ABSTRACT: In a copying machine, a combined disposable shipping container and dispensing tray for a processing liquid. The container has a concavity in one of its sidewalls which forms the dispensing tray for the processing liquid. The concave sidewall is punctured by a pump arrangement which supplies the processing liquid to the dispensing tray from the interior of the container. The container has raised end walls interconnected with the concave sidewall for preventing the escape of processing liquid from the dispensing tray.
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COMBINED LIQUID CONTAINER AND DISPENSING MEANS

This invention relates in general to a combined storage receptacle and dispensing device for liquids, and, more particularly, to a container construction and related apparatus for supplying developing liquids and dispensing the same in an electrostatic copying machine or the like.

In conventional copying machine serious difficulties have been encountered where the handling of a liquid developer is required. In some instances, the developer is supplied in concentrated or other unmixed form, and an intricate and messy mixing operation must be performed. Further, there is the problem of filling the machine, typically by pouring from an oversized shipping container. In many instances the liquid developer is received in a reservoir within the machine and must pass through a pump for delivery to the dispensing tray and the liquid tends to deteriorate under the influence of the heat generated by the pump. In any event, all machines of this general type require the operator to remove and empty the dispensing tray regularly. This cumbersome and unpleasant task, involving disassembly, emptying, thorough cleaning and refilling, is often neglected and the quality of the copies automatically suffers. The foregoing disadvantages have been held directly responsible for the failure of liquid-type copying machines to compete favorably with those employing a dry process.

It is therefore a primary object of the present invention to provide a convenient means for supplying liquid developer to the user on an economical basis, wherein the supply container itself and its associated apparatus provide the user with a convenient dispensing tray and means for maintaining the liquid level of developer therein.

A related object is to eliminate the spillage and inconvenience normally attendant to maintenance of a liquid-type developer of copying machine.

A further object is to provide dispensing apparatus for developer solutions and the like, wherein a dispensing tray is automatically filled with the solution as soon as the machine is turned on, is maintained at the proper level while the machine is in operation, and is drained from the dispensing tray as soon as the machine is turned off.

Another object is to provide means for maintaining a constant supply of developer fluid in an electrostatic copying machine or the like without requiring the operator to transfer liquid from one receptacle to another by hand, without requiring elaborate disassembly, cleaning, and reassembly steps when the liquid is changed, and without requiring the liquid itself to be transferred directly through a pump from the reservoir to the liquid dispensing tray.

Still another object is to provide apparatus for handling liquid developer employed in copying machines or the like, wherein a minimum of time and effort is required to effect a change of the liquid and wherein this operation can be performed with a minimum of skill and without the dangers of heat generated waste.

Other objects and advantages will be apparent from the following description when read in conjunction with the accompanying drawings, in which:

FIG. 1 is a fragmentary top view illustrating an apparatus which incorporates the principles of the present invention.

FIG. 2 is a sectional view taken on the line 2-2 of FIG. 1.

FIG. 3 is an enlarged fragmentary section taken on the line 3-3 of FIG. 2.

FIG. 4 is an enlarged sectional view taken on the line 4-4 of FIG. 1, the device being shown here in operating position.

FIG. 5 is a further enlarged sectional view taken on the line 5-5 of FIG. 4, and

FIG. 6 is a sectional view taken on the line 6-6 of FIG. 5.

Referring now more specifically to the drawings, the invention comprises a receptacle or container generally indicated by the numeral 1, which is in the nature of a bottle. The receptacle is preferably formed integrally of a plastic material such as polyethylene and includes a bottom 3, sidewalks 4 and 5, end walls 6 and 7, and a top 8. As shown in FIG. 1, top wall 8 is provided with a neck portion 9, which may be screw-threaded or otherwise adapted to receive a cap number 11 thereon. When the container 1 is laid on its side in the manner shown in the drawings the sidewall 4 is uppermost and this sidewall is deformed to provide a concavity 12. The concavity 12 is generally arculate in cross section, as best shown in FIG. 2, and extends across substantially the entire face of the upper sidewall 4. Preferably a plurality of transverse ribs 13 is integrally formed on the upper surface of sidewall 4 to serve as a guide means for copy sheets passing thereover in a manner to be described hereinafter.

It is intended that the container 1 be filled and capped in the normal manner and a plurality of containers can be packaged in conventional cartons, with the capped top walls 8 directed upwardly, for delivery to the user. Only a minimum of shipping space is lost by the provision of the concavities 12.

In use a container 1 of fresh liquid developer is laid on its lower sidewall 5 and is inserted through a suitable opening, not shown, in a side end or the copy machine. Sidewall 5 of the receptacle may be supported directly on the bottom wall 15 of the copy machine and the lower portion including bottom wall 3 is preferably received beneath a supporting flange 16. A lever arm 17 pivotally mounted on the supporting flange 16 and having a handle 21 serves to suspend a piercing tube 19 vertically disposed in a central position over the adjacent end of upper sidewall 4. The lower extremity of piercing tube 19 is provided with a sharply beveled edge 20 whereby depression of the handle 21 or other control mechanism linked to lever 17 effects a piercing of the top of wall 4 and the lower end mounted of tube 19 is inserted therethrough (see FIG. 4). In this operation the adjacent edges of wall 4 at the aperture formed by the piercing tube tend to closely surround the tube and form an effective seal along the periphery thereof, as shown at 21a in FIG. 4.

The piercing tube 19 has its upper portion bent at right angles in the form of an elbow 22 and the outer end thereof is connected to a conventional air pump 23, as by a flexible tube 24. The pump 23 may be of any suitable type having power sufficient to generate a small amount of pressure within the container 1 by communication through the tube 19. A miniatu re pump of the type normally employed for aerating home aquariums has been sufficient for this purpose.

As shown in FIG. 5, the lower end of tube 19 is provided with ports 25 immediately above its beveled edge 20, and in operating position these ports are disposed closely adjacent the bottom of the dispensing tray formed by concavity 12. A plug member 26 is fixed in the lower portion of tube 19 and is provided with two vertical passages 27 and 28 therethrough. Passage 27 serves to communicate air under pressure from the tube 19 into the container 1, through the opening formed in upper sidewall 4 by the beveled edges 20.

A vertical liquid transfer tube 29 is telescopically received in the tube 19, being slidably mounted in passage 28. Tube 29 is provided with a cap 30 at the upper end thereof which shuts the upper surface of plug 26 to serve as a stop member when the tube 29 is in its extended or operational position, as shown in FIGS. 4 and 5. A light spring 31 extends between the elbow 20 and the cap 30 to yieldably urge tube 29 into its extended position, one end being secured by any suitable means at the elbow and the other end being preferably received in a recess 32 provided on the upper surface of cap 30. A port 33 is provided in the tube 29 for registration with a periphery of passage 28. Passage 25 is provided on the plug 26 and communication through port 25 to the dispensing tray provided by concavity 12. In actual use it will be seen that the liquid transfer tube 29 may be moved into retracted position prior to the piercing of upper sidewall 4, but will automatically adjust to its extended position of operation after an opening has been provided therethrough.

A float generally indicated by the numeral 35 is slidably mounted on the tube 19. Float 35 may be formed at expanded polystyrene material or the like and includes an upper portion
36 telescopically mounted on the tube 19 by means of a closely fitting internal bearing sleeve 37 formed of nylon or the like. An annular body portion 38 is suspended below the portion 36 and in spaced surrounding relation with respect to the tube 19, as by an integral depending annular, skirt portion 39.

When the float 35 is in its lowermost position, at or near the bottom of the dispensing tray provided by upper sidewall 4, the air pressure generated by pump 23 is delivered directly to the interior of container 1 through the port 27. This pressure forces liquid developer upwardly through tube 29 and through ports 33 and 25 into the bottom of the dispensing tray. As the liquid level in the tray rises, the float 35 is raised until venting ports 40 provided in tube 19 are uncovered to release the air pressure within container 1, and the air is successively vented through appropriate ports 41 provided in the skirt portion 39 of the float. As the air pressure is thus vented through ports 40 and 41, liquid immediately tends to drain back into the container 1 through ports 25 and 33 until the port 40 is again covered by the bearing sleeve 37 and the pressure on the liquid within the container is reinstated. Accordingly, a delicate equilibrium is established at the desired level and is maintained there with barely noticeable fluctuations until the air pump is deactivated, preferably by operation of the main on-off switch which controls the operation of the machine itself. At this point, of course, the pressure within the container 1 is eliminated and the liquid within the tray drains back into the container to be stored until the machine is again put into operation. It will be understood that when the dispensing tray provided by concavity 12 is filled to the desired level, the processing of copy sheets can be accomplished in the normal manner. As shown in phantom lines in FIG. 2, each copy sheet 42 is introduced at one side of the dispensing tray and is drawn through the liquid developer by rollers 43 at the other side.

It will be seen that after one supply of developing fluid has become exhausted, it is a relatively simple matter to replace the container 1. The lever 17 is simply raised to withdraw the tube 19 and the container can readily be removed and replaced by a new one with a fresh supply. The original container can simply be emptied of any remaining liquid and disposed of.

While one specific embodiment and manner of use has been described herein above, it will be readily appreciated that numerous modifications and alterations may be made in the construction, design, and operation without departing from the spirit of the invention of the scope of the annexed claims.

We claim:
1. Apparatus for use in a copying machine, comprising:
a. a container for a processing liquid, said container being formed with an external concavity in one wall thereof having a cylindrical bottom surface adapted to serve as a dispensing tray when said container is positioned in said machine, with said one wall facing upwardly;
b. means defining a liquid passageway between said container and the bottom of said concavity; and,
c. means for moving said liquid from said container into said concavity.

2. The apparatus as defined in claim 1 wherein said means for moving said liquid comprises an air pump removably connected with said container and capable of building up sufficient pressure within said container to force liquid through said passageway into said concavity.

3. The apparatus as defined in claim 1 wherein liquid level means are provided to maintain the liquid at a predetermined level within said dispensing tray.

4. In a copying machine:
a. a disposable container for a processing liquid, said container being sealed for shipping before use in said machine and being formed with an external cylindrical concavity in one wall thereof;
b. opening and support means removably supporting said container in said machine with said concavity facing upwardly, whereby said concavity defines a liquid tray; and
c. means defining a liquid passageway between the bottom of said concavity and the interior of said container;

d. an air pump;

e. a tube connected to said pump and having a beveled extremity;
f. means for moving said tube into an operative position to penetrate said one wall;
g. said container being formed of a material adapted to establish a sealed connection with said tube beveled extremity in said operative position;
h. and means for operating said pump to build up pressure within said container, whereby liquid is transferred from said container to said tray through said passageway and drains from said tray into said container in the absence of pressure.

5. In a copying machine:
a. a disposable container for a processing liquid, said container being sealed for shipping before use in said machine and being formed with an external concavity in one wall thereof;
b. opening and support means for removably inserting said container into said machine with said concavity facing upwardly, whereby said concavity defines a liquid tray;
c. a pump;
d. a first tube positioned above said one wall connected to said pump;
e. means for axially moving said tube to penetrate said inserted container to establish a sealed connection therewith;
f. a second tube contained in said first tube and telescopically slidable to a position adjacent to the wall of said container opposite to said one wall, said second tube having openings cooperating in said position with openings in said first tube for establishing communication between said second tube and said tray; and
g. means for operating said pump, whereby liquid is transferred from said inserted container into said tray through said second tube.

6. In a copying machine:
a. a receptacle for storing processing liquid;
b. means generally above said receptacle defining a tray for dispensing said liquid;
c. means defining a fluid passageway between said tray and said receptacle;
d. an air pump connected to said receptacle and operable to establish pressure within said receptacle to force liquid therefrom through said passageway into said tray;
e. said passageway being arranged to drain liquid by gravity from said try into said receptacle in the absence of said pressure within said receptacle;
f. a float element movable to a position corresponding to the level of liquid within said tray; and
g. vent means connected to said receptacle and operative in response to said float element moving beyond a predetermined position.

7. In a copying machine:
a. a receptacle for storing processing liquid;
b. means generally above said receptacle defining a tray for dispensing said liquid;
c. means defining a fluid passageway between said tray and said receptacle;
d. a tube vertically extending through said tray into said receptacle;
e. an air pump connected to said tube and operable to establish pressure within said receptacle to force liquid therefrom through said passageway into said tray;
f. said passageway being arranged to drain liquid by gravity from said try into said receptacle in the absence of said pressure within said receptacle;
g. a float element slidable mounted on said tube and movable to a position corresponding to the level of liquid within said tray;
h. a venting port in the wall of said tube; and
i. said port being covered by said float element when said float element is in a position lower than a predetermined position and uncovered when said float element is in a higher position.
8. In a copying machine:
   a. a receptacle formed of substantially rigid walls for storing processing liquid;
   b. means generally above said receptacle defining a tray for dispensing said liquid;
   c. means defining a fluid passageway between said tray and said receptacle;
   d. an air pump connected to said receptacle for creating pressure within said receptacle to force liquid therefrom through said passageway into said tray; and
   e. said passageway being arranged to drain liquid by gravity from said tray into said receptacle in the absence of an overriding pressure within said receptacle.

9. For use in a copying machine, a combined shipping container and disposable dispensing tray for a processing liquid comprising a receptacle having a pair of sidewalls, one of said sidewalls having a deformed portion defining a depression therein disposed between the opposite end portions of said sidewall and adapted to serve as a liquid-containing tray, said depression being formed to define an external cylindrical concavity extending longitudinally between said end portions across substantially the entire surface of said sidewall with the space within said depression being confined at either end thereof by raised walls extending transversely, with respect to the axis of said concavity and interconnecting said deformed portion with said end portions to prevent the escape of liquid from the ends of said concavity, at least a part of said concavity being formed of a material adapted to be punctured to place said tray in communication with the interior of said receptacle.

10. A combined container and receptacle as defined in claim 9 wherein said container is formed integrally with said dispensing tray and is of plastic material substantially rectangular in configuration having filling and capping means provided at the top thereof, said one sidewall being generally arculate in cross section.

11. A construction as defined in claim 10 wherein a plurality of raised external guide ribs are provided in parallel relation across the external surface of said one sidewall for guiding sheet material through said tray.

12. In a copying machine:
   a. a disposable container for a processing liquid, said container being formed with an external concavity in one wall thereof;
   b. opening and support means for removably inserting said container into said machine with said concavity facing upwardly, whereby said concavity defines a liquid tray;
   c. a pump;
   d. a tube connected to said pump and having a beveled extremity;
   e. means for moving said tube to penetrate the bottom of said concavity; and
   f. means for operating said pump to transfer liquid from said inserted container into said tray.

13. In a copying machine:
   a. a receptacle formed of substantially rigid walls for storing processing liquid;
   b. means generally above said receptacle and integrally formed with one wall thereof defining a tray for dispensing said liquid;
   c. means defining a fluid passageway between said tray and said receptacle; tray; and
   d. an air pump connected to said receptacle for creating pressure within said receptacle to force liquid therefrom through said passageway into said tray;
   e. said passageway being arranged to drain liquid by gravity from said tray into said receptacle in the absence of an overriding pressure within said receptacle.