

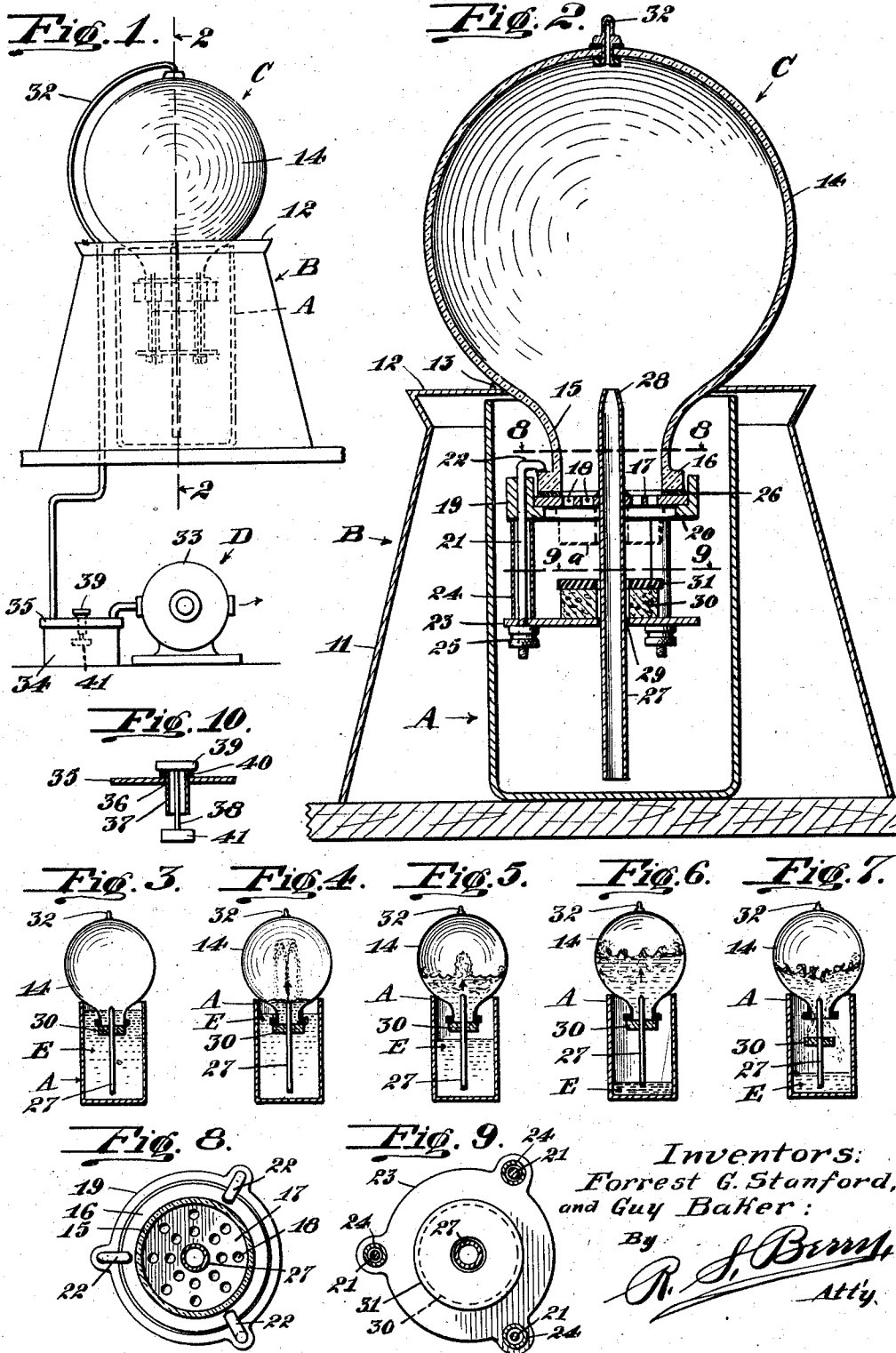
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LIQUID DISPLAY FOUNTAIN

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## UNITED STATES PATENT OFFICE

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## LIQUID-DISPLAY FOUNTAIN

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This invention relates to a liquid display apparatus of the type set forth in applications for United States Letters Patents Serial Number 237,415, filed December 3, 1927, 5 Serial Number 250,754, filed January 31, 1928, and Serial No. 303,947, filed September 4, 1928 and embodied in a copending application filed Sept. 9, 1929, Serial Number 391,444, which include a reservoir for a liquid to be displayed with which is associated 10 a transparent display container and a means whereby a liquid in the reservoir is caused to be delivered to the container from the reservoir and confined in said container for an interval and then be discharged therefrom, 15 and whereby the liquid while in the container will be subjected to agitation and maintained in a state of turbulence. The apparatus includes in its ensemble a float 20 valve for controlling accumulation of liquid in the container and its discharge therefrom by alternately closing and opening a downwardly extending mouth on the container.

25 An object of the present invention is to provide a guide mounting for the float valve associated with a seat for the valve adapted to be collectively affixed to the container, which is so constructed and arranged as to 30 insure proper seating of the valve and thereby effect a proper sealing action, and also afford a limitation of the movement of the valve.

Another object is to provide a liquid display apparatus in which a volume of liquid 35 contained in a reservoir may be caused to be ejected upwardly through a nozzle into a display container by the action of a continuous suction induced in the container by the continuous evacuation of air therefrom and 40 the liquid be caused to be intermittently redelivered from the display container to the reservoir.

Another object is to provide a liquid display apparatus in which the liquid accumulating 45 in the container will be maintained in a state of turbulence both during its delivery to the container and its discharge therefrom.

Another object is to provide a display ap-

paratus of the above character in which the timing of the inflow and outflow of the liquid relatively to the display container is automatically controlled by variations of liquid level in a reservoir so as to obviate the 55 employment of extraneous timing mechanism.

Another object is to provide an auxiliary reservoir for collecting overflow from the container including means operable to place 60 the display apparatus out of operation and thereby serve as a warning to attendants that the auxiliary reservoir requires emptying, thereby minimizing the possibility of loss of the display liquid by overflow of the auxiliary reservoir. 65

Another object is to provide a liquid display apparatus which is simple in construction and efficient in operation and which requires little or no attention and is not liable 70 to get out of order.

With the foregoing objects in view, together with such other objects and advantages as may subsequently appear, the invention resides in the parts and in the combination, 75 construction and arrangement of parts hereinafter described and claimed and illustrated by way of example in the accompanying drawings, in which:

Figure 1 is a view of the display apparatus as seen in side elevation showing the operating means in diagram; 80

Fig. 2 is a detail in section and elevation as seen on the line 2—2 of Fig. 1;

Figs. 3, 4, 5, 6 and 7 are diagrams illustrating the cycle of operation of the apparatus. 85

Fig. 8 is a horizontal section as viewed on the line 8—8 of Fig. 2;

Fig. 9 is a view in horizontal section as 90 seen on the line 9—9 of Fig. 2;

Fig. 10 is a detail in section taken on the line 10—10 of Fig. 1.

Referring to the drawings more specifically, A indicates a reservoir for containing a 95 liquid to be displayed, B designates a housing enclosing the reservoir, C denotes a display container associated with the reservoir A, and D indicates an actuator.

The reservoir A is here shown as compris- 100

ing a jar which is open at its upper end, and the housing B is shown as embodying side walls 11 supporting a top wall 12 having an opening 13 arranged over the open upper end of the reservoir. The display container C embodies a transparent or semi-transparent globular body 14 having a neck portion 15 and which container is inverted over the reservoir A with the neck portion 15 projecting through the opening 13 and into the reservoir; the container seating on the margin of the opening 13 in the housing top wall 12 and the mouth of the neck 15 opening downwardly into the reservoir.

Formed on the end of the neck 15 is an outwardly projecting marginal flange 16 and extending over the mouth or open end of the neck 15 is a plate 17 formed with a plurality of apertures 18; the plate 17 being secured in place by means of a clamp including an annulus 19 which encircles the plate 17 and has an intumed flange 20 arranged to bear against the under side of the plate 17; the annulus 19 being secured to the neck 15 by means of a series of clamps each of which includes a stem 21 which passes through the annulus 19 and has an intumed upper end portion 22 which projects over and seats on the upper faces of the flange 16.

The lower end of the stem 21 passes through a disk 23 spaced below the plate 17 and held in spaced relation thereto by spacing tubes 24 which encircle the stems 21; the lower end portions of the stems 21 being threaded and having nuts 25 screwed thereon whereby the plate 17, annulus 19, disk 23 and spacers 24 may be clamped together and to the container C with the plate 17 seating on a gasket 26 interposed between the upper face of the plate and the end margin of the neck 15.

Projecting centrally through the plate 17 and affixed to the latter is an open ended tube 27, the upper end of which projects into the container C and is converged into a nozzle 28 opening to the interior of the container; the lower end portion of the tube projecting downwardly below the disk 23 which disk is formed with an opening 29 to receive the tube 27. The lower end of the tube 27 terminates and opens adjacent the bottom of the reservoir A.

Encircling the portion of the tube 27 extending between the disk 23 and the apertured plate 17 is an annular float 30 formed of cork or other suitable buoyant material, the upper surface of which is faced with a resilient pad 31 preferably formed of rubber or rubber composition, which pad is adapted, when the float is in an uppermost position, to seat on the under side of the plate 17 as indicated in dotted lines *a* in Fig. 2 and thereby effect closing of the apertures 18. The plate 17 constitutes a valve seat, the float 30 with the pad 31 constitutes a valve cooperating with the seat, the tube 27 con-

stitutes a guide for the valve in directing it to and from its seat, and the disk 23 serves as a stop to limit downward movement of the valve.

Leading from the upper portion of the container C and opening to the interior of the latter is an air conduit 32 which communicates with the intake side of a pump 33 constituting the actuator D; this pump being of a conventional rotary type and embodying a rotor, not shown, operable to effect evacuation of air from the container C to create a partial vacuum in the latter.

As a means for collecting any overflow of liquid or vapors from the container C, an auxiliary reservoir 34 is interposed between the container C and the pump 33; the conduit 32 having a section which leads from the container C and opens through a cap 35 sealing the reservoir 34 and having another section which affords a communication between the jar 34 and the intake of the pump through the cap 35. The cap 35 is formed with an opening 36 from which downwardly extends a tube 37 opening to the interior of the reservoir 34, and extending through the tube 37 is a stem 38 on the upper end of which is a valve head 39 adapted to seat on a gasket 40 surrounding the margin of the opening 36 to normally close said opening. A float 41 is mounted on the lower end of the stem within the reservoir 34 and is adapted to be lifted by accumulation of liquid in the reservoir to effect lifting of the valve head 39 to uncover the opening 36.

In the operation of the invention, the reservoir A is filled with a liquid E to a level above the mouth of the container C which normally disposes the float valve 30 in its seated position against the under side of the plate 17 to close communication between the container and reservoir as shown in Fig. 3. By placing the pump 33 in operation it acts to effect continuous evacuation of air from the container C through the conduit 32 thus setting up a continuous suction in the latter which will operate to initially draw liquid from the reservoir A upwardly through the tube 27 and to induct it into the container C through the nozzle 28 in the form of a fountain as shown in Fig. 4. The partial vacuum created in the container C by the evacuation of air therefrom is such as to hold the float 30 against the under side of the plate 17 until the level of the liquid in the reservoir A falls below the lower end of the tube 27 and thereby open the latter to atmosphere and thus break the vacuum in the container.

The liquid flowing into the container rises in the latter over the discharge end of the nozzle 28 so that the incoming stream will then be caused to pass through the body of liquid in the container so that the incoming stream of the liquid will be projected through and above the rising level of the liquid in the

container as shown in Fig. 5. This incoming stream maintains the liquid in the container under a state of highly active turbulence, the incoming stream flowing continuously into the container until the liquid in the reservoir falls to a point adjacent the lower end of the tube 27 as shown in Fig. 6, whereupon air will be drawn through the tube 27 and through the volume of liquid in the container so as to break the partial vacuum in the latter whereupon the weight of the accumulated liquid in the container will cause the float to move downwardly and thereby open the apertures 18 so that the volume of liquid in the container will flow through the apertures back into the reservoir as shown in Fig. 7.

During this back flow of the liquid the suction induced in the container by the pump 33 draws air from the reservoir through the openings 18 counter to the down flowing liquid thereby maintaining the diminishing volume of liquid in the container under a high state of continuous agitation. The perforated plate serves to retard discharge of liquid from the container.

The liquid flowing back into the reservoir as it rises therein will act to re-elevate the float 30 to its container sealing position as shown in Fig. 3 whereupon the cycle of operation is repeated. During this operation such vapors or liquid as may be drawn off from the container C through the conduit 32 will be collected in the auxiliary reservoir 34 and when such overflow liquid accumulates in the reservoir 34 sufficiently to lift the float 31, the valve head 39 will be lifted so as to uncover the opening 36 and thereby open the conduit 32 to the atmosphere thus terminating evacuation of air from the container and placing the display element out of operation. This serves to prevent overflow of the auxiliary reservoir as it terminates the drawing off of vapors from the container and necessitates emptying of this reservoir in order to restore the apparatus to an operating condition. The auxiliary reservoir 34 also serves as a trap to prevent the overflow liquid from the container C from being drawn into the pump 33.

The discontinuance of the operation of the display element serves as a tell-tale to indicate to an attendant that the auxiliary reservoir requires emptying.

By mounting the tube 27, float valve and its seat directly on the lower end of the container C and guiding the float valve on the tube as here set forth, proper seating of the valve and closing of the container outlet is insured, and a simple and easily installed mounting of the valve, seat and guide is afforded.

We claim:

1. In a liquid display apparatus, a liquid reservoir, a display container having a down-

wardly opening neck projecting into said reservoir, means for maintaining air pressure in said container less than air pressure externally thereof, a tube leading from said reservoir into said container, a valve seat on the end of said neck surrounding said tube, a float valve guided on said tube, and a stop limiting downward movement of said float valve carried on said container.

2. In a liquid display apparatus, a liquid reservoir, a display container having a downwardly opening neck projecting into said reservoir, means for maintaining air pressure in said container less than air pressure externally thereof, a valve seat carried on the end of said neck, a tube affixed to said seat projecting upwardly into said container and projecting downwardly into said reservoir, a clamp detachably holding said seat on said neck, and a float valve guided on said tube.

3. In a liquid display apparatus, a liquid reservoir, a display container having a downwardly opening neck projecting into said reservoir, means for maintaining air pressure in said container less than air pressure externally thereof, a valve seat carried on the end of said neck, a tube affixed to said seat projecting upwardly into said container and projecting downwardly into said reservoir, a clamp detachably holding said seat on said neck, a float valve guided on said tube, and a stop engaged by said clamp spaced below said valve seat for limiting downward movement of said float valve.

4. In a liquid display apparatus, a liquid reservoir, a display container having a downwardly opening neck leading into said reservoir, means for maintaining air pressure in said container less than air pressure externally thereof, a flange on said neck, an apertured plate extending over the open end of said neck, a tube affixed to said plate extending therethrough opening upwardly into said container and opening downwardly into said reservoir, a clamp engaging said flange demountably affixing said plate to said container, and a float valve guided on said tube beneath said plate.

5. In a liquid display apparatus, a liquid reservoir, a display container having a downwardly opening neck leading into said reservoir, means for maintaining air pressure in said container less than air pressure externally thereof, a flange on said neck, an apertured plate extending over the open end of said neck, a tube affixed to said plate extending therethrough opening upwardly into said container and opening downwardly into said reservoir, a clamp engaging said flange demountably affixing said plate to said container, a float valve guided on said tube beneath said plate, and a stop engaged by said clamp for limiting downward movement of said float valve.

6. In a liquid display apparatus, a liquid

reservoir, a display container having a downwardly opening neck projecting into said reservoir formed with a marginal flange, means for maintaining air pressure in said container less than air pressure externally thereof, an apertured plate extending over the opening of said neck, a ring encircling said plate having a flange projecting therebeneath, a disk spaced below said plate, spacing tubes interposed between said plate and disk, stems projecting through said tubes and through said plate and disk having intumed upper ends engaging said flange, nuts screwed on said stems, said stems and nuts operable to clamp said plate and disk in spaced relation and to detachably secure them to said container, a tube leading through said plate and disk opening upwardly into said container and opening downwardly into said reservoir, and a float valve guided on said tube between said plate and disk.

7. In a liquid display apparatus, a liquid reservoir, a display container having a downwardly opening neck projecting into said reservoir formed with a marginal flange, means for maintaining air pressure in said container less than air pressure externally thereof, an apertured plate extending over the opening of said neck, a ring encircling said plate having a flange projecting therebeneath, a disk spaced below said plate, spacing tubes interposed between said plate and disk, stems projecting through said tubes and through said plate and disk having intumed upper ends engaging said flange, nuts screwed on said stems, said stems and nuts operable to clamp said plate and disk in spaced relation and to detachably secure them to said container, a tube leading through said plate and disk opening upwardly into said container and opening downwardly into said reservoir, and a float valve guided on said tube between said plate and disk, said tube being affixed to and carried by said apertured plate.

8. In a liquid display apparatus, a liquid reservoir, a display container having a downwardly opening neck leading into said reservoir, a tube leading from said reservoir upwardly into said container, a valve seat on said neck, a float valve guided on said tube operable by liquid in said reservoir to seat on said valve seat and then close communication between said reservoir and said container, and means for effecting continuous evacuation of air from said container.

9. In a liquid display apparatus, a liquid reservoir, a display container having a downwardly opening neck leading into said reservoir, a tube leading from said reservoir upwardly into said container, a valve seat on said neck, a float valve guided on said tube operable by liquid in said reservoir to seat on said valve seat and then close communication between said reservoir and said container, a conduit leading from said container,

an air evacuating pump having an intake with which said conduit connects, said pump and conduit serving as a means for effecting continuous evacuating of air from said container, and an auxiliary reservoir interposed in said conduit for receiving liquid drawn off from said container by said pump.

10. In a liquid display apparatus, a liquid reservoir, a display container having a downwardly opening neck leading into said reservoir, a tube leading from said reservoir upwardly into said container, a valve seat on said neck, a float valve guided on said tube operable by liquid in said reservoir to seat on said valve seat and then close communication between said reservoir and said container, a conduit leading from said container, an air evacuating pump having an intake with which said conduit connects, said pump and conduit serving as a means for effecting continuous evacuating of air from said container, an auxiliary reservoir interposed in said conduit for receiving liquid drawn off from said container by said pump, and means for interrupting evacuation of air from said container actuated by accumulated liquid in said auxiliary reservoir.

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