

[54] **DEVICE FOR DISPLACING A  
SUBSTANCE IN RESPONSE TO FORCES  
GENERATED BY A FLUID UNDER  
PRESSURE**

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[22] Filed: June 29, 1970

[21] Appl. No.: 50,834

[52] U.S. Cl. .... 222/386.5

[51] Int. Cl. .... B67d 5/54

[58] Field of Search. .... 222/131, 214, 335, 386.5, 389

[56] **References Cited**

**UNITED STATES PATENTS**

2,723,161	11/1955	Covington .....	222/386.5
2,529,937	11/1950	Hale .....	222/386.5 X
2,063,430	12/1936	Graser .....	222/386.5
2,758,747	8/1956	Stevens .....	222/386.5 X
1,731,767	10/1929	Cramer .....	222/386.5 X

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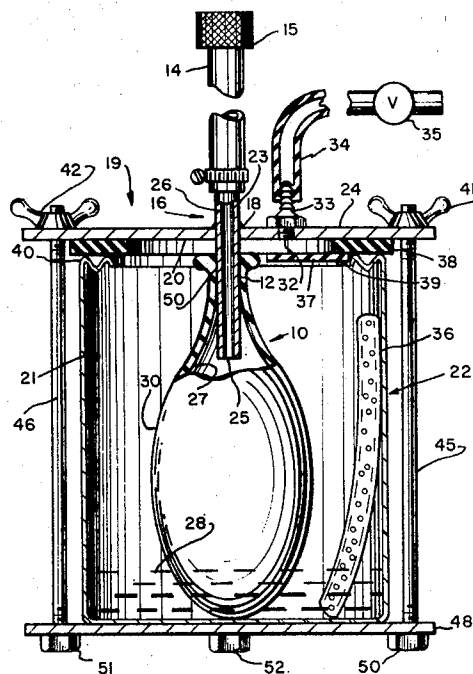
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[57]

**ABSTRACT**

A device for forcing a substance to be displaced from a containing enclosure using the forces generated by a fluid under pressure. The fluid under pressure enters an enclosure, a portion of whose surface is formed by a flexible membrane. The flexible membrane forms a common surface between the enclosure in which the fluid under pressure is held and the containing enclosure in which the substance to be displaced is held so that forces generated on the membrane by the fluid under pressure are applied to the substance to be displaced. As the fluid under pressure flows into the enclosure the membrane deflects and forces the substance to be displaced from the containing enclosure. An embodiment of this invention is disclosed in which the flexible membrane expands within the interior of a rigid container thus forcing the substance within the container to be displaced. Another embodiment of this invention is disclosed in which the fluid under pressure enters a rigid container and causes the flexible membrane within the container to collapse thus forcing the substance to be displaced out of the containing enclosure a portion of whose surface is formed by the flexible membrane.

**3 Claims, 3 Drawing Figures**



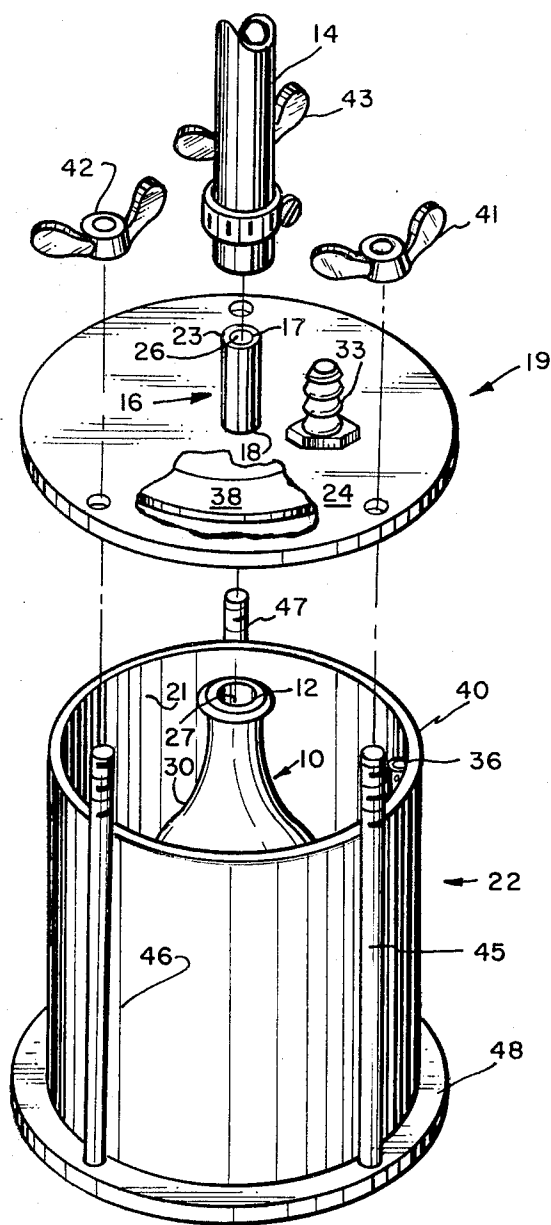
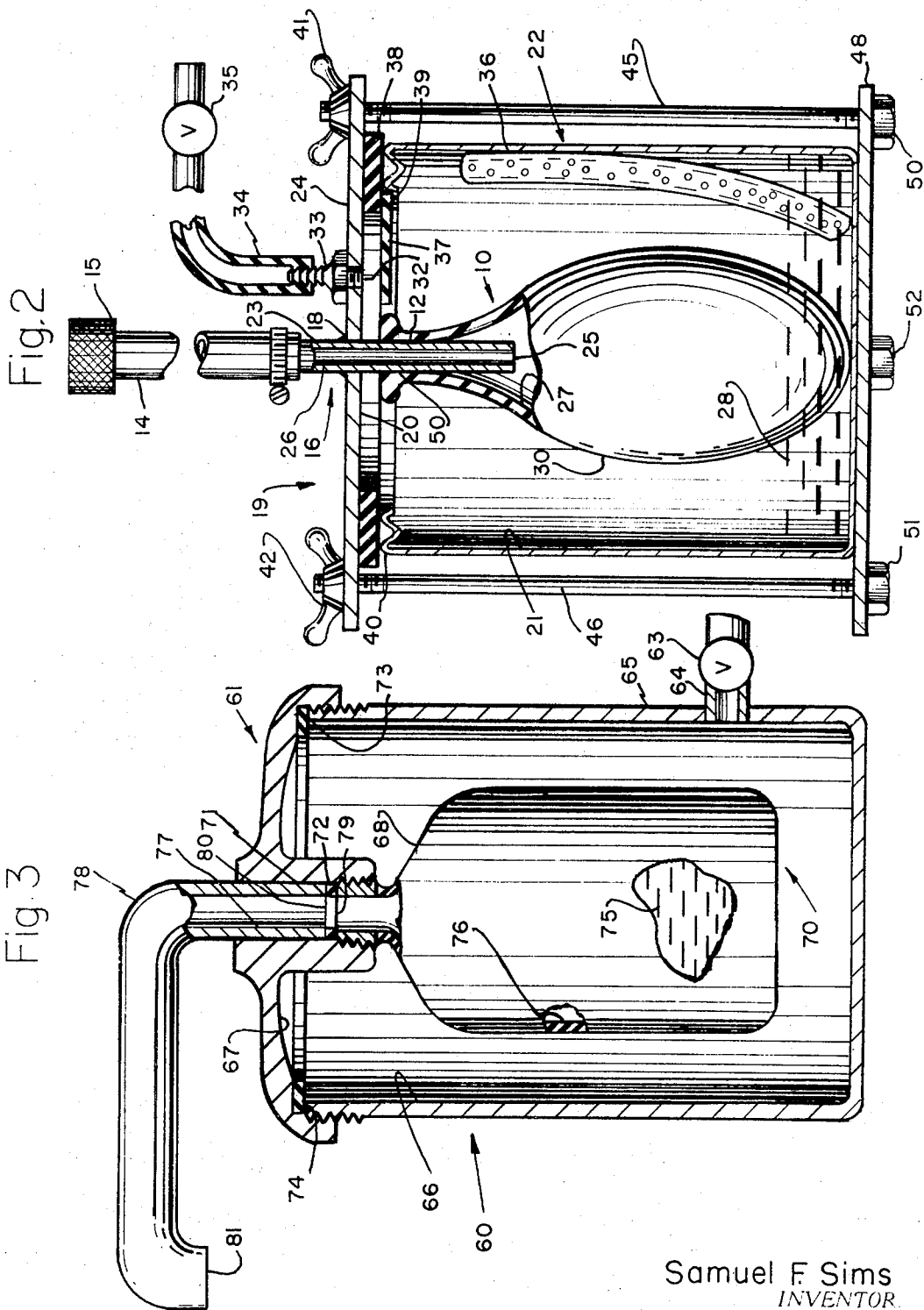


Fig. 1

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# DEVICE FOR DISPLACING A SUBSTANCE IN RESPONSE TO FORCES GENERATED BY A FLUID UNDER PRESSURE

## BACKGROUND OF THE INVENTION

### 1. Field of the Invention

This invention relates in general to devices for displacing a fluid from a container and in particular to a device which uses forces generated by an available fluid under pressure to accomplish the displacement of the substance.

### 2. Description of the Prior Art

Many devices for displacing a substance are known in the prior art. One such device is a pump driven electrically or by an internal combustion engine or by some other means. One difficulty with a device of this type is that the necessity of having a prime mover to drive the pump increases the size and weight of the device thereby decreasing its portability and usefulness. Another disadvantage of using a pump to displace a substance is that the pump is a complex combination of opening and closing ports or of rapidly rotating elements which are subject to dynamic forces and wear. It can be seen then that a device using a pump to displace a substance is likely to be unreliable due to its large number of moving parts and is also likely to be relatively expensive for the same reason.

Other devices are available which displace a substance from a closed container by pressurizing the air above the surface of the substance in the container and drawing the substance out of the container through an opening near the bottom of the container. This type of device suffers from the same limitations as the device which uses a pump to displace the substance because a compressor is used to pressurize the air. The compressor has numerous moving parts and requires a prime mover just as a pump does. This invention overcomes much of the complexity of the prior art devices and makes available, at a very low cost, the benefits of being able to displace a substance from a container without manual effort.

This invention eliminates much of the expense, weight, and complexity of prior art devices by eliminating the need for a device which produces fluid pressure from a source of mechanical energy. This is done by using a source of a fluid under pressure already available. One source of fluid under pressure which may be used for this purpose is water pressure. Since the invention provides a separation between the fluid under pressure and the substance to be displaced, there are no problems associated with the mixing of the fluid under pressure and the substance to be displaced. The invention has essentially one moving part; therefore, it is much more reliable and simpler to operate than the prior art devices.

## SUMMARY OF THE INVENTION

This invention is a device for displacing a substance in response to forces generated by a fluid under pressure comprising a first, hollow enclosure having an interior and an exterior surface, said first enclosure also having a first opening and a second opening, the first opening being connected to a source of fluid under pressure. The invention also comprises a flexible member having an interior surface and an exterior surface and an opening, said opening being connected to the second opening of the first hollow enclosure so that the fluid under pressure is contained by the interior surface of the first enclosure and the interior surface of the flexible member. This invention further comprises a second, hollow enclosure having an interior surface and an exterior surface, said second enclosure having a first opening and a second opening, the first opening providing a passageway from a point interior to the second enclosure to a point exterior to the second enclosure, the second opening being attached to a portion of the exterior surface of the first enclosure so that a containing enclosure, in which the substance to be displaced is contained, is formed by the exterior surface of the flexible member and the interior surface of the second enclosure so that the entry of the fluid under pressure into the enclosure formed by the interior surfaces of the first enclosure and the flexible member will dis-

place the substance to be displaced from the containing enclosure, the substance exiting from the containing enclosure through the first opening in the second enclosure.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an isometric view of the embodiment of the invention in which the flexible membrane is expandable. A cross-sectional view of the same embodiment shown in FIG. 1 is shown in FIG. 2. A cross-sectional view of an embodiment of the invention in which the flexible member is collapsible is shown in FIG. 3.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

In FIGS. 1 and 2 an embodiment of the invention is shown having a flexible member which is the expandable container 10 with opening 12. The conduit 14 which may be a hose, has means 15 which may be a female garden hose connection for attaching the conduit 14 to a source of fluid under pressure. The conduit 14 is connected to a first hollow enclosure 16, said enclosure 16 being a conduit, at the first opening 17 in the conduit 16. The conduit 16 is inserted within an opening 18 in the cover plate 19, opening 18 being the second opening of the second hollow enclosure formed by the bottom surface 20 of cover plate 19 and the interior surface 21 of the container 22. The cover plate 19 is attached to a portion of the exterior surface 23 of conduit 16 so that the first opening 17 of the conduit 16 is above the top surface 24 of the cover plate 19 and the second opening 25 of the conduit 16 is below the bottom surface 20 of the cover plate 19 when the top surface 24 of cover plate 19 is disposed upwardly as shown in FIGS. 1 and 2.

The fluid under pressure entering the enclosure formed by the interior surface 26 of the conduit 16 and the interior surface 27 of the expandable container 10 will displace the substance to be displaced 28 from the containing enclosure formed by the exterior surface 30 of the expandable container 10 and the interior surfaces of the second hollow enclosure formed by the bottom surface 20 of the cover plate 19 and the interior surface 21 of the container 22. For purposes of clarity, in FIG. 2 the substance to be displaced 28 is only shown near the bottom of container 22. It is to be understood that the substance to be displaced 28 will be displaced from container 22 only after the level of the substance to be displaced 28 has reached the bottom surface 20 of the cover plate 19. The substance to be displaced 28 exits from the second hollow enclosure formed by the bottom surface 20 of the cover plate 19 and the interior surface 21 of the container 22 through the first opening 32 in the cover plate 19 within which is fastened a connection port 33 which may be a hose connection fitting. A conduit 34 is connected to connection port 33 to conduct the substance to be displaced 28 to its point of utilization. A valve 35 is connected to the end of conduit 34 to control the flow of the substance to be displaced 28.

As the expandable container 10 becomes filled with fluid under pressure to the extent that the exterior surface 30 of the expandable container 10 contacts the interior surface 21 of the container 22 some provision must be made to allow the portion of the substance to be displaced 28 below the expandable container 10 to flow between the exterior surface 30 of expandable container 10 and the interior surface 21 of the container 22. Such a provision is made by perforated conduit 36. A flexible flap 37 is attached to the gasket 38 in the region 39 adjacent to the first opening 32 in the cover plate 19 so that when the exterior surface 30 of the expandable container 10 becomes expanded to the extent that it comes into contact with flexible flap 37, flexible flap 37 will cover the opening 32 in the cover plate 19 so that the expandable container 10 will be prevented from entering the opening 32 and internal pressure will rise within the enclosure formed by the bottom surface 20 of cover plate 19 and the interior surface 21 of the container 22 so that entry of the fluid under pressure into the expandable container 10 will cease and leakage of the fluid

under pressure from the region 50 where the expandable container 10 is connected about the periphery of conduit 16 will be prevented.

The bottom surface 20 of cover plate 19 to which gasket 38 is attached is urged forcibly toward the top surface 40 of the container 22 by the wing nuts 41, 42, and 43 so that a leak-proof seal is formed between the bottom-surface 20 of the cover plate 19 and the top surface 40 of the container 22. The wing nuts 41, 42, and 43 are threadably attached to dowels 45, 46, and 47 which are in turn attached to base plate 48 by nuts 50, 51, and 52.

A second embodiment of the invention is shown in FIG. 3. In the embodiment of FIG. 3 the first hollow enclosure is formed by container 60 and cover 61. Valve 63 is connected to a source of fluid under pressure. The fluid under pressure flows from valve 63 into port 64 which is attached to side 65 of container 60, said port 64 being the first opening of the first enclosure. Fluid under pressure flowing from port 64 enters the enclosure formed by the interior surface 66 of container 60, the bottom surface 67 of cover 61, and the interior surface 68 of collapsible member 70. Collapsible member 70 is connected to the second opening 71 of the first enclosure in the bottom surface 67 of cover 61 and presses against gasket 72 so that leakage of the fluid under pressure from the first enclosure formed by container 60 and cover 61 is prevented. Leakage of the fluid under pressure from the first enclosure formed by container 60 and cover 61 is also prevented by gasket 73 which fits between the bottom surface 67 of the cover 61 and the top surface 74 of the container 60.

The substance to be displaced 75 is contained within the containing enclosure formed by exterior surface 76 of the collapsible container 70 and the interior surface 77 of the conduit 78, the conduit 78 being the second hollow enclosure for the embodiment shown in FIG. 3. The substance to be displaced 75 is displaced from the containing enclosure in response to forces applied to the interior surface 68 of collapsible member 70 by the fluid under pressure within the first enclosure formed by cover 61 and container 60. The substance to be displaced flows from the opening 79 in the collapsible member 70 into the second opening 80 of the conduit 78 and thence through the first opening 81 of the conduit 78.

I claim:

1. A device for displacing a substance in response to forces generated by a fluid under pressure, comprising:

a conduit having a first end with an opening and a second end with an opening,

means attached to the first end of the conduit for connecting the conduit to a source of fluid under pressure,

an expandable container having an opening, the opening of said expandable container being connected to the second end of the conduit so that the fluid under pressure may pass through the conduit and enter the interior of the expandable container causing the container to expand,

a container having a top, a side, and a substantially flat bottom surface, said container also having an opening in its top,

a cover having a top surface and a bottom surface, said cover having a shape which at least covers the opening in the top of the container, said cover also having a first hole and a second hole, the holes being located centrally on the cover, the second hole having the conduit inserted within it, the periphery of the second hole being attached to the exterior of the conduit so that a leakproof seal is formed between the exterior of the conduit and the periphery of the second hole, and so that the first end of the conduit extends above the top surface of the cover

and the second end of the conduit extends below the bottom surface of the cover when the top surface of the cover is disposed upwardly,

a hose connection fitting having a longitudinal bore, said hose connection fitting being connected to the periphery of the first hole in the cover and extending above the top surface of the cover, said fitting providing a passageway for the substance to be displaced,

an exhaust hose having a first end and a second end, the first end of said exhaust hose being attached to the hose connection fitting so that the substance to be displaced exiting from the hose fitting will pass into the interior of the exhaust hose,

a valve connected to the second end of the exhaust hose to control the flow of the substance to be displaced, said valve forming the first opening of the second enclosure,

a perforated conduit which is supported in an upright position by the bottom surface and the side of the container so that the substance to be displaced may pass from the bottom of the container to the top of the container after the expandable container has expanded to such an extent that there are no longer any openings between the expandable container and the side of the container through which the substance to be displaced could reach the top of the container,

a gasket which fits between the bottom surface of the cover and the periphery of the opening in the top of the container, said gasket having an outline which conforms generally to the periphery of the opening in the top of the container so that a seal is formed around the periphery of the opening in the top of the container when the cover is held forcibly against the top of the container,

a flexible flap attached to a portion of the gasket adjacent the first hole in the cover, said flap extending to a point so that the flap covers the first hole when a portion of the expandable container comes into contact with the flap thus preventing the fluid under pressure from forcing the expandable member into the first hole and also establishing pressure within the container which prevents the further entry of fluid under pressure into the expandable container and also prevents the fluid under pressure from leakage from the region where the expandable container is connected to the conduit, and

means for forcibly holding the cover against the top of the container so that a substantially equal compressive force is applied to points on the gasket.

2. A device for displacing a substance in response to forces generated by a fluid under pressure as recited in claim 1 wherein the cover, comprises:

a plate having a portion which extends beyond the side of the container, said plate having a hole in the portion which extends beyond the side of the container.

3. A device for displacing a substance in response to forces generated by a fluid under pressure, as recited in claim 2 wherein the means for forcibly holding the cover against the top of the container, comprises:

a base plate upon which the bottom surface of the container rests,

a dowel connected at one end to the base plate and having a portion near its other end threaded, said threaded end extending through the hole in the portion of the cover which projects beyond the side of the container, and

a wing nut threadably attached to the threaded end of the dowel and exerting a holding force against the top surface of the cover.

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