

Nov. 18, 1930.

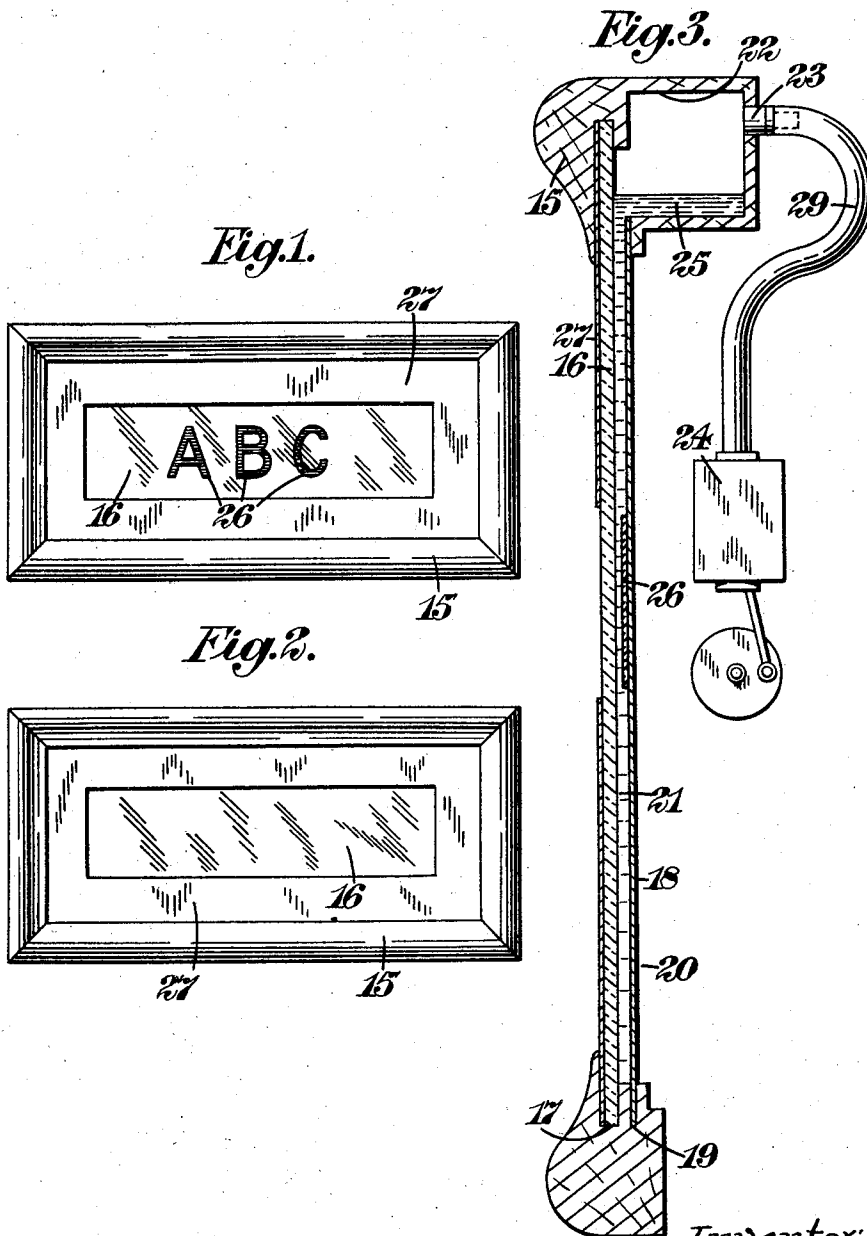
G. A. WEARHAM

1,782,328

DISPLAY APPARATUS AND METHOD OF OPERATING THE SAME

Filed May 21, 1929

3 Sheets-Sheet 1



Inventor:
G. A. Wearham,
By Byrnes, Stebbins & Parnelle,
Attys.

Nov. 18, 1930.

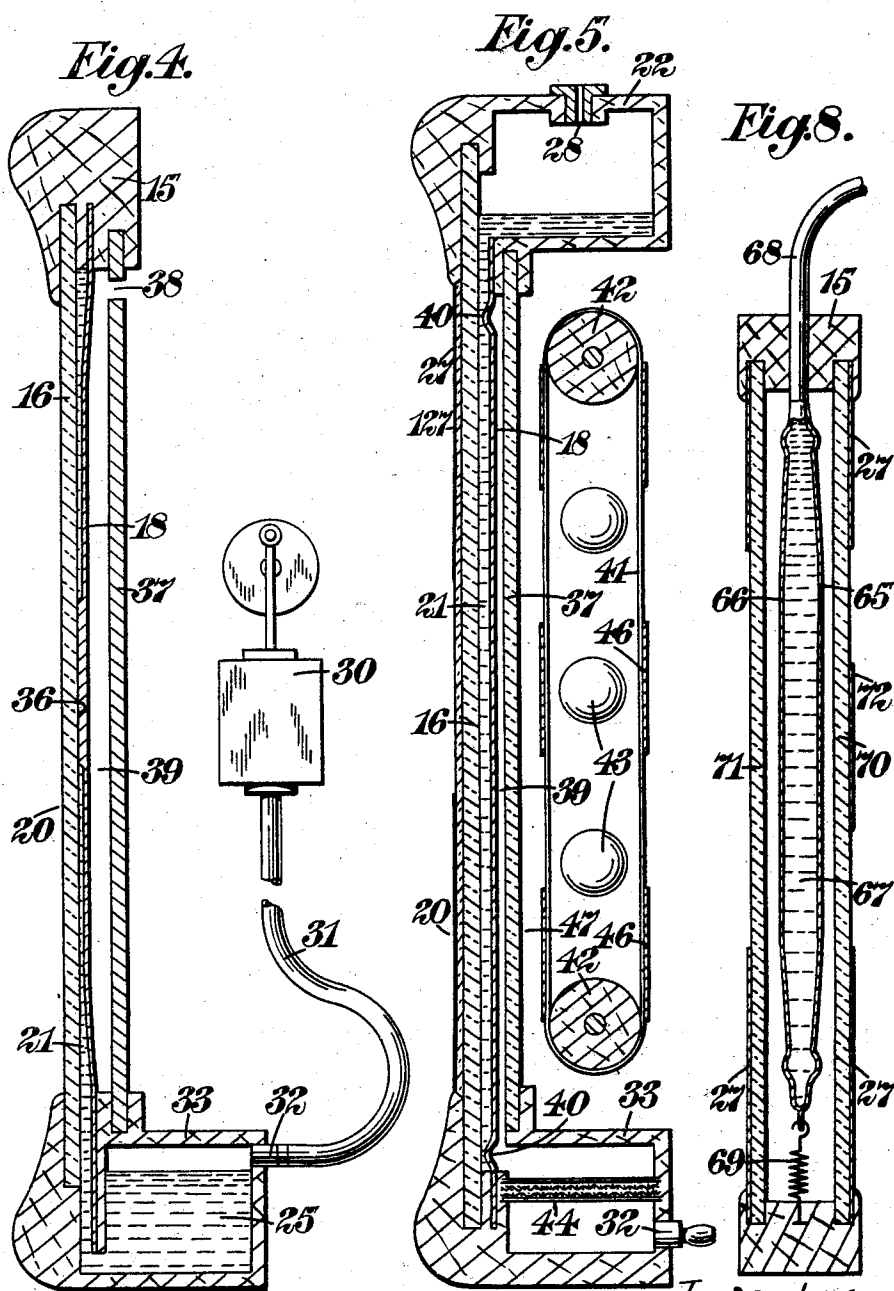
G. A. WEARHAM

1,782,328

DISPLAY APPARATUS AND METHOD OF OPERATING THE SAME

Filed May 21, 1929

3 Sheets-Sheet 2



Inventor
G. A. Wearham,
By Bynnes, Stebbins & Parnell,
attys.

Nov. 18, 1930.

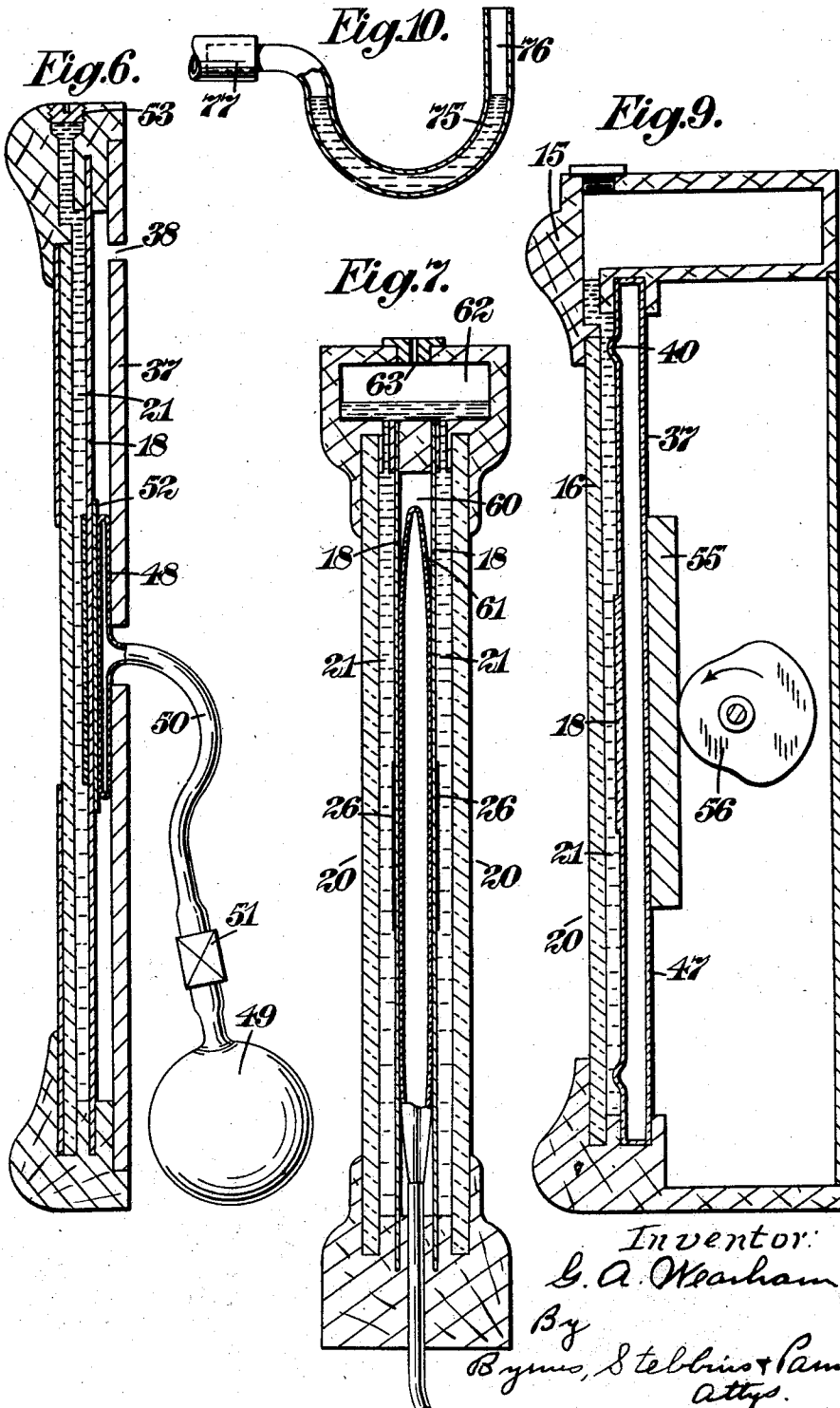
G. A. WEARHAM

1,782,328

DISPLAY APPARATUS AND METHOD OF OPERATING THE SAME

Filed May 21, 1929

3 Sheets-Sheet 3



UNITED STATES PATENT OFFICE

GORDON AUGUSTUS WEARHAM, OF LONDON, ENGLAND

DISPLAY APPARATUS AND METHOD OF OPERATING THE SAME

Application filed May 21, 1929, Serial No. 364,354, and in Great Britain May 23, 1928.

This invention relates to apparatus for use in displaying matter of various kinds, such as advertisements, pictures, notices and articles of merchandise (hereinafter referred to generally as "display matter") of the type wherein a container that contains a liquid screen, such as an opaque milk-like liquid screen, has a wall, e. g. a glass wall, constituting a window through which the said screen is visible, the thickness of which screen is varied so as to change the appearance of the apparatus, as by rendering display matter associated with the container visible or invisible or changing its appearance when viewed through the window.

This invention has for one of its objects to obviate the use of actuating mechanism built into the container, and to provide an improved method for operating the apparatus in a more simple manner than heretofore. Another object is to provide an improved construction of apparatus of the type described which shall be more simple than those made heretofore, shall occupy only a relatively small space and can be made at a low cost.

According to an important feature of the invention, there is provided a method of operating display apparatus of the type described, consisting in varying the thickness of the liquid screen, for example reducing it to zero, in the chamber under the action of fluid pressure, such as pneumatic, hydraulic or atmospheric pressure. Such a method of operation obviates the use of mechanism built into the container and enables the apparatus to be conveniently operated from a distance.

According to another important feature of the invention, there is provided a method of operating a display apparatus of the type described wherein one of two opposed walls of the chamber situated in line with the display matter and having the liquid screen between them is flexible, consisting in flexing the flexible wall towards and away from its opposed wall under the action of fluid pressure and thereby varying the thickness of the liquid screen.

According to a further important feature

of the invention, there is provided apparatus of the type described comprising a container having one side wall (e. g. front wall) constituting a window, through which display matter may be viewed, and a liquid screen (e. g. of opaque liquid) situated in said container so as to be visible through the window, in combination with means operating by fluid pressure (e. g. pneumatic, hydraulic or atmospheric pressure) for varying the thickness of said screen (e. g. reducing it to zero). Owing to the absence of mechanism built into the container for actuating the apparatus, the container can be made very thin as measured from back to front and can occupy only a small space.

In one construction according to the invention, the wall constituting the window and the opposed wall (e. g. rear wall) of the container are both flexible and are caused to approach towards and recede from one another under the action of fluid pressure (e. g. directly on the liquid in the container).

In another construction according to the invention, the said wall constituting the window or the opposed wall (e. g. rear wall) of the container is flexible and the other is rigid, which flexible wall is caused to approach towards and recede from the rigid wall under the action of fluid pressure (e. g. directly on the liquid in the container).

The said space for the liquid screen may open below, according to another feature of the invention, into the lower part of a storage compartment containing liquid, which compartment has means for exerting pressure on the liquid therein and thereby lifting liquid into said space for operating the apparatus.

Alternatively, the said space for liquid may open above, according to another feature of the invention, into the lower part of a storage compartment containing liquid, which compartment has means for reducing the pressure on the free surface of the liquid in said compartment and thereby lifting liquid out of said space, for operating the apparatus.

According to yet another feature of the invention, a plurality of containers, for example two thereof, each as described above,

may be arranged one beside or one in front of another, and means common to said containers may be provided for varying, for example in unison, the thickness of the liquid screens therein.

Other features of the invention relating to means for varying the thickness of the liquid screen and to various features of the construction of the apparatus will be described hereinafter and pointed out in the claims.

Several forms of apparatus according to the invention and adapted for carrying the described method into practice are diagrammatically illustrated by way of example in the accompanying drawing, wherein:—

Figures 1 and 2 are front elevations of one form of display sign according to the invention, respectively showing the display matter visible and invisible from the front of the sign, and

Figure 3 is a diagrammatic vertical transverse section, on an enlarged scale, taken through the same;

Figures 4, 5, 6, 7, 8 and 9 are views in cross-section corresponding to Figure 3 showing various other constructions of display sign according to the invention, and

Figure 10 is a side elevation of a detail.

Like reference characters designate like parts throughout the several views.

Referring first to Figures 1 to 3, the display sign comprises a rectangular frame 15 of wood, metal or other convenient material, carrying a sheet of glass 16 constituting a window secured fluid tight as by a groove 17 in the frame. Behind the glass 16 and preferably parallel therewith is a flexible diaphragm 18 which may be transparent, translucent or opaque, and may be a thin sheet of celluloid metal or other convenient material. This diaphragm 18 is mounted fluid tight in the frame 15 as by a groove 19, so as to form with the glass 16 and frame 15 a container, designated generally 20, whereof the glass window 16 is the front wall and the diaphragm 18 is the opposite rear wall. These two walls may be placed at any convenient distance apart, say $\frac{1}{8}$ ", so that the space 21 between them is quite narrow to enable the middle portion of the diaphragm 18 when flexed as described hereinafter to lie flat against or close to the middle of the window 16.

The upper part of the frame 15 is formed at the rear as a compartment 22 which opens below into the space 21 and has above an outlet 23 which can be secured by a tube 29 to any convenient intermittently-operated suction device 24, such as a suction pump. This compartment 22 serves for storing an opaque, semi-opaque, translucent or transparent liquid 25 which may be coloured and which fills the space 21 and there constitutes

a liquid screen between the front and rear walls of the container 20.

The matter, such as words or a design, to be displayed may be carried on either side of the diaphragm 18 if the latter is transparent, and may be embossed, engraved, printed, stamped, stenciled or photographed thereon, or otherwise applied thereto. When the diaphragm 18 is opaque the display matter will be on its front face and may be in the form of yielding material 26, such as rubber, shaped to form letters for example, and adapted to bed tightly against the glass 16. A mount 27, which may be of cardboard or other convenient material, or may be constituted by a coat of paint or the like on the glass, may be arranged in front of the glass 16 to screen off from view the greater part of the diaphragm 18 and the liquid surrounding the display matter.

Assuming that the liquid 25 is milk-white and so opaque as to obscure the display matter when viewed through the window, the display sign will have the blank appearance shown in Figure 2. When the suction device 24 operates to reduce the pressure in the compartment 22, atmospheric pressure acting on the back of the diaphragm 18 will flex the latter and gradually press the display matter 26 into contact with the glass window 16 and thereby render it clearly visible, as shown in Figure 1. On the return stroke of the piston the diaphragm 18 will return to its normal position spaced away from the glass 16, and the liquid will again obscure the display matter 26.

When the liquid 25 is tinted and transparent, the display matter will also preferably be coloured, and the colour of the liquid may contrast with and be complementary to the colour of the display matter. For example, if the display matter is in the form of yellow letters and a blue liquid is used, then when the thickness of the liquid screen varies the colour of the sign will change gradually from a green to a yellow when the letters are pressed tightly against the glass. Alternatively red letters may be used with a green liquid when the letters will normally appear black and will gradually change to red.

Instead of the above described arrangement of the display matter, such matter, for example in the form of a stencil or transparency, may be wholly or in part provided on the window at the front or rear thereof. If it is on the front of the window the front face of the rear wall will preferably be coloured or it may also carry some display matter.

When both the front and rear walls 16, 18 of the container 20 are transparent the display matter may be arranged at the rear of the container so as to be viewed through both of the walls. It may be arranged on the rear face of the diaphragm 18 or spaced away from the same, in which case actual ar-

articles of merchandise, such as ribbons of various colours, may serve as display matter. If a source of light, such as an electric light, constitutes the display matter the liquid screen may serve to vary the intensity of illumination of the same.

In the display apparatus shown in Figure 4, a device 30, such as a pressure pump for intermittently producing fluid pressure, is connected by a tube 31 to an inlet 32 to the upper part of a compartment 33 that contains liquid 25 and opens below into the space 21 between the glass 16 and the flexible diaphragm 18. Display matter 36 is shown moulded on the diaphragm 18, and the space 21 remains filled with liquid but varies in size. When the pump 30 operates, the diaphragm 18 is flexed alternately away from and towards the glass 16. If desired, the compartment 33 and tube 31 may always be filled with liquid. Similarly the compartment 22 and tube 29 shown in Figure 3 may always be filled with liquid. In this construction, and in that shown in Figure 3, a backboard 37 or a third sheet of transparent, translucent or opaque material may be arranged behind the diaphragm 18, either spaced away therefrom as shown, or close to it, a vent hole 38 being arranged to connect the space 39 between the two walls 18, 37 with the atmosphere so as to allow the diaphragm 18 to flex freely.

The display sign shown in Figure 5 has an upper storage chamber 22 and a lower pressure chamber 33, but the latter opens into an otherwise closed space 39 between the walls 18, 37 and not into the space 21 as in the sign shown in Figure 4. When air or other fluid under pressure is intermittently supplied to the inlet 32 the diaphragm 18 will be moved towards and away from the glass window 16 to change the appearance of the display matter or to render it visible and invisible. In order to facilitate the movement of the diaphragm 18 in this construction and in those shown in Figures 3 and 4 the marginal portions of the diaphragm may be rendered readily flexible as by corrugations shown at 40. Alternatively, the diaphragm may be resiliently suspended in any convenient fluid tight manner, as by means of a marginal portion of india-rubber or other flexible material. The rear wall 37 is transparent and the display matter 46 is carried by an endless band 41 arranged round two rollers 42 which may be driven by any convenient mechanism to move the display matter across the line of vision through the window 16. This band 41 may be transparent, and electric lamps 43 may be arranged within it or at some other position so as to illuminate the display matter or parts of the sign surrounding the latter, for example, in some cases a lamp may be arranged in the chamber 22 to throw light downwards into the liquid screen in the space 21. A filter 44 may be arranged in the com-

partment 33 to prevent dust from collecting in the space 39. A mount 27 which may be a coat of paint as described hereinafter is preferably arranged so that only one section of the display matter 46 is visible through the window 16 at one time. A vent 28 is preferably provided in the compartment 22 to allow air to escape therefrom when the diaphragm 18 is flexed, but instead thereof this compartment may have a flexible wall to accommodate various quantities of liquid in it without causing undue pressure. In this construction the walls 18 and 37 enclosing the space 39 constituting an actuating chamber, designated generally 47, arranged to be subjected to air pressure, the diaphragm 18 being common to the two chambers 20 and 47 arranged one in front of the other. Instead of actuating this sign by fluid pressure it may be actuated by intermittently evacuating the actuating chamber 47 by means of a suction device connected to the outlet 32 of the chamber 33. Alternatively, a liquid which may be coloured may be used instead of a gas in the container 47 for flexing the diaphragm 18.

The sign shown in Figure 6 has an actuating chamber in the form of an expansible bag 48, for example an air-bag, arranged between the middle of the diaphragm 18 and a back wall 37 of the sign. This bag 48 may be operated by a gas or liquid by means of an india-rubber bulb 49 or other pressure or suction device connected with the bag by a tube 50 which may be provided with an audible signalling device, such as a whistle 51, to make a sound whenever the sign is operated. In order to distribute the pressure of the bag 48 evenly over the adjacent portion of the diaphragm 18 a sheet of rigid material, such as a piece of sheet aluminium 52 may be interposed between the diaphragm 18 and the bag 48. When the middle portion of the diaphragm 18 is flexed towards the window 16 other parts of the diaphragm will be flexed away therefrom to accommodate the displaced liquid. For filling the container 20 a filling plug 53 is provided.

Figure 7 shows a display sign comprising two containers 20 arranged one in front of the other with their diaphragms 18 placed back to back but spaced apart one from the other to provide a space 60 which may constitute or accommodate an expansible actuating chamber. As illustrated a bag 61, which may contain gas or liquid, has opposed walls each bearing against one of the diaphragms 18, and serves to vary the thickness of the liquid screens in the two containers in unison when the bag is expanded and allowed to contract by fluid pressure to which it is subjected by any convenient means. Each of the liquid spaces 21 opens above into a storage chamber 62 common to them both and having a vent 63. Display matter 26 may be

arranged on the diaphragms 18 or, if they are transparent, on the outside of the air-bag 61. Alternatively, the bag may be composed of transparent material as well as the diaphragm 18, in which case the display matter may be arranged inside the bag.

Instead of arranging two or more containers back to back or one in front of another as just described, a plurality of such containers 20 may be arranged one beside another, and means common to them all may be provided for varying the thickness of the liquid screens in unison, or in succession, or in groups.

In the display sign shown in Figure 8 a container consists of two circular transparent walls 65, 66 of flexible material having their marginal portions joined together to form a circular bag which when filled with liquid 67 constitutes a magnifying lens. As illustrated this bag has at the top a liquid supply tube 68 by which it is supported in the frame 15, and it is resiliently anchored at the bottom to the frame by one or more springs 69 to allow for its contraction and expansion when the quantity of liquid in it varies. Two sheets of glass 70, 71 may be arranged one at each side of the bag in the frame, and the display matter 72 may be carried on one or both windows 70, 71, or it may be placed at any convenient distance from the display sign so as to be viewed through it. The marginal portions of the wall 65, 66 of the bag are preferably corrugated, and mounts 27 may be arranged to hide such corrugations.

Figure 9 shows a display sign comprising a container 20 having behind it a closed actuating chamber 47 containing either a gas or liquid, the rear wall 37 of which actuating chamber is flexible, and carries a massive body 55 in the form of a metal weight. When such a sign is mounted on a movable support, such as a motor driven vehicle, and is arranged facing the direction of travel, the inertia of the weight 55 will serve to vary the pressure of the air in the actuating chamber 47 and thereby vary the thickness of the liquid screen in the space 21, when the rate of movement of the vehicle varies. For example, if the vehicle stops suddenly the weight 55 will move towards the liquid screen and reduce its thickness, and will subsequently move away from the screen, thereby changing the appearance of the sign.

Instead of or as well as using this weight 55 the wall 37 may be flexed by any convenient mechanical means, such as a cam 56 arranged to move it toward and away from the liquid screen.

Figure 10 shows a modified form of actuating device for operating the display sign under the action of fluid pressure varied by the inertia of a movable mass. In this construction the movable mass is a body of mercury 75 constituting a piston movable freely in a cylinder 76 in the form of a U-tube, and

a conduit 77 which may contain gas or a liquid serves to connect the cylinder 76 with the display sign. This actuating device may be used instead of any of the operating devices described above in an analogous manner.

In any of the constructions of display sign described above the whole or part of a diaphragm 18 opposed to a window 16, or display matter on the inner face of a diaphragm 18, may be coated with a self-luminous composition. In order to prevent the liquid on the sign freezing in cold weather an ingredient, such as glycerine, may be added to it for lowering the freezing point thereof.

Instead of an audible signalling device such as the whistle 51, Figure 6, being provided, a visible signalling device of a convenient construction, may be associated with the sign.

If it is desired for parts of the display matter in a sign to appear or disappear in advance of one or more other parts, the wall 18 of the container 20 opposed to the window 16 in any of the constructions described above, may be arranged not parallel to one another but at a small angle so that contact between the window and the opposed wall will be effected gradually along the height or length of the same. Alternatively, the wall 18 may be moulded or shaped for the same purpose, or display matter fixed to the said wall may vary in thickness.

Any of the display signs described above may be provided in front of the window with a coloured screen of transparent material, such as celluloid, as shown at 127 in Figure 5. Such a screen may have a coating of paint 27 on a face of its marginal portion to constitute a mount. Alternatively this mount may consist of cardboard or other sheet material.

Any convenient safety device, for example a valve, may be provided for the pressure or suction compartments referred to above to prevent undue pressures therein.

A reflector may be arranged in a display sign as described above so as to be visible through the window. For example, in the construction shown in Figure 3, part of the front face of the flexible wall 18 may constitute or be provided with a reflector.

These and various other modifications in the details of construction described above may be made without departing from the invention as defined in the claims.

I claim:

1. A method of operating display apparatus wherein a container that contains a liquid screen has a wall constituting a window through which the screen is visible, consisting in varying the thickness of the liquid screen in the container under the action of fluid pressure.

2. A method of operating display apparatus wherein a container has two opposed walls

with a liquid screen between them, one of which walls constitutes a window through which the screen is visible, and at least one of which walls is flexible, consisting in flexing a flexible wall of the container towards and away from its opposed wall under the action of fluid pressure and thereby varying the thickness of the liquid screen so as to change the appearance of the apparatus.

3. Display apparatus comprising a container having one wall constituting a window, and liquid constituting a screen situated in the container so as to be visible through the window, in combination with means operating by fluid pressure arranged to vary the amount of liquid situated in the line of vision through the window.

4. Display apparatus comprising a container having two opposed walls and a liquid screen between them, one of which walls constitutes a window and at least one of which walls is movable towards and away from the other wall, in combination with means operating by fluid pressure arranged to move a said movable wall towards and away from its opposed wall and thereby vary the thickness of the liquid screen.

5. Display apparatus comprising a container having two opposed walls and a liquid screen between them, one of which walls constitutes a window, and at least one of which walls is flexible and movable towards and away from the other wall, in combination with means operating by fluid pressure arranged to flex a said flexible wall towards and away from its opposed wall and thereby vary the thickness of the liquid screen.

6. In display apparatus of the character described, a container having two opposed walls spaced apart, a liquid screen between said walls, one of which walls constitutes a window, and one of which walls is flexible and movable towards and away from the other wall, and a storage compartment for supplying liquid to and receiving liquid from the space between said walls.

7. In display apparatus of the character described, a container having two opposed walls spaced apart, a liquid screen between said walls, one of which walls constitutes a window, and one of which walls is flexible and movable towards and away from the other wall, and a storage compartment for liquid opening into the space between said walls, which compartment has an inlet for connection to means for varying the fluid pressure in said compartment.

8. In display apparatus of the character described, a container having two opposed vertical walls spaced apart, a liquid screen between said walls, one of which walls constitutes a window, and one of which walls is movable towards and away from the other of said walls, and a storage compartment for liquid opening into the top of the space be-

tween said walls, and means operated by fluid pressure for moving the movable wall and thereby causing liquid to be supplied from said space to the storage chamber and reversely.

9. Display apparatus comprising in combination a container whereof one wall constitutes a window, and an opposed wall is movable towards and away therefrom, a liquid screen in the container between the opposed walls, and an actuating chamber operated by fluid pressure arranged to move said movable wall towards and away from the window.

10. Display apparatus comprising in combination a container whereof one wall constitutes a window, and an opposed wall is translucent, liquid constituting a screen occupying the space between said walls, and means operating by fluid pressure arranged to vary the amount of liquid situated in the line of vision through the window and said opposed wall.

11. Display apparatus comprising in combination a container, whereof one wall constitutes a window, and an opposed wall is translucent, liquid constituting a screen occupying the space between said walls, one of which walls is movable towards and away from the other, and an actuating chamber that has translucent walls situated in the line of vision through said opposed walls, and operated by fluid pressure, and is arranged to vary the thickness of said screen by moving the movable wall of the container.

12. Display apparatus comprising in combination a container, whereof one wall constitutes a window, and an opposed wall is translucent, liquid constituting a screen occupying the space between said walls, one of which walls is movable towards and away from the other, means operated by fluid pressure and arranged to vary the thickness of said screen by moving the movable wall of the container, and display matter mounted to move transversely across the line of vision through said window.

13. In display apparatus of the character described, a container having two opposed walls spaced apart, a tinted liquid screen between said walls, one of which walls constitutes a window, and one of which walls is movable towards and away from the opposed wall, and means operating by fluid pressure arranged to vary the thickness of said screen.

14. In display apparatus of the character described, a container having two opposed walls spaced apart, a tinted liquid screen between said walls, one of which walls constitutes a window, and one of which walls is movable towards and away from the opposed wall, means operating by fluid pressure arranged to vary the thickness of said screen, the wall opposed to said window having associated with it tinted display matter arranged to be viewed through said window,

the tint of which liquid is of a colour that contrasts with the colour of the display matter.

15. Display apparatus comprising in combination a container having one wall constituting a window, liquid that contains an ingredient for lowering the freezing point thereof, constituting a screen situated in the container so as to be visible through the window, and means operating by fluid pressure arranged to vary the amount of liquid situated in the line of vision through the window.

16. In display apparatus of the character described, a container having two opposed walls spaced apart, a liquid screen between said walls, one of which walls constitutes a window, and one of which walls is flexible and movable towards and away from the other wall, a storage compartment for liquid opening into the space between said walls, and means for intermittently reducing the fluid pressure in the space between said walls to below atmospheric pressure.

17. In display apparatus of the character described, a container having two opposed walls spaced apart, a liquid screen between said walls, one of which walls constitutes a window, and one of which walls is flexible and movable towards and away from the other wall, a storage compartment for liquid opening into the bottom of the space between said walls, and means for intermittently exerting fluid pressure on the liquid in said storage compartment and thereby intermittently moving the flexible wall towards and away from its opposed wall.

18. In display apparatus of the character described, a container having two opposed walls spaced apart, a liquid screen between said walls, which walls are both transparent and flexible and movable each towards and away from the opposed wall, and means operating by fluid pressure arranged to vary the amount of liquid situated in the line of vision through said walls, which container together with the liquid screen therein, constitutes a lens-like structure when its transparent opposed walls are caused to recede from one another.

19. In display apparatus of the character described, a container having two opposed walls spaced apart, a liquid screen between said walls, one of which walls constitutes a window, and one of which walls is movable towards and away from the opposed wall, the inner face of one of said walls having display matter composed of yielding material mounted on it and arranged to contact with the inner face of the other wall.

20. Display apparatus comprising a container having one wall constituting a window, and liquid constituting a screen situated in the container so as to be visible through the window, in combination with means operating by fluid pressure arranged to vary the amount of liquid situated in the line of

vision through the window, and an acoustic signalling device arranged to be actuated by the fluid pressure serving for varying the thickness of the liquid screen.

21. Display apparatus comprising in combination a plurality of containers arranged one in front of another and each having one wall constituting a window, and containing each a liquid screen situated so as to be visible through a window, in combination with means operating by fluid pressure common to said containers arranged between the same to vary the thickness of the liquid screens in the containers.

In testimony whereof I affix my signature.
GORDON AUGUSTUS WEARHAM.

70

75

80

85

90

95

100

105

110

115

120

125

130