adhesive set up before it was dispensed.

To alleviate the problems created, even more complex apparatus were developed. However, the operation of these devices usually entailed the use by the operator of both hands thereby increasing the difficulty of making the desired bond. Furthermore, problems have arisen in the underwater use of certain embodiments of such devices when used at relatively great depths where large hydrostatic pressure are present. In such circumstances, the "back pressure" acting on such mixer-dispensers is so high as to break the fluid seal separating the interior of the device from the external environment thereby effectively precluding the proper operation thereof.

In addition, in various previous adhesive mixer-dispenser devices, the configurations employed for the mixing portions thereof frequently were of a design whereby, inherently a large proportion of the volume of the adhesive components intended to be mixed would be trapped in the device by means other than premature solidification. The cause of this adhesive loss was the relatively large internal volumes presented in the mixing chambers available for the adhesive to fill.

### SUMMARY OF THE INVENTION

Accordingly, one object of this invention is to provide a new and improved two component adhesive mixer-dispenser.

Another object of the invention is the provision of a new and improved adhesive dispenser which will mix adhesive components to a greater extent than was heretofore possible.

Still another object of the present invention is to provide a new and improved adhesive mixer-dispenser which may be operated using only a single hand.

A further object of the instant invention is to provide a new and improved two component adhesive mixer-dispenser which provides accurate proportioning of the two components during the mixing and dispensing process.

A still further object of this invention is the provision of a new and improved two component adhesive mixer-dispenser wherein a minimum of adhesive is trapped and wasted in the mixing chamber.

Another still further object of the instant invention is the provision of a new and improved adhesive mixer-dispenser wherein back pressure present at great depths will not adversely affect the operation thereof.

Briefly, in accordance with one embodiment of this invention, these and other objects are attained by providing a fluid dispenser body including a pair of adjacent parallel cylindrical bores or chambers and a pair of pistons slidably mounted therein with a common push bar associated therewith. The pistons fluidly seal one end of the chambers and the opposite ends thereof are normally closed by a valve system and mixing chamber. The valve system and mixing chamber include a plurality of discs having appropriately formed cutouts such that when stacked, form passages for the fluids to flow through, directing them in such a way that they mix. The valve system includes a rupture disc which is designed to selectively rupture upon the application of pressure from within the dispenser body in response to actuation of the pistons. The valve system is designed to withstand great external pressure without failing.

### BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a side view in section of the adhesive mixer-dispenser according to the present invention;

FIG. 2 is a view of the mixer-dispenser taken along line 2—2 of FIG. 1;

FIG. 3 is a layout view illustrating the discs which comprise the mixing chamber and valve system; and

FIG. 4 is an exploded view of the valve system and mixing chamber indicating the direction of the adhesive component fluid flow.

### DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings wherein like reference characters designate identical or corresponding parts throughout the several views, and more particularly to FIG. 1 thereof, the adhesive mixer-dispenser, generally denoted as 10, is shown as including a body member 12 having a generally elongate, substantially cylindrical shape. A pair of spaced parallel cylindrical bores 14 and 16 are longitudinally formed through the body member 12 and comprise adhesive component retaining chambers as described hereinbelow. A pair of pistons 18 and 20 are slidably disposed within bores 14 and 16, respectively. O-rings 22 and 24 are provided within annular grooves formed at the end portions of respective pistons 18 and 20 and provide a fluid seal between the interior of the respective bores and the external environment. The pistons may be connected at their upper end portions by a push bar 26 thereby forming an assembly, including pistons 18 and 20 and push bar 26, for ejecting the adhesive components from within the bores as will be described in greater detail hereinbelow. Extending from about the midpoint of body member 12 are a pair of transverse projecting portions 28 and 30 which constitute finger grips for use during adhesive ejection. A circumferentially extending annular flange 32 is formed at the lower end portion of body member 12 and has formed therein four equally spaced fastener receiving openings 34 (FIG. 2)

for providing a means for connecting a valve system 36, a mixing chamber 38, and a nozzle 40 thereto. Additionally, prior to use, the piston assembly is rigidly held in a raised position as shown in FIG. 1 by the cooperation of a removable pin 41 held in a series of aligned holes 43 and 45 in piston 20 and body member 12, respectively (see FIG. 2).

Referring now to FIGS. 3 and 4, the valve system 36 of the present embodiment comprises three thin circular discs 42, 44 and 46 having circular outlines adapted to conform with the circular flange 32 formed on body member 12. Each disc is formed with four equally spaced openings 48 (not shown in FIG. 4) for receiving a conventional fastener upon being connected to body member 12 as will be described. In assembly, the discs 42, 44 and 46 are stacked in a laminar configuration so that the respective openings 48 are aligned to form a fastener receiving hole. In the present embodiment, disc 42 includes a pair of clusters of small cutout ports 49 formed in positions such that, upon fastening disc 42 to body member 12, the clusters will be adjacent to respective bores 14 and 16. Disc 44 comprises a continuous member having no cutouts while disc 46 includes a pair of circular cutouts 50 of a larger diameter than the cluster of cutouts and in corresponding positions thereto when the discs are stacked and attached to body member 12.

Still referring to FIGS. 3 and 4, the mixing chamber 38 of the present embodiment is shown as including a series of five thin circular discs 52, 54, 56, 58 and 60 of identical outer configuration as the discs comprising valve system 36, and also adapted to be stacked in a laminar arrangement. The mixing chamber discs further include openings 62 in positions alignable with openings 48 of the discs of the valve system 36 and openings 34 of body member 12 to receive fasteners. The discs have formed therein a series of cutouts of both circular and generally serpentine configurations such that when the discs are stacked, the cutouts form passages for the adhesive components to flow through, directing them in such a way that intimate mixture occurs. The various formations of the cutouts are best described in connection with the description of the operation of the device hereinbelow. Suffice it to say that the cutouts cooperate with the adjacent surfaces of the flanking discs to form adhesive fluid conducting passages.

Returning to FIG. 1, the nozzle 40 is provided with a series of four equally spaced openings alignable with openings 62, 48 and 34 of the mixing chamber, valve system, and body member, respectively, for receiving a fastener, a bore 68 formed therethrough cooperating with disc 60 of the mixing chamber 38 and a planar surface 69 for assisting in the application of the adhesive as will be described in the operation of the device.

In the construction of the device, the mixing chamber 38 and the valve system 36 are formed by stacking discs 52, 54, 56, 58, 60 and 42, 44, 46 in order designated in FIG. 4 and attaching nozzle 40 thereto by passing four conventional fasteners 67 (FIG. 1) through the fastener receiving openings. The nozzle 40, mixing chamber 38 and valve system 36 are then attached to flange 32 by fasteners 67, the two adhesive components having been previously deposited in bores 14 and 16. For the sake of clarity in the description of the operation of the device, the adhesive component in bore 14

will be termed Fluid A while the adhesive component in bore 16 will be denoted as Fluid B.

In operation, the operator places the body member 12 between his index and middle fingers, so that, while his thumb rests on the push bar 26 his fingers rest on the respective projections 28 and 30. The locking pin 41 is then removed, the push bar is forced toward the finger grips with an opposing motion of the thumb and forefingers causing the pistons 18 and 20 to displace the adhesive components, previously provided in bores 14 and 16. The fluid pressure increases until the valve system 36 is actuated. In the currently used system the disc 44 ruptures permitting flow through the mixing chamber 38 and out nozzle 40. Prior to use, disc 42 acts as a backup plate to prevent exteriorly applied pressure from rupturing disc 44 prematurely, i.e., cutouts 49 adjacent to bores 14 and 16, respectively, reduce the area on which back pressure can act.

Referring now to FIG. 4, the light line 71 indicates the path of flow of the adhesive component stored in bore 14, i.e., Fluid A, the heavy line 70 indicates the path of flow of the adhesive component stored in bore 16, i.e., Fluid B, and the double line 72 indicates the path of the mixture of the adhesive components.

The mixing chamber functions as follows: fluid A enters through cutouts in disc 42 and breaks through the rupture disc 44 at a point defined by cutouts 50 in disc 46. Cutout 50 may be adjusted slightly in diameter or changed in shape to afford a greater or lesser force to break the ruptured disc 44. The fluid (A) is directed through port 50 in disc 46 through port 74 in disc 52 and through port 75 in disc 54 into chamber 77 in disc 56. At this point only flow through the upper half of the mixing chamber will be discussed since upper and lower halves are symmetric. Fluid A enters area 79 of disc 56 and is injected through holes 80 in disc 54 into area 78 of disc 52 where it makes its initial contact and primary mixing with fluid B.

Fluid B has entered through cutouts 49 of backup disc 42 and has broken through rupture disc 44 at a point defined by cutout 50 in disc 46. The fluid B is directed through cutout 50 into a chamber 76 in disc 52 into an area 78 where the fluids first mix. After the primary mixing, the fluids continue in chamber 76 to area 81 where the fluids are forced through a number of holes 80 in disc 54 for secondary mixing. The mixed fluid proceeds through chamber 82 in disc 56, holes 84 in disc 58 for final mixing and chamber 86 in disc 60 which directs the fluid to bore 68 in nozzle 40.

An important advantage of the structure of the mixing chamber is that due to the extreme thinness of the chambers formed by the cutouts in the various discs, little adhesive fluid is trapped and wasted therein. The volume of the passageways from cutout 50 to area 78 where the fluids first mix are in direct proportion to the ratio in which the fluids A and B, respectively, are to be combined. Further, the relative cross-sectional area of the pistons and bores are in direct proportion to the ratio in which the fluid components are to be combined.

Obviously, numerous modifications and variations of the present invention are possible in the light of the above teachings. For example, in order to maintain a reasonable mechanical advantage so that the device remains operable with one hand, levers and/or ratchets and/or screwthreads, etc. may be added to the present system. In addition, gas or spring power may be pro-

vided to drive the pistons. Also, fluid dispensers other than the one described may be utilized within the scope of the invention. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described herein.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. A fluid mixer-dispenser comprising:

a body member having a plurality of chambers for receiving various fluid materials;

piston means fluidly sealing one end of said chambers and operatively associated therewith for ejecting said fluids therefrom;

laminar valve means positioned at the end of said body member opposite said piston means for fluidly sealing the other end of said chambers and for selectively permitting fluid communication between the external environment and said chambers only in response to interiorly applied pressure;

laminar mixing means connected to said valve means for intimately mixing the fluids ejected from said chambers; and

nozzle means connected to said mixing means for directing the egress of the mixed fluids from said mix-

ing means.

2. A fluid mixer-dispenser as recited in claim 1 wherein said laminar mixing means comprises:

a laminar mixing chamber including a plurality of thin discs adapted to be stacked upon each other, each one of said discs having appropriately shaped cutouts such that when said discs are stacked, said cutouts form intersecting passages which cooperate with said piston means within said chambers to direct said fluid materials in such a manner that they intimately mix.

3. A mixer-dispenser as recited in claim 2 wherein said laminar valve means comprises:

a thin rupture disc normally sealing said compartments from the external environment;

a back-up disc provided on one side of said rupture disc between said rupture disc and said body member having a pair of clusters of small circular cutouts formed therein at positions defined by the ends of said compartments; and

a thin disc positioned on the other side of said rupture disc having a pair of holes formed therein having diameters determinative of rupture pressure.

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