

May 29, 1934.

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1,960,902

SUCTION DEVICE

Filed July 11, 1931

2 Sheets-Sheet 1

Fig. 1.

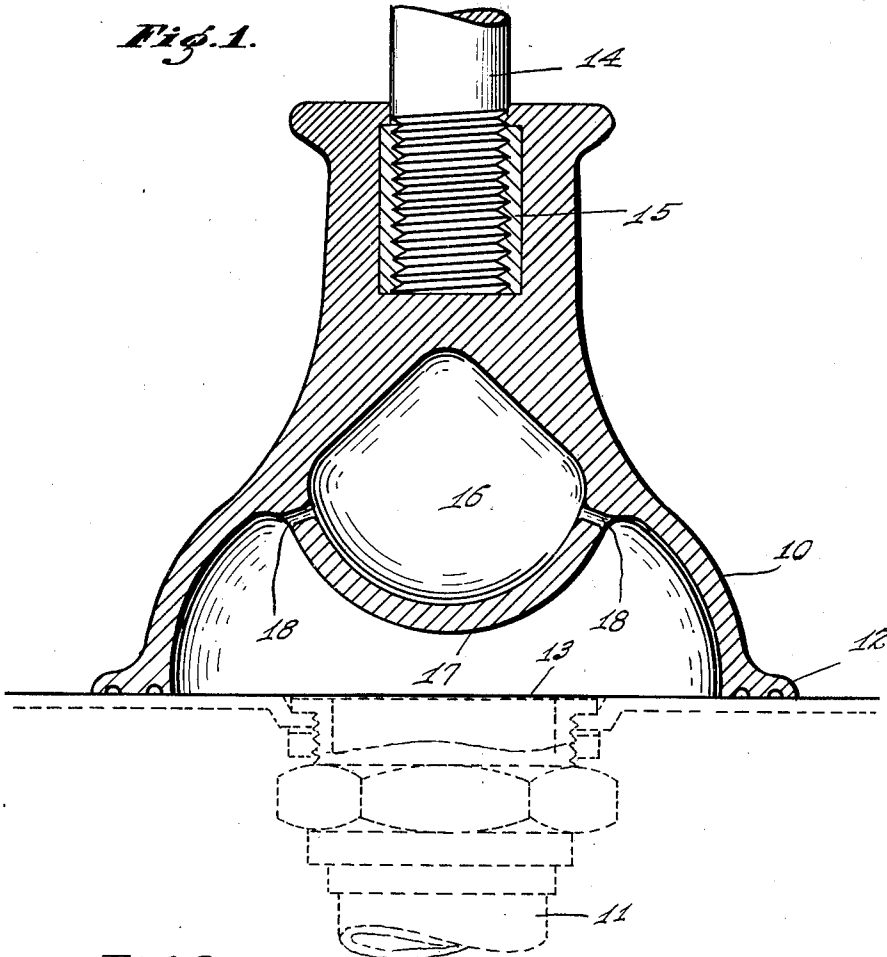
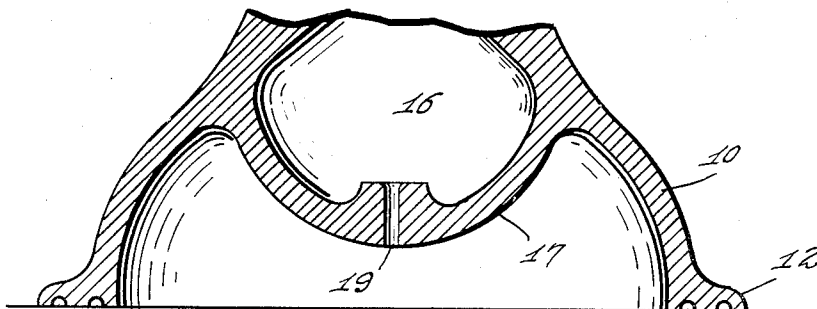


Fig. 2.



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Fig. 3.

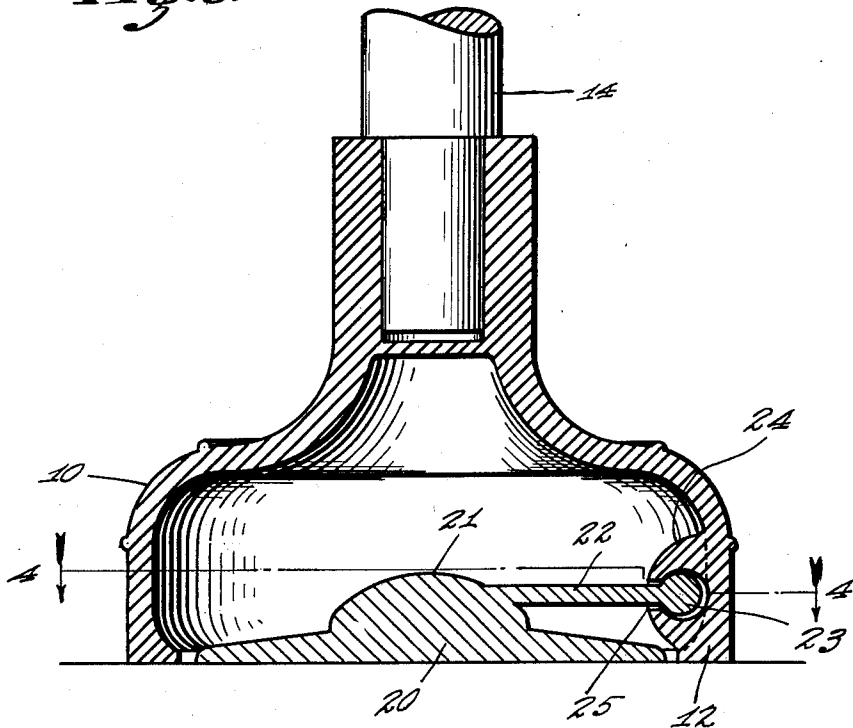
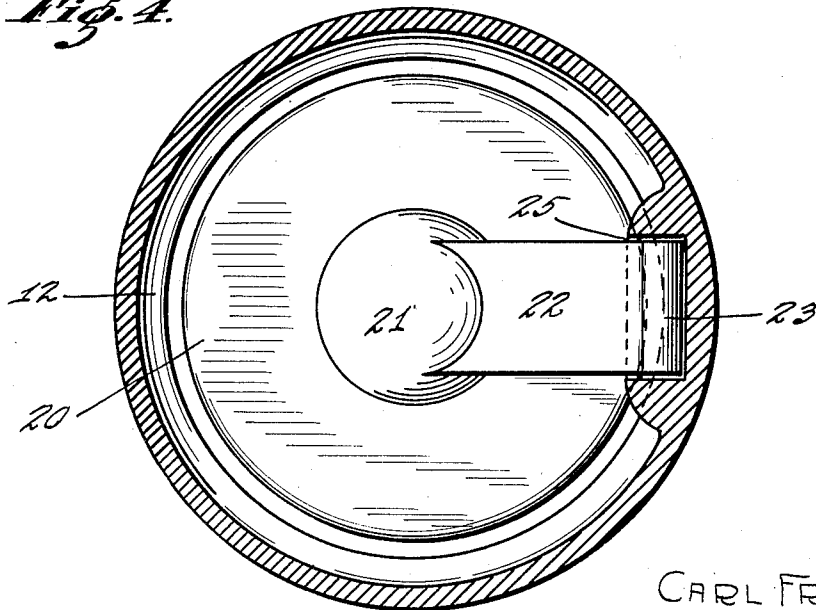


Fig. 4.



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UNITED STATES PATENT OFFICE

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SUCTION DEVICE

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Application July 11, 1931, Serial No. 550,095

11 Claims. (Cl. 4-255)

My invention is concerned with drain cleaning plungers of the type comprising generally a bell-shaped piece of soft rubber which is placed over the mouth of the drain and alternately collapsed and extended to produce variations in pressure designed to facilitate the removal of any obstructions contained in the drain. When such a plunger is operated over the mouth of a drain, the pressure within such drain and plunger varies between substantially that obtaining when the plunger is not present over the drain, since the collapsing of the plunger does not substantially increase the pressure in such drain but merely drives part of its contents out past the edges of the bell, and a lower pressure which is the result of the increased volume contained in the extended plunger over that contained in the collapsed plunger.

This pressure oscillation is often not sufficient to break up or remove obstructions in the drain, especially if such obstruction is a considerable distance from the mouth thereof.

It is the object of my invention to increase the effectiveness of plungers of this type by providing in association therewith means which cooperate with the plunger and the drain to produce a substantial vacuum in the drain and which may also operate to increase the range of pressure oscillation obtaining in the drain by reason of the alternate collapsing and extending of the plunger.

In accomplishing my objects, I provide within the bell-shaped plunger, a valve means for sealing the opening of the drain during the collapsing stroke of the plunger to prevent communication between the drain and at least part of the space within the plunger. This valve means may be a flat circular piece of material such as soft rubber adapted to form a flap valve over the drain opening. Also, this valve means may be in the form of a collapsible compartment having a wall adapted to engage the edge of the drain opening. The compartment may be provided with an outlet discharging into the bell of the plunger to permit the discharge of its contents into such bell and out past the lip thereof for increasing the evacuating action of the plunger; or the compartment outlet may open into the drain to cause an increase of the pressure therein during the collapsing stroke, while still permitting the progressive decrease in pressure in the drain upon the repeated operation of the plunger.

A plunger having the compartment outlet opening into the drain is shown in my co-pending application Serial No. 444,990, filed April 17, 1930,

and the present application is a continuation in part of such co-pending application.

The accompanying drawings illustrate my invention: Fig. 1 is an axial section through a plunger with a collapsible compartment having its outlet opening into the bell of the plunger; Fig. 2 is a similar section through a plunger having a compartment outlet opening into the plunger body when the body is extended and into the drain when the body is collapsed, as shown in my co-pending application above identified; Fig. 3 is an axial section through a plunger having a flap valve associated therewith; and Fig. 4 is a section substantially on the line 4-4 of Fig. 3.

In outward appearance my improved plunger resembles the usual type of plunger in that it has a downwardly opening bell-shaped body 10 adapted to be placed over the opening of a drain pipe 11 with its lower edge or lip 12 in contact with the bottom 13 of the sink or other fixture with which the drain pipe 11 communicates.

In the usual type of plunger, the body 10 is provided at its top with a central opening which receives a handle 14. So far as I am aware, the handle-receiving opening in prior plunger-bodies has been a plain recess, and the plunger-body has been frictionally retained on the end of the handle as the result of the elastic nature of the material from which the plunger-body is formed. With such a handle-mounting, it frequently happens that the elastic grip of the plunger-body is insufficient to hold it on the end of the handle, with the result that the handle is pulled out of the handle-receiving opening in the plunger-body.

To overcome this difficulty, I may mount in the handle-receiving opening of the plunger-body an internally screw-threaded sleeve 15 and provide the end of the handle 14 with screw-threads adapted to mesh with those of such sleeve. The sleeve 15 may be molded in place in the plunger-body, and therefore can not be accidentally removed therefrom. Because of this screw-thread engagement of the handle with the sleeve 15, the handle is therefore positively secured to the plunger-body under all circumstances.

Within the body 10 of the plunger as shown in Fig. 1, I provide a compartment 16 the lower portion of which is defined by a generally hemispherical wall 17 having one or more openings 18 near the juncture of such wall with the body 10. The wall 17 forms a valve means so shaped that while the plunger is being collapsed downwardly such wall engages the edges of the open-

ing of the drain 11 in sealing relation, and further collapse of the plunger results in the expulsion past the lip 12 of the body 10 of the greater portion of the air in both the body 10 and the compartment 16. When the plunger is then extended, the lip 12 acts a check-valve preventing inflow of fluid, and a pressure-drop in the drain results.

With this form of my improved plunger, continued alternate collapse and extension results in a progressive and substantial decrease in pressure within the drain, a result unobtainable with ordinary plungers which is in direct consequence of the sealing action of the compartment wall 17.

In the plunger shown in Fig. 2 the openings 18 are eliminated and the hemispherical wall 17 has an opening 19 in its lower central portion, which during the collapse of the body 10 of the plunger carries the contents of the compartment 16 into the drain 11 while such drain is sealed by the wall 17, and temporarily increases the pressure in such drain. At the same time, the collapse of the body 10 while the drain is thus sealed by the wall 17 causes the contents of the body to be expelled past the lip 12; and upon the ensuing extending of the body accompanied by a disengagement of the wall 17 from the mouth of the drain, the pressure in the drain is reduced from the temporarily increased state to a materially lower pressure than originally obtained. The evacuation of the drain by the repeated collapse and extension of the plunger is somewhat slower with this arrangement than when the plunger has a compartment with openings at 13, although a substantial evacuation is still easily obtained as I have found by actual tests with a pressure gage. In addition, with this arrangement the operation of the plunger produces pulsating pressure changes simultaneously with the general reduction of the pressure in the drain 11.

The plunger shown in Figs. 3 and 4 can readily be used either to produce the improved results in accordance with my invention or, by removing the valve, as an ordinary plunger.

In this form of plunger the valve is in the form of a flat soft rubber disk 20, normally held substantially in the plane of the lip 12 of the plunger body, and of sufficient diameter to project well beyond the edges of a drain opening. This disk 20 is desirably tapered from its center toward its edges, and provided at its center with a thickened portion 21. A relatively stiff strap of rubber integral with this thickened portion 21 serves as an arm 22 by which the disk 20 is held in place. Conveniently, the connection between the arm and the plunger body is disengageable to permit the valve to be removed and the plunger used as an ordinary plunger. For this purpose, I provide the end of the arm 22 with a laterally extending cylindrical enlargement 23 which may be slipped into a hollow lug 24 on the inner surface of the plunger body near the lip 12 through a slot 25 in such lug.

With the disk 20 in place, this form of my improved plunger operates in substantially the same manner as the forms shown in Figs. 1 and 2, and is most efficient in building up a vacuum in the drain. During each collapsing stroke of the plunger the disk 20 acts as a flap valve over the mouth of the drain, sealing such mouth and causing the contents displaced from within the plunger body to escape past the lip 12. During each upward or extending stroke, however, the lip 12 acts as a check valve while the disk 20 permits free flow from the drain to the plunger,

and the increase in volume within the plunger materially decreases the pressure in both the drain and plunger.

Repeated alternate collapse and extension of this plunger, as with the forms shown in Figs. 1 and 2, produces a high degree of vacuum unobtainable with plungers that lack the drain-mouth sealing valve. That such is the case will be apparent by analogy to a piston-and-cylinder type of pump operating on a compressible fluid to create a pressure difference. As is well recognized, the maximum pressure difference which can be produced by such a pump is directly dependent upon the ratio of piston displacement to clearance volume. With a drain-cleaning plunger of the type in common use, the effective clearance volume is the volume of the space beneath the collapsed plunger and within the drain above the obstruction therein. With my improved plunger, owing to the fact that the compartment wall 17 in the forms shown in Figs. 1 and 2, or the disk 20 in the form shown in Figs. 3 and 4, seals the drain opening as the plunger is collapsed, the effective clearance volume is only the volume beneath the collapsed plunger, which clearance volume may be and frequently is only a fraction of the volume of the space within the drain and above the obstruction therein. Thus the maximum pressure drop which can be produced with my improved plunger will be many times greater than that which can be produced with prior plungers, especially if the obstruction in the drain is at a considerable distance from the opening thereof.

I have found by actual experiments that my improved plunger including the compartment 16 or the disk 20 is more effective than the ordinary type of plunger in removing obstructions in the drain, irrespective of the particular location of the compartment outlet in the forms having the compartment 16. Tests made with a pressure gage show that a high degree of vacuum may be built up quickly in a drain 11 by alternate collapse and extension of a plunger having a compartment with outlet near the body wall, or having a disk flap valve; and that the pressure variations produced in the drain by similar operation of a plunger with a compartment having its outlet in the central portion of the compartment wall are greater in extent than those created by the ordinary type of plunger.

While I have shown and described my invention as embodied in a drain-cleaning plunger, my invention is readily capable of application for pulling fluid through any opening in a surface, and will for instance produce and maintain a vacuum in a space with which such opening communicates.

I claim as my invention:

1. A device for pulling fluid through an opening in a surface, comprising an elastic hollow bell-shaped body having an open end but being otherwise closed, and a wall within said body providing a convex surface disposed toward said open end, said wall having an opening providing communication between the space within said wall and the space within said body.

2. A device for pulling fluid through an opening in a surface, comprising an elastic hollow bell-shaped body having an open end but being otherwise closed, and provisions within said body adapted to limit flow of fluid into said opening from the interior of said body.

3. A device for pulling fluid through an opening in a surface, comprising an elastic hollow

bell-shaped body having an open end but being otherwise closed, and a flexible disk positioned within said open end substantially in the plane thereof adapted to overlie the edges of said opening and seal it against flow into such opening.

4. A device for pulling fluid through an opening in a surface, comprising an elastic hollow-bell-shaped body having an open end but being otherwise closed, and a member positioned within said open end substantially in the plane thereof adapted to overlie the edges of said opening and seal it against flow into such opening.

5. The invention set forth in claim 3 in which said disk is removable.

6. The invention set forth in claim 4 in which said member is removable.

7. A drain-cleaning plunger, comprising an elastic hollow bell-shaped body having an open end adapted to be placed over the opening of the drain to be cleaned, said body being otherwise closed, the edge of said body around said open end being thickened to provide a sealing surface, and provisions within said body including a member engageable with the edge of and capable of covering the drain-opening for sealing the drain-opening to prevent fluid-flow into the drain from at least a part of the space within the plunger body as said body is collapsed, said member being incapable of preventing flow in the reverse direction as the plunger-body is extended.

8. A drain-cleaning plunger, comprising an elastic hollow bell-shaped body having an open end adapted to be placed over the opening of the drain to be cleaned, said body being otherwise closed, and means within said body operative as said body is collapsed for sealing the drain-opening to prevent fluid-flow into the drain from at least part of the space within the plunger-body, and for permitting fluid flow in the reverse direction as the body is extended.

9. A device for drawing fluid through an opening in a surface, comprising an elastic hollow bell-shaped body having an open end, said body being otherwise closed, a collapsible chamber within said body having a wall normally spaced inwardly from said open end and adapted as the body is collapsed to be seated against the edges of said opening in sealing relation therewith, said chamber having an opening adapted to communicate with the interior of said bell-shaped body and said drain opening.

10. A device for drawing fluid through an opening in a surface, comprising an elastic hollow bell-shaped body having an open end, and a member yieldably supported within said body in line with the open end thereof and in position to cover the opening as the body is collapsed whereby to prevent fluid displaced from within the body by the collapse thereof from passing through the opening, said member being incapable of preventing flow in the reverse direction as the body is extended.

11. A device for drawing fluid through an opening in a surface, comprising a member having a generally outwardly flaring annular wall adapted to engage said surface around the opening therein, said wall being of elastic material to permit reciprocation of the member toward and away from said surface and to permit the escape of fluid from within said wall between the edge thereof and said surface as the member is moved toward the surface, and valve means associated with said opening for preventing the escape of fluid through said opening from within said wall but for permitting fluid-flow in the opposite direction through the opening.

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