A liquid pickup assembly for retrieving liquid stored in a container for delivery to an associated liquid dispensing apparatus. The assembly may have three embodiments: a rigid section (112) and a flexible section (114), a section of rigid tubing (218) and a flexible joint (220), and a tiltable or bendable tube (312, 314). Another embodiment of the device allows for the spray head (12) to be attached by a ball and socket joint (14) to the container (16) to enable angular orientation. The three pickup tube assemblies all allow the tubes to bend. Thus, enabling the pickup assemblies to operate even at nearly depleted levels of liquid. Weights (50, 124, 230) may be attached to the ends of the pickup tubes (46, 110, 216, 310) to ensure that the end always stays submerged in the liquid (L), regardless of the position the container (16, 104, 214, 304) is in.
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TITLE OF THE INVENTION

LIQUID PICKUP COMPONENTS FOR DISPENSING DEVICES

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FIELD OF THE INVENTION

The present invention relates to a spray bottle having a spray head which swivels with respect to the bottle, and a flexible, weighted pickup enabling inverted operation of the spray bottle.

Further, the present invention relates to liquid pickup devices for retrieving liquid stored in a container and delivering this liquid to an associated liquid dispensing apparatus. The novel pickup device, a hose assembly, works with sprayers, nozzles, and other dispensing apparatus.

The present invention also relates to a liquid dispenser, such as a sprayer, having an improved pickup device for retrieving liquid stored in a liquid dispenser container.

In addition, the present application relates to liquid dispensing devices, particularly spray bottles having pump actuators and aerosol liquid dispensers.

BACKGROUND OF THE INVENTION

RELATING TO FIRST EMBODIMENTS:

Attempts to provide a spray dispenser having selectively variable nozzle angles are known, as exemplified by U.S. Pat. Nos. 3,921,912, issued to Jerry R. Hayes on November 25, 1975 and 4,035,004, issued to Robert W. Hengesbach on July 12, 1977, and West German Pat. Application No. 2,236,368, published on February 8, 1973. The Hayes patent discloses a nozzle attached to a lawn sprinkler by a ball type swivel joint through which a liquid flows. The sprinkler does not provide pump means, relying on water pressure. Also, the sprinkler is intended for connection to a hose or other pressurized source of water, and no receptacle is provided. The patent to Hengesbach and the German reference disclose elongated nozzle structures used in association with spray apparatus projecting from a pressurized receptacle.
Hengesbach provides a multi-segment joint connecting a liquid receptacle to a spray gun connected to pressurized air. The multi-segment joint includes a plurality of ball joints arranged in series, a flexible tube conducting liquid from ball to ball. The advantage afforded by this invention is to enable variable orientation of the spray gun while maintaining the receptacle in an upright orientation.

The German reference discloses a receptacle having an elongated discharge tube which, when stowed, is disposed adjacent and parallel to a substantially cylindrical pressurized liquid receptacle. The tube swings upwardly to a deployed orientation normal to its stowed orientation.

Spray apparatus having pickup means within the receptacle capable of collecting liquid regardless of receptacle attitude with respect to upright orientation is seen in the following patents. U.S. Pat. No. 3,490,656, issued on January 20, 1970 to Kenneth A. Taschner and U.K. Pat. Application No. 2,136,057, published on September 12, 1984, both provide flexible pickup tubes having weights attached at the pickup end. As the weight seeks a level below the liquid level, the tube flexes to accommodate each succeeding weight location. U.S. Pat. No. 5,119,974, issued to Frederick J. Mann on June 9, 1992, provides two pickup points, one being operable and the other inoperable given any one receptacle attitude with respect to upright orientation.

U.S. Patent No. 4,958,754, issued to Stephen R. Dennis on September 25, 1990, discloses a typical manually operated spray head which ejects pressurized liquid in spray form, and pumps air into a receptacle to maintain atmospheric pressure on liquid remaining in the receptacle.

None of the above inventions and patents, taken either singularly or in connection, is seen to describe the instant invention as claimed.

RELATING TO SECOND EMBODIMENTS:

The prior art has addressed a need to have the pickup end of a pickup tube track a low point within a liquid reservoir, which low point migrates about the bottom of a container as the container is tipped.
U.S. Pat. No. 3,490,656, issued to Kenneth A. Taschner on January 20, 1970, discloses a pickup tube for use in spray dispensing apparatus employing compressed gas propellant. The pickup tube is flexible along its entire length, and includes a weighted pickup terminal end.

U.K. Pat. Application No. 2,136,057A, published on September 12, 1984, shows a pickup tube providing similar function to that of Taschner. The U.K. reference discloses tube structure comprising series connected, hollow compartments communicating through common openings. Each compartment has an expanded center portion and a constricted waist, each waist being common to adjacent compartments. Flexure at the waists is cumulative, the result being that a length including a plurality of compartments enables considerable being capability. Thus, the pickup tube of the U.K. reference achieves bending even though the tube is not highly flexible along a continuous length, as is provided in Taschner. The U.K. reference also discloses a weight disposed at the pickup end of the tube.

U.S. Pat. No. 5,119,974, issued to Frederick J. Mann, on June 9, 1992, discloses a pickup tube selectively from a high or low location within the container, dependent upon the upright orientation thereof.

None of the above inventions and patents, taken either singly or in combination, is seen to describe the instant invention as claimed.

RELATING TO THIRD EMBODIMENTS:

The prior art has addressed a need to have the pickup end of a pickup tube track a low point within a liquid reservoir, which low point migrates about the bottom of a container as the container is tipped.

U.S. Pat. No. 3,490,656, issued to Kenneth A. Taschner on January 20, 1970, discloses a pickup tube for use in spray dispensing apparatus employing compressed gas propellant. The pickup tube is flexible along its entire length, and includes a weighted pickup terminal end.

U.K. Pat. Application No. 2,136,057A, published on September 12, 1984, shows a pickup tube providing similar function to that of Taschner. The U.K. reference discloses tube structure
comprising series connected, hollow compartments communicating through common openings. Each compartment has an expanded center portion and a constricted waist, each waist being common to adjacent compartments. Flexure at the waists is cumulative, the result being that a length including a plurality of compartments enables considerable bending ability. Thus, the pickup tube of the U.K. reference achieves bending even though the tube is not highly flexible along a continuous length, as is provided in Taschner. The U.K. reference also discloses a weight disposed at the pickup end of the tube.

U.S. Pat. No. 5,119,974, issued to Frederick J. Mann on June 9, 1992, discloses a pickup tube selectively drawing liquid from a container for subsequent dispensing selectively from a high or low location within the container, dependent upon the upright orientation thereof.

None of the above inventions and patents, taken either singly or in combination, is seen to describe the instant invention as claimed.

RELATING TO FOURTH EMBODIMENTS:

The prior art has addressed a need to have the pickup end of a pickup tube track a low point within a liquid reservoir, which low point migrates about the bottom of a container as the container is tipped.

U.S. Patent No. 3,490,656, issued to Kenneth A. Taschner on January 20, 1970, discloses a pickup tube for use in spray dispensing apparatus employing compressed gas propellant. The pickup tube is flexible along its entire length, and includes a weighted pickup terminal end.

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the tube is not highly flexible along a continuous wall thickness length, as is provided in Taschner. The U.K. reference also discloses a weight disposed at the pickup end of the tube.

U.S. Pat. No. 5,119,974, issued to Fredrick J. Mann on June 9, 1992, discloses a pickup tube selectively drawing liquid from a container for subsequent dispensing selectively from a high or low location within the container, dependent upon the upright orientation thereof.

None of the above inventions and patents, taken either singly or in combination, is seen to describe the instant invention as claimed.

SUMMARY OF THE INVENTION

RELATING TO FIRST EMBODIMENTS:

The present invention provides a spraying apparatus comprising spray head and receptacle, the spray head of which can assume selectively variable angularity with the receptacle, the apparatus further being able to deliver liquid to the spray head at any attitude with respect to upright orientation. A ball type swivel joint has two passages therethrough, one for liquid flowing from the receptacle into the spray head, the other enabling air to pass into the receptacle. Pressure is exerted upon a conventional piston pump by section, and pressurizes air flowing into the receptacle.

The swivel joint flexes, enabling angularity of the spray head while preserving necessary communication of the liquid and air passages with their respective connection points in the spray head.

A flexible pickup hose has a weight to insure immersion of the pickup end in liquid held within the receptacle. The pickup hose may be highly flexible along its length, or may be substantially rigid, there being a short, flexible section providing a flex joint.

Accordingly, it is a principal object of the invention to provide a flexible joint between a spray head and its associated liquid storage receptacle, enabling selectively variable spray head orientation with respect to the receptacle.
It is another object of the invention to provide a spray apparatus having selectively variable spray head orientation and being operable with a conventional manually operated spray head.

It is further object of the invention to provide a spray apparatus operable in any attitude with respect to upright orientation.

Still another object of the invention is to provide a spray apparatus having a manually assembled flexible joint.

Yet another object of the invention is to provide a spray apparatus exerting selectively variable pressure on a flexible joint, whereby force required to flex the joint is varied as desired by a user.

Yet a further object enabling a simultaneous and segregated flow of gas and liquid through the swivel joint.

A still further object of the invention is to provide a spray apparatus having liquid and air passages provided by, respectively, a bore in a swivel joint, and a pickup hose arranged to pass through the bore, whereby two passages are enabled while requiring but one bore through the joint.

An additional object of the invention is to provide a spray apparatus pickup having a pickup orifice which remains submerged in liquid contained in the spray apparatus regardless of attitude of the same with respect to upright orientation.

A still further object of the invention is to provide a pickup hose for a spray apparatus which pickup hose has a flexible section, yet is substantially made from rigid tube.

It is an object of the invention to provide improved elements and arrangements therein in an apparatus for the purposes described which is inexpensive, dependable and fully effective in accomplishing its intended purposes.

These and other objects of the present invention will become readily apparent upon further review of the following specification and drawings.

RELATING TO SECOND EMBODIMENTS:

Many liquid dispensers are mass produced for sale to the general public for storage and dispensing of myriad liquid products. It is generally considered desirable to provide conveniences and perceived advantages in such liquid dispensers,
such as the ability of the dispenser to utilize substantially all of the liquid held in a container component thereof. One approach toward this end is to provide a liquid pickup device which tracks the liquid, particularly as the point of depletion is reached.

Important elements in the design of the liquid pickup device are simplicity and cost. While materials are known which provide the degree of flexibility required in the Taschner invention, these materials must also be able to resist deterioration in the often harsh chemical environment of the liquid being stored and dispensed. This combination may result in high expense.

Similarly, to form a tube in the elongated bellows configuration seen in the U.K. reference increases cost and manufacturing steps.

The complicated structure of the Mann invention also increases complexity and cost.

The present invention seeks to retain the major advantages of these inventions while mitigating complexity and, especially, materials costs. Given the extremely competitive nature of the container industry and the very large production runs therein, the importance of even small economies to a single container will be fully appreciated.

Since most liquid dispensers are used in an upright or in a substantially upright orientation, it becomes possible to forgo the extreme flexibility shown in the U.K. and Taschner references. Instead, it is desired to provide a pickup tube which sways as the container is tipped, maintaining the pickup end near the container bottom, immersed in even shallow remaining liquid.

The prior art fails to provide a pickup tube which maintains the pickup end thereof near the bottom of the container while accommodating sway, which sway enables the pickup tube to track low points within the liquid level.

The present invention addresses this need by the provision of an expensive pickup tube having an uncomplicated, inexpensive joint to accommodate sway. In a preferred embodiment, a short section of flexible tubing is slipped over a length of standard, rigid or semi-rigid tubing. The flexible tubing provides the joint, and the rigid tubing maintains the open pickup end thereof.
at the bottom of the container. The joint enables the rigid section to seek the lowest point in the container. A substantial fraction of the pickup tube length is comprised of inexpensive standard tubing, while the more expensive flexible tubing requires only a short length.

Both types of tubing may be provided from mass produced stock material. This material is preferably selected due to, in addition to cost, the ability to resist attack from the chemical nature of its environment. Moreover, the longer section of pickup tube is optionally selected to be heavier than the liquid, so that the pickup tube sways under the influence of gravity.

In alternative embodiments, a separate weight is attached to the pickup tube.

In further alternative embodiments, attachment of the respective components may be by resilient gripping or by adhesive.

Accordingly, it is a principal object of the invention to provide a liquid pickup apparatus comprising a section of rigid tubing and a short section of flexible tubing.

It is another major object of the invention to provide a liquid pickup apparatus which is made from readily available, inexpensive stock material which need only by cut to provide components in a form suitable for assembly.

Still another important object of the invention is to provide a liquid pickup apparatus which is assembled by slipping one end of a first section of tubing over another component.

It is a further object of the invention to provide a liquid pickup apparatus which maintains a pickup end of thereof toward the bottom of a liquid container while enabling the liquid pickup apparatus to sway in response to gravity.

A still further object of the invention is to provide a liquid pickup apparatus which includes a strong flex joint and is still leaktight along its length.

Yet an additional object of the invention is to provide a liquid pickup apparatus being of greater density than the liquid being dispensed, whereby the liquid pickup apparatus sways in response to gravity when the container is inclined from an upright orientation.
Still an additional object of the invention is to provide a liquid pickup apparatus having a separate weight disposed thereon.

Another object is to provide a weight disposed on a liquid pickup wherein the weight is located in close proximity to the container bottom while including means enabling liquid pickup.

Again another object of the invention is to provide a liquid pickup apparatus having screen means mounted thereon.

It is an object of the invention to provide improved elements and arrangements thereof in an apparatus for the purposes described which is inexpensive, dependable and fully effective in accomplishing its intended purposes.

RELATING TO THIRD EMBODIMENTS:

Many liquid dispensers are mass produced for sale to the general public for storage and dispensing of myriad liquid products. It is generally considered desirable to provide conveniences and perceived advantages in such liquid dispensers, such as the ability of the dispenser to utilize substantially all of the liquid held in a container component thereof. One approach toward this end is to provide a liquid pickup device which tracks the liquid, particularly as the point of depletion is reached.

Important elements in the design of the liquid pickup device are simplicity and cost. While materials are known which provided the degree of flexibility required in the Taschner invention, these materials must also be able to resist deterioration in the often harsh chemical environment of the liquid being stored and dispensed. This combination may result in high expense.

Similarly, to form a tube in an elongated bellows configuration throughout its entire length as seen in the U.K. reference increases cost and manufacturing steps.

The complicated structure of the Mann invention also increases complexity and cost.
The present invention seek to retain the major advantages of these inventions while reducing complexity and, especially, components costs. Given the extremely competitive nature of the container industry and the very large production runs therein, the importance of even small economies to a single container will be fully appreciated.

Since most liquid dispensers are used in an upright or in a substantially upright orientation, it becomes possible to forgo the extreme flexibility shown in the U.K. and Taschner references. Instead, it is desired to provide a pickup tube which sways as the container is tipped, maintaining the pickup end near the container bottom, immersed in even a very low quantity of residual liquid.

The prior art fails to provide a pickup tube which maintains the pickup end thereof near the bottom of the container while accommodating sway, which sway enables the pickup tube to track low points within the liquid level.

The present invention address this need by the provision of an inexpensive pickup tube having an uncomplicated, inexpensive joint to accommodate sway. In a preferred embodiment, an elbow is formed in a length of standard, rigid or semi-rigid tubing. The elbow comprises a flexible, accordion pleated joint (hereinafter referred to as a bellows joint). The rigid tubing maintains the open pickup end thereof at the bottom of the container. The joint enables the rigid section to seek the lowest point in the container when the container is inclined, and when level of the liquid contained therein is lowered.

An advantage afforded by the bellows joint is that this type of joint is both extensible and yet flexible. Thus, requirement for precision is reduced when it is desired to maintain a specified tolerance between the bottom of the pickup tube and the floor of the reservoir. Also, a single length of pickup tube in usable with reservoirs having different vertical dimensions. Thus, costs in the manufacturing of liquid dispensers is reduced.

When the pickup tube is filled with liquid, and a level of the liquid within the liquid dispenser reservoir depletes, the pickup tube sways under the influence of gravity. This occurs
because pump action fills the pickup tube with liquid, thus making it more dense relative to the reservoir portion of the liquid dispensing apparatus.

In alternative embodiments, a separate weight is attached to the pickup tube to enhance the tendency of the pickup tube to seek the lowest position.

In further alternative embodiments, the elbow may be formed either at the top of the rigid section of tubing, or may be formed between upper and lower surrounding sections of rigid tubing.

The pickup tube may be provided from mass produced stock material. This material is preferably selected due to, in addition to cost, the ability to resist attack from the chemical nature of its environment.

An important object of the present invention is to provide a liquid dispenser having a liquid pickup apparatus which includes a bellows joint.

It is a second object of the invention is to provide a liquid dispenser having a liquid pickup apparatus including a bellows joint disposed between relatively rigid tubing sections.

It is another major object of the invention to provide a liquid dispenser having a liquid pickup apparatus which is made from relatively available, inexpensive stock material.

Another object of the invention is to provide a liquid dispenser having a liquid pickup apparatus which is assembled by deforming a section of standard tubing.

It is a further object of the invention to provide a liquid dispenser having a liquid pickup apparatus which maintains a pickup end of thereof toward the bottom of a liquid container while enabling the liquid pickup apparatus to sway in response to gravity.

A still further object of the invention is to provide a liquid dispenser having a liquid pickup apparatus which includes a flexible joint and is still leaktight along its length.

Yet an additional object of the invention is to provide a liquid dispenser having a liquid pickup apparatus being of greater density than the liquid being dispensed, whereby the liquid pickup apparatus sways in response to gravity when the container is inclined from an upright orientation.
Still an additional object of the invention is to provide a liquid pickup apparatus having a liquid pickup apparatus having a separate weight disposed thereon.

Still a further object is to provide a liquid pickup apparatus wherein a weight comprises a body having a throughbore, which weight body surrounds and moves axially on the liquid pickup tube.

Again a further object is to provide a liquid pickup apparatus wherein a weight is pinned to the liquid pickup tube.

An additional object is to provide a liquid pickup apparatus wherein a weight is retained on the liquid pickup tube by at least one surrounding pin driven through the liquid pickup tube.

Still another object is to provide a liquid pickup apparatus wherein a weight comprises sponge material, whereby the sponge swells and resiliently grips the liquid pickup tube, and also gains density, thus acting as a weight, when immersed in liquid.

Another object is to provide, for use with a liquid dispenser having a container, a liquid pickup apparatus wherein a weight is disposed thereupon, the weight being located in close proximity to the container bottom while including means enabling liquid pickup.

Again another object of the invention is to provide a liquid pickup apparatus having a screen mounted thereon.

It is an object of the invention to provide improved elements and arrangements thereof in an apparatus for the purposes described which is inexpensive, dependable and fully effective in accomplishing its intended purposes.

These and other objects of the present invention will become apparent upon further review of the following specification and drawings.

**RELATING TO FOURTH EMBODIMENTS:**

Many liquid dispensers are mass produced for sale to the general public for storage and dispensing of a myriad of liquid products. It is generally considered desirable to provide conveniences and perceived advantages in such liquid dispensers, such as the ability of the dispenser to utilize substantially all of the liquid held in a container component thereof. One
approach toward this end is to provide a liquid pickup device which tracks the liquid, particularly as the point of depletion is reached.

Important elements in the design of the liquid pickup device are simplicity and cost. While materials are known which provide the degree of flexibility required in the Taschner invention, these materials must also be able to resist deterioration in the often harsh chemical environment of the liquid being stored and dispensed. This combination may result in high expense.

Similarly, to form a tube in the elongated bellows configuration seen in U.K. reference increases cost and manufacturing steps. The complicated structure of the Mann invention also increases complexity and cost.

The present invention seeks to retain the major advantages of these inventions while mitigating complexity and, especially, material and production costs. Given the extremely competitive nature of the container industry and the very large production runs therein, the importance of even small economies to a single container will be fully appreciated.

Since most liquid dispensers are used in an upright or in a substantially upright orientation, it becomes possible to forgo the extreme flexibility shown in the U.K. and Taschner references. Instead, it is desired to provide a pickup tube which tilts or bends (i.e. sways) as the container is tipped, maintaining the pickup end near the container bottom, immersed in even in shallow remaining liquid.

The prior art fails to provide a pickup tube which maintains the pickup end thereof near the bottom of the container while accommodating sway, which sway enables the pickup tube to track low points within the liquid level.

The present invention addresses this need by the provision of a variety of different pickup tube and sprayhead combinations that provide tilting motion of the pick up tube relative to the sprayhead to accommodate sway. In a preferred embodiment, a flexible connection is provided between the pickup tube and sprayhead to provide relative tilting therebetween. In another preferred embodiment, a semi-flexible pick up tube is designed or provided with a weight to enable the pickup tube to sway when tilting the spray bottle by the effect of gravity. These
features enables the pickup tube to seek the lowest point in the container, and a standard inexpensive semi-flexible pickup tube can be utilized in the assemblies. Further, the flexible connection between the pickup tube and sprayhead is preferably made without modification to either the standard sprayhead or the standard pickup tube, for example with an add on item. Alternatively, the standard connector component of a standard sprayhead can be modified or replaced with a flexible connection for the pickup tube without modification of the main component of the standard sprayhead.

The pickup tube may be provided from mass produced stock material. This material is preferably selected due to, in addition to cost considerations, the ability to resist chemical attack. Moreover, the pickup tube is optionally selected to be heavier than the liquid, so that the pickup tube sways under the influence of gravity. This also includes tubing which may be less dense but becomes denser when filled with liquid.

In alternative embodiments, a separate weight is attached to the semi-flexible pickup tube.

In further alternative embodiments, attachment of the respective components may be by resilient compression or tension gripping connections, snap connectors and/or by adhesive.

Accordingly, it is a principal object of the present invention to provide a liquid dispensing device having a tilting pickup tube to accommodate sway.

Another object of the present invention is to provide a liquid dispensing device having a pickup tube connected to a dispensing unit such as a sprayhead by means of a flexible connector to allow tilting of the pickup tube relative to the sprayhead to accommodate sway.

A further object of the present invention is to provide a liquid dispensing device having a semi-flexible pickup tube provided with a weight to allow tilting or bending of the pickup tube relative to the sprayhead to accommodate sway.

A still further object of the present invention is to provide a liquid dispensing device with a pickup tube maintained towards the bottom of a liquid container while enabling the pickup tube to tilt in response to gravity to accommodate sway.
BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a side elevational view, substantially in cross-section, of a preferred embodiment of the invention.

Fig. 1A is a side elevational view, substantially in cross-section, of an alternative embodiment pickup hose.

Fig. 2 is a side elevational view, substantially in cross-section, of an alternative embodiment of the invention, featuring threaded assembly of the ball joint.

Fig. 3 is a sectional view of the ball joint, taken along line 3-3 of Fig. 2, and drawn to an enlarged scale.

Fig. 4 is a side elevational view, substantially in cross-section, of the invention in an inverted position.

Fig. 5 is a side elevational view, substantially in cross-section, of an alternative embodiment of the invention including a dual ball joint.

Fig. 6 is a side elevational view, substantially in cross-section, of an alternative embodiment of the invention wherein a ball is secured to a receptacle portion of the invention.

Figs. 7 and 8 are side elevations of the invention in its environment, taken substantially in cross-section.

Fig. 9 is a side cross-sectional detail view of the present invention.

Fig. 10 is an alternative embodiment of the invention as seen in Fig. 3.

Fig. 11 is a top plan environmental view of the invention, taken along line 5-5 of Fig. 2.

Figs. 12, 13, 14 and 15 are cross-sectional detail views of alternative embodiments of a weight attached to the novel liquid pickup apparatus.

Fig. 16 is a cross-sectional detail view of the novel liquid pickup apparatus showing an alternative embodiment wherein a weight is formed integrally therewith.

Figs. 17 and 18 are side elevations of alternative embodiments of the invention in its environment, taken substantially in cross section.

Figs. 19 and 20 are side cross sectional detail view of the liquid pickup apparatus of the embodiments of Figs. 17 and 18, respectively.
Fig. 21 is a top plan environmental detail view of a liquid pickup apparatus, taken along line 21-21 of Fig. 18.

Figs. 22, 23, 24, and 25 are cross sectional detail views of alternative embodiments of a weight attached to the liquid pickup apparatus.

Fig. 26 is a cross sectional detail view of the liquid pickup apparatus showing an alternative embodiment wherein a weight is formed integrally therewith.

Figs. 27, 28, and 29 are cross sectional detail views of the liquid pickup apparatus showing alternative embodiments wherein a weight has a throughbore and partially encircles a liquid pickup tube.

Fig. 30 is a cross sectional detail view of the liquid pickup apparatus showing an alternative embodiment of weight wherein the weight comprises sponge material.

Figure 31 and 32 are side cross-sections views of an embodiment of the invention in its environment;

Figure 33 is a side cross-sectional detail view of a lower portion of the pickup tube shown in Figures 31 and 32;

Figure 34 is an alternative embodiment of the invention as seen in Figure 33;

Figure 35 is a top plan environmental view of the invention, taken along line 35-35 of Fig. 32;

Figures 36, 37, 38 and 39 are cross-sectional detail views of alternative embodiments of a weight attached to the pickup tube; and

Figure 40 is a cross-sectional detail view of a novel pickup tube showing an alternative embodiment wherein a weight is formed integrally therewith.

Figure 41 is a side elevational view of a prior art spray bottle;

Figure 42A is a detailed cross-sectional view of a connector portion of the conventional sprayhead shown in Figure 41;

Figure 42B is a detailed cross-sectional view of another embodiment of the flexible connector according to the present invention;

Figure 42C and 42 are detailed cross-sectional views of a further embodiments of the flexible connector according to the present invention;
Figure 43 is a detailed cross-sectional view of a ball and socket flexible connector according to the present invention;

Figure 44A is a detailed cross-sectional view of still another embodiment of the flexible connector according to the present invention;

Figure 44B is a detailed cross-sectional view of an even further embodiment of the flexible connector according to the present invention;

Figure 45A is a partial cross-sectional view and broken away view of a spray bottle with a modified sprayhead and flexible membrane connector;

Figure 45B is a side elevational view of a spray bottle/pickup unit for use with a sprayhead not provided with a pickup tube;

Figure 45C is a partial side elevational view of another liquid bottle/pickup tube unit.

Figure 46 is a elevational side view of a spray bottle according to the present invention having a weight semi-flexible pickup tube;

Figure 47 is a detailed cross-sectional view of the distal end and weight;

Figure 48 is a detailed cross-sectional view of the distal end of the pickup tube provided with another embodiment of the weight; and

Figure 49 is a cross-sectional view of another embodiment of a weighted pickup tube.

Similar reference characters denote corresponding features consistently throughout the attached drawings.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIRST EMBODIMENTS

The present invention is seen in Fig. 1 to comprise a spray head apparatus 10 having a spray head 12, a ball type swivel joint 14 depending from the spray head 12, and a receptacle 16. A cap 18 partially surrounds the swivel joint 14, pinning it against a seat 20 formed in the receptacle 16. The cap 18 has
threads 22 engaging corresponding threads 24 formed in the receptacle 16, and may be adjustably tightened by a user to provide a desired degree of tension on the swivel joint 14.

The cap 18 has a shoulder 26 which bears on the swivel joint 14, forcing it against the seat 20. An O-ring 28 seals the receptacle 16 and modifies properties of the frictional fit of the swivel joint 14 to its seat 20. A user can tighten or loosen the cap 18 to vary hand pressure required to adjust angularity of the spray head 12, or to immobilize the spray head 12 in a desired position.

The spray head 12 swivels or pivots about the center of the swivel joint 14, limited only by a top wall 30 of the cap 18 defining an opening 32 therein, against which wall 30 a stem 34 of swivel joint 14 abuts, thus defining a limit of spray head angularity. Connection of stem 34 to spray head 12 is performed within spray head 12 in a manner well known in the art, and need not be shown or described herein. As seen by comparing Fig. 1 to Fig. 2, spray head 12 varies angularity of orientation with respect to the receptacle 16.

Referring again to Fig. 1, the swivel joint 14 is seen to have first and second passages 36, 38 constantly communicating between the spray head 12 and a liquid storage chamber 40 formed in the receptacle 16. The spray head 12 is of conventional type, employing a piston type pump (not shown) to draw liquid L into the pump, to pressurize and expel liquid L through a nozzle N, and similarly to force air, indicated generally by arrows A, into the chamber 40, which would defeat pump operation, and further exerts pressure urging liquid L to flow up to the pump. Liquid L flows from the liquid storage chamber 40 to the pump in the spray head 12 in the first passage 36, this direction being indicated by arrows also designated L, and air flows from the pump into the chamber 40 in the second passage 38.

Swivel joint 14 terminates in a tube 42 extending first passage 36 over which is slipped a proximal end 44 of a hose 46. Hose 46 is preferably made from silicone, which is a highly flexible material resisting attack from or deterioration in response to many strong chemicals, including solvents, herbicides and pesticides, adhesives, architectural coatings and finishing, lubricants, and other liquid products which are applied by
spraying. As employed hereinafter, "flexible" will be taken to mean universally flexible, free from kinking, and able to describe 180 degree bends in confines of twice the diameter of the hose.

A distal or pickup end 48 of hose 46 is attached to a weight 50 in the same manner as the proximal end, or by other suitable means. The hose distal end 48 is unobstructed by weight 50 so as to be able to pick up liquid L.

The weight 50 is sufficiently heavy as to urge hose distal end 48 to the lowest point in the storage chamber 40 by means of gravity. Liquid L contained within the storage chamber 40 by means of gravity. Liquid L contained within the storage chamber 40 will also seek the lowest point, thereby maintaining hose distal end 48 immersed therein. Thus, the pump is always supplied with liquid L regardless of attitude of the receptacle 16 with respect to upright orientation. Also, spray apparatus 10 remains operable until liquid L held in storage chamber 40 is substantially depleted.

In an alternative embodiment, hose 46 may be made from a material stiffer that silicone, yet sufficiently flexible to permit hose 46 to bend, such that distal end 48 seeks the lowest point of receptacle 16, although not being capable of describing a 180 degree bend, as could occur if silicone were employed. An advantage is still realized in that when receptacle 16 is tipped, and as it approaches the horizontal, pickup hose 46 continues to seek a lowest level, and thus, distal end 48 remains immersed in liquid L.

In a still further embodiment, hose 46 may comprise a rigid main section 46A and a flexible section 46B, as seen in Fig. 1A. In this embodiment, flexible section 46A is slipped over tube 42. This embodiment of pickup hose 46 reduces the requirement of selecting a bending material for main section 46A, while minimizing cost accruing from the use of silicone tubing. A further advantage is that weight 50 is more easily secured to more rigid hose section 46A than to a flexible hose.

Fig. 2 shows an alternative embodiment spray apparatus 10 wherein a second embodiment swivel joint 14A is formed in two parts. A spherical member 52 includes a threaded throughbore 54 and an associated relief or channel 56 being carved therein and
extending therealong in the manner of a keyway (this relief being referred to hereinafter as a keyway 56). The keyway 56 communicates with the throughbore 54 along its entire length.

The stem 34 of the first embodiment discussed herein is modified in the alternative embodiment as follows. The alternative embodiment stem 34A connects to the spray head 12 in similar manner employed in the first embodiment. The portion of the stem 34A connecting to the spray head 12 defines a head section 58. Depending from the head section 58, and having a diameter less than that of the head section 58, is a threaded shank 60.

The swivel joint first passage is formed in the second embodiment stem 34A, extending through both head section 58 and shank 60, thereby passing liquid L up to the pump. The swivel joint second passage is spaced from the first passage, and communicates only to a head lower surface 62 demarcating head section 58 from shank 60.

Shank 60 is screwed into the spherical member 52 until abutment ensues between head lower surface 62 and spherical member 52, and the shank 60 extends through and outside spherical member 52. It will be understood that shank 60 terminates at tube 42, again providing for attachment of hose 46. Formation of first passage 36 and second passage 38 by shank 60, throughbore 54, and keyway 56 is seen in Fig. 3.

Upon abutment of head lower surface 62 and spherical member 52, the second passage aligns with keyway 56, thereby forming a continuous flow path for air being ejected from the pump into the liquid storage chamber 40, and complementing first passage 36.

Turning now to Fig. 4, the spray apparatus 10 is shown inverted. Liquid L and the pickup hose weight 50 both gravitate toward the swivel joint 14A, the distal end 48 of hose 46 remaining immersed in liquid. Thus, the present invention 10 is usable in any attitude with respect to upright orientation.

In an alternative embodiment, as shown in Fig. 5, a swivel joint 14B includes upper and lower spherical members 64, 66 joined by a common neck 68. Spherical member 64 is pivotally retained against spray head 12 by an upper cap 70 threadedly mating to spray head 12, and spherical member 66 is similarly retained by lower cap 72 to the receptacle 16. Upper and lower
caps 70, 72 each have an O-ring 28 and opening 32. The plurality of pivot points thus provided enables a greater degree of swivel, or enables each opening 32 to be of correspondingly smaller diameter.

Another feature shown in Fig. 5 is an arrangement wherein passage 36 surrounds passage 38. The diameter of passage 36 is made sufficiently great to accommodate hose 46 and still provide space for passage 36. Hose 46 therefore extends entirely through swivel joint 14B, and connects directly to spray head 12.

In still a further embodiment, shown in Fig. 6, spherical member 52C is formed unitary with a cap 76. A socket 78, depending from the spray head 12, fits over, snaps onto, and pivotally retains spherical member 52C. Since spray head 12 is spaced apart from spherical member 52C in this embodiment, it is advantageous to employ the arrangement wherein hose 46 passes thorough passage 36, since an offset location of connection of hose 46 to spray head 12 is accommodated by space thus created, enabling hose 46 to flex without being pinched.

Cap 76 attaches securely to the receptacle 16, being threaded thereto. Since caps 18, 70, 72, 76 have threaded connection, ready assembly and disassembly of the spray apparatus 10 is enabled. This facilitates assembly and enables ready servicing, as for refilling receptacle 16, renewing O-ring 28, or for other purposes.

The ability to swivel the spray head 12, thus varying spray head angularity, combined with the ability to operate at any attitude results in a spray apparatus 10 very well suited for spraying liquids in tight quarters and awkward or inaccessible locations in those situations favoring the use of standard manually pumping spray heads.

SECOND EMBODIMENTS

The present invention is seen in Figs. 7 and 8 in its environment. In a liquid dispensing device, as represented by a sprayer 102, the present invention comprises a pickup tube 100 which is disposed within a container 104 of the sprayer 102. As seen in Fig. 9, pickup tube 110 comprises a first or main tubular section 112 which provides substantially most of the length of pickup tube 110, and a second, short section 114 os flexible
tubing. The short, flexible section 114 is resilient, so that it is easily slipped over, and resiliently grips, a proximal end 116 of main tubular section 112. If desired, short, flexible section 114 can be fused to the main tubular section 112, as by ultrasonic welding, or other suitable techniques.

The short, flexible section 114 also slips over a connection tube 106 provided as part of sprayer 102. Resilient grip of short, flexible section 114 securely holds pickup tube 110 to the sprayer 112. If desired, and as shown in Fig. 10, adhesive material 118 could be provided to further improve bonding of flexible section 114 to main section 112. In contrast to use of adhesive 118, shown in Fig. 10, fusing eliminates a constituent material, there being only the original main and short, flexible sections 112, 114 as reflected in Fig. 9.

Again referring to Fig. 7, it will be seen that due to flexibility, section 114 provides a flex joint 120 about which main tubular section 112 pivots universally, within limits dictated by container 104. This is also seen in top plan view in Fig. 11. Pickup tube 110 is shown inclined relative to container 104 in Figs. 7 and 8, and could incline in an opposite direction as indicated in dashed lines (Fig. 7). Inclination may be affected by design of the sprayer 102 in that an elongated connection tube 106A could bend slightly, thus altering bending characteristics of the combination of connection tube 106A and pickup tube 110. Pickup tube 110 will continue to perform as described, although its length may be adjusted to accommodate bending (not shown) of connection tube 106A.

The main tubular section 112 terminates in an open pickup end 122 facing downwardly and accepting flow of liquid \( L \) thereinto. Due to pickup tube 110 constantly seeking the lowest point in response to gravity, pickup end 122 is submerged in liquid \( L \) substantially until depletion.

Inclination of pickup tube 110 relative to container 104 is, as mentioned, responsive to gravity. To enhance the ability of pickup tube 110 to respond independently of an influence of the liquid \( L \) being dispensed, it may prove desirable to increase density of the main tubular section 112. This may be accomplished in two ways. One is selection of a material known to be of greater density than that of liquid \( L \). It may,
therefore, be desirable to form main tubular section 112 of metal, glass, ceramic material, or a dense synthetic polymer. Homogenous materials may be enhanced, as by embedding a denser material therein, an example being the addition of glass into a polymer, or the incorporation of metal into a polymer or other material.

A second approach is to attach a separate weight to main tubular section 112. In keeping with the construction of pickup tube 110, that being sections of cut tubular material, one embodiment of a weight 124 provides a section of cut metal tubing, seen in Fig. 12. In this embodiment, weight 124 is located exteriorly of main tubular section 112. Although weight 124 may be friction fit, adhesive material 118 may be employed to secure attachment.

In a second embodiment, shown in Fig. 13, weight 126 is of lesser diameter than main tubular section 112. Given a weight 126 being attached within main tubular section 112, then main tubular section 112 may be made from a resilient plastic polymer, in which case resilience of the polymer enables a reasonably secure friction fit to weight 126. If weight 126 is metal, it will more easily resist compression from this fit, unlike the previous embodiment wherein the innermost member comprises plastic, which lacks suitable resistance to compression.

If the pickup tube 110 is designed to approach the floor 108 of container 104 at close proximity, such proximity could obstruct open end 122. As seen in Fig. 14, a weight 123 having lateral ports 130 will pickup liquid L at very low level while accommodating the minimal clearance.

As seen in Fig. 15, a weight 132 is provided wherein a screen 134 is incorporated, thus enabling filtering of liquid L prior to induction into the sprayer 102. This feature is advantageous in situations wherein blockage of sprayer 102 is possible due to the nature of liquid L.

In a still further alternate embodiment, as seen in Fig. 16, main tubular section 112A is formed to surround a weight 136. This arrangement protects weight 136, enabling selection of a material forming weight 136 which might adversely react with liquid L.
The short, flexible section 114 is preferably made from a highly flexible and chemically resistant material. Silicone rubber-like material has served well in this regard, and is commercially available in forms resistant to many commonly used solvents and vehicles. Silicone is highly resilient, and provides secure resilient grip when slipped over an object. It also can accommodate sharp bends and resists kinking.

It will thus be seen that an uncomplicated pickup tube 110 can be made from cutting sections of inexpensive tubular stock material. The resultant pickup tube has a flex joint 120 providing desired swiveling, and is sufficiently rigid along most of its length as to maintain pickup end 122 in close proximity to the container floor 108. The main tubular section 112 is provided with sufficient mass or density to respond satisfactorily to gravity, enabling the sprayer 102 to be operated successfully at orientations other than vertical.

THIRD EMBODIMENTS

The present invention is seen in Fig. 17 to comprise a liquid dispenser 210, as represented by a sprayer, having a spray head 212, a container 214, and a pickup tube 216. The pickup tube 216 comprises a main section 218 of relatively rigid material and a bellows joint 220. The main section 218 provides substantially most of the length of pickup tube 216. The bellows joint 220 is slipped over a connection tube 222 provided as part of spray head 212.

In a second embodiment, seen in Fig. 18, pickup tube 216 may be formed to have main and second rigid sections 218,228 surrounding bellows joint 220. This accommodates such design variations as the long necked container 214A shown in Fig. 18.

Pickup tube main section 218 pivots or swivels universally about bellows joint 220, within limits dictated by container 214. This is also seen in top plan view in Fig. 21. Pickup tube 216 is shown inclined relative to container 214 in Fig. 17, and could incline in an opposite direction as indicated in dash lines (Fig. 21).
The main section 18 terminates in an open pickup end 224 facing downwardly and accepting flow of liquid L thereinto. Due to pickup tube constantly seeking the lowest point in response to gravity, pickup end 224 is submerged in liquid L substantially until depletion.

Bellows joint construction of pickup tube 216 is advantageous in several ways. Firstly, it enables pickup tube 216 to be fabricated from a single section of stock tubular material. Only a deforming step forming the pleats 226 (see Figs. 19 and 20) of the bellows joint 220 need be added to a fabrication method to arrive at the resultant single piece, continuous pickup tube 216. This obviates the necessity of forming a joint from a separate part or material, and results in a pickup tube 216 which is leak tight throughout its length.

Inexpensive, readily available materials, such as plastic, may still be used to form pickup tube 216.

Another property of bellows joint construction is that pickup tube 16 is selectively extensible and contractible, as seen by comparing Figs. 19 and 20. This property enables a pickup tube 216 of a given length to be usable with containers 214 of different depth. Alternatively, the pickup tube 216 may be adjusted in length by extending or contracting to accommodate variations in manufacturing tolerances of any component while maintaining a specified tolerance between the open end 224 and the container 214.

Inclination of pickup tube 216 relative to container 214 is, as mentioned, responsive to gravity. To enhance the ability of pickup tube 216 to respond independently of an influence of the liquid L being dispensed, it may prove desirable to increase density of the main section 218. This may be accomplished in two ways. One is selection of a material known to be of greater density than that of liquid L. It may, therefore, be desirable to form main section 218 of metal, glass, ceramic material, or a dense synthetic polymer. Homogenous materials may be enhanced, as by embedding a material of greater density therein, an example being the addition of glass into a polymer, or the incorporation of metal into a polymer or other material.
A second approach is to attach a separate weight to main section 218. In keeping with the construction of pickup tube 216, that being sections of cut tubular material, one embodiment of a weight 230 provides a section of cut metal tubing, seen in Fig. 22. In this embodiment, weight 230 is located exteriorly of main section 18. Although weight 230 may be friction fit, adhesive material 232 may be employed to secure attachment.

In a second embodiment, shown in Fig. 23, weight 234 is of lesser diameter than tubular main section 218. Given a weight 234 being attached within main section 218, then main section 218 may be made from a resilient plastic polymer, in which case resilience of the polymer enables a reasonably secure friction fit to weight 234. If weight 234 is metal, it will more easily resist compression from this fit, unlike the previous embodiment wherein the innermost member comprises plastic, which may lack suitable resistance to compression.

If the pickup tube 216 is designed to approach the floor of container 214 at close proximity, such proximity could obstruct open end 224. As seen in Fig. 24, a weight 236 having lateral ports 238 will pick up liquid L at very low level while accommodating the minimal clearance.

As seen in Fig. 25, a weight 240 is provided wherein a screen 242 is incorporated, thus enabling filtering of liquid L prior to induction into the sprayer 210. This feature is advantageous in situations wherein blockage of sprayer 210 is possible due to the nature of liquid L.

In a still further alternate embodiment, as seen in Fig. 26, main section 244 is formed to surround a weight 246. This arrangement protects weight 246, enabling selection of a material forming weight 246 which might adversely react with liquid L.

In yet further embodiments, shown in Figs. 27-29, a weight 248 comprises a movable object having a throughbore 250 of slightly greater diameter than the outer diameter of pickup tube main section 218. Weight 248 thus becomes logged with liquid L when container 214 is filled, and remains disposed on main section 218 at a lowermost point thereon. The same type of weight 248 may be positively retained in place by stops.
comprising throughpins 252 driven through main section 218 (Fig. 28), or by retaining pin 254 driven through both weight 248 and main section 218.

Another alternative embodiment weight 256 is shown in Fig. 30. A section of sponge, preferably a type which swells greatly when immersed in liquid, also has a throughbore 250, and resiliently adheres to main section 218 as it swells. Sponge gains density as it becomes liquid-logged, and thus acts as a weight.

It will thus be seen that an uncomplicated pickup tube can be made from cutting sections of inexpensive tubular stock material which sections are deformed to provide a bellows joint therein. The resultant pickup tube has a flexible, selectively extensible and contractible joint providing desired swiveling, and is sufficiently rigid along most of its length as to maintain pickup end in close proximity to the container floor. The main section is provided with sufficient mass or density to respond satisfactorily to gravity, enabling the sprayer to be operated successfully at orientations other than vertical.

FOURTH EMBODIMENTS

An embodiment of the present invention is seen in Figures 31 and 32. A liquid dispensing device, as represented by a sprayer 302, comprises a pickup tube 310, which is disposed within a container 304 of the sprayer. As seen in Figure 33, pickup tube 310 comprises a first or main tubular section 312, which provides substantially most of the length of pickup tube 310, and a second, short section 314 of flexible tubing. The short, flexible section 314 is resilient, so that it is easily slipped over, and resiliently grips, a proximal end 316 of main tubular section 312. If desired, short, flexible section 314 can be fused to the main tubular section 312, as by ultrasonic welding, or other suitable techniques.

The short, flexible section 314 also slips over a connection tube 306 provided as part of sprayer 302. Resilient grip of short flexible section 314 securely holds pickup tube 310 to the sprayer 302. If desired, and as shown in Figure 34, adhesive material 318 could be provided to further improve bonding of flexible section 314 to main section 312. In contrast to use of
adhesive 318, shown in Figure 34, fusing eliminates a constituent material, there being only the original main and short, flexible sections 312, 314, as reflected in Figure 33.

Again referring to Figure 31, it will be seen that due to flexibility, section 314 provides a flex joint 320 about which main tubular section 310 pivots universally, within limits dictated by container 304. This is also seen in top plan view in Figure 35. Pickup tube 310 is shown inclined relative to container 304 in Figures 31 and 32, and could incline in an opposite direction as indicated in dashed lines (Figure 31).

Inclination may be affected by design of the sprayer 302 in that an elongated connection tube 6A could bend slightly, thus, altering bending characteristics of the combination of connection tube 306A and pickup tube 310. Pickup tube 310 will continue to perform as described, although its length may be adjusted to accommodate bending (not shown) of connection tube 306A.

The main tubular section 312 terminates in an open pickup end 322 facing downwardly and accepting flow of liquid L thereinto. By the pickup tube 310 constantly seeking the lowest point in response to gravity, pickup end 322 is submerged in liquid L substantially until depletion.

Inclination of pickup tube 310 relative to container 304 is, as mentioned, responsive to gravity. To enhance the ability of pickup tube 310 to respond independently of an influence of the liquid L being dispensed, it may prove desirable to increase density of the main tubular section 312. This may be accomplished in two ways. One is selection of a material known to be of greater density than that of liquid L. It may, therefore, be desirable to form main tubular section 312 of metal, glass, ceramic material, or a dense synthetic polymer. Homogenous materials may be enhanced, as by embedding a denser material therein, an example being the addition of glass into a polymer, or the incorporation of metal into a polymer or other material.

A second approach is to attach a separate weight to main tubular section 312. In keeping with the construction of pickup tube 310, that being sections of cut tubular material, one embodiment of a weight 324 provides a section of cut metal
tubing, seen in Figure 36. In this embodiment, weight 324 is located exterior of main tubular section 312. Although weight 324 may be friction fit, adhesive material 18 may be employed to secure attachment.

In a second embodiment, shown in Figure 37, weight 326 is of lesser diameter than main tubular section 312. Given a weight 326 being attached within main tubular section 312, then main tubular section 312 may be made from a resilient plastic polymer, in which case resilience of the polymer enables a reasonably secure friction fit to weight 326. If weight 326 is metal, it will more easily resist compression from this fit, unlike the previous embodiment wherein the innermost member comprised plastic, which lacks suitable resistance to compression.

If the pickup tube 310 is designed to approach the floor 308 of container 304 at close proximity, such proximity could obstruct open end 322. As seen in Figure 38, a weight 328 having lateral ports 330 will pick up liquid L at a very low level while accommodating the minimal clearance.

As seen in Figure 39, a weight 332 is provided wherein a screen 334 is incorporated, thus enabling filtering of liquid L prior to induction into the sprayer 302. This feature is advantageous in situations wherein blockage of sprayer 302 is possible due to the nature of liquid L.

In a still further alternate embodiment, as seen in Figure 40, main tubular section 312A is formed to surround a weight 336. This arrangement protects weight 336, enabling selection of a material forming weight 336 which might adversely react with liquid L.
The short, flexible section 314 is preferably made from a highly flexible and chemically resistant material. Silicone rubber-like material has served well in this regard, and is commercially available in forms resistant to many commonly used solvents and vehicles. Silicone is highly resilient, and provides secure resilient grip when slipped over an object. It also can accommodate sharp bends and resists kinking.

It will thus be seen that an uncomplicated pickup tube 310 can be made from butting sections of inexpensive tubular stock material. The resultant pickup tube has a flex joint 320 providing desired swiveling, and is sufficiently rigid along most of its length as to maintain pickup end 322 in close proximity to the container floor 308. The main tubular section 312 is provided with sufficient mass or density to respond satisfactorily to gravity, enabling the sprayer 302 to be operated successfully at orientations other than vertical.

[FLEXIBLE CONNECTORS]

A series of embodiments according to the present invention involves providing a flexible connector between the dispensing unit (e.g. sprayhead) and pickup tube to allow for tilting of the pickup tube relative to the sprayhead to accommodate sway during operation of the liquid dispensing device such as a spray bottle.

A conventional sprayhead and pickup tube assembly 400 for a spray bottle is shown in Figure 41. The assembly 400 comprises a sprayhead 402 and semi-rigid pickup tube 404. The proximal end of the semi-rigid pickup tube 404 is received within a rigid connector 406. The rigid connector 406 having a suction chamber 408 is received within cylindrical housing 410. An upper portion
of the rigid connector 406 is provided with a ball check valve 412.

The proximal end of the pickup tube 404 is forced fit into the rigid connector 406 by controlling the dimensions of the outer diameter of the pickup tube 404 and the inner diameter of the rigid connector 406 providing a slight interference fit connection therebetween. The interference fit connection allows the pickup tube 404 to be forced fit into the rigid connector 406 of the sprayhead 402 during assembly, and prevents separation of these component during the useful life of the spray bottle.

An embodiment of a flexible connection between the pickup tube 404 and the sprayhead 402 is illustrated in Figure 42A. In this embodiment a modified cylindrical suction chamber 408' having a greater diameter than the suction chamber 408 in the sprayhead 402 illustrated in Figure 31 is provided.

A flexible membrane connector 414 is provided for connecting the pickup tube 404 to the cylindrical suction chamber 408' in a manner to allow tilting of the pickup tube relative to the sprayhead. The flexible membrane connector 414 comprises a flexible web portion 416 connecting an outer compression sealing ring 418 to an inner tension sealing ring 420. The flexible membrane connector 414 also provides a liquid seal between the pickup tube 404 and sprayhead for proper operation of the pump assembly. Thus, the flexible membrane connector 414 must properly seal therebetween by the type of sealing connections selected and/or through the use of adhesive.

The flexible web portion 416 is made so as to be sufficiently flexible to allow tilting of the pickup tube 404 relative to the sprayhead. Preferably, the flexible membrane is
made sufficiently flexible to allow the pickup tube 404 to tilt relative to the sprayhead under the influence of gravity under the weight of the pickup tube 404 alone (i.e. no weight added to pickup tube) to reduce manufacturing, assembly, and materials costs.

The flexibility of the flexible web portion 416 is controlled by material thickness, diameter, and composition. Thus, a proper material and thickness must be selected to provide proper tilting operation of the pickup tube relative to the sprayhead. Further, the material should be selected to withstand chemical attack and wear during the operational lifetime of the spray bottle. Materials used could come from a variety of readily available stock materials such as latex, teflon, neoprene, silicone, etc., or combinations thereof.

The outer compression sealing ring 418 connects the flexible membrane connector 414 to the suction chamber 408, typically having a cylindrical configuration. Specifically, the outer compression ring fits within the inner diameter of the of the suction chamber 408, and seals against the inner wall thereof by means of compression.

The inner tension sealing ring 420 connects to the pickup tube 404, typically having a cylindrical configuration. Specifically, the inner tension sealing ring 420 fits around the outer diameter of the pickup tube 404 at its proximal end, and seals against the outer wall thereof by means of tension.

The flexible web portion 416, the outer compression sealing ring 418 and inner tension sealing ring 420 can be made of a one piece construction, such as by molding elastic material, or can have a composition construction. For example, the outer
compression sealing ring 418 and inner tension sealing ring 420 can be made as separate ring components 418' and 420', as shown in Figure 42B, and then connected to the flexible web portion 416'. In such an embodiment, the rings 418 and 420 can be made of metal (e.g. stainless steel, anodized aluminum), plastic or other suitable material with a flexible material, such as elastomeric material, forming the flexible web portion 416. Further, the flexible web portion 416 may be made of a composite material or multilayer film material tailored to be both flexible and chemically resistant.

The diameter of the suction chamber 408' should be sufficiently great so that there is no contact of the proximal end of the pickup tube 404 with the suction chamber 408', which would inhibit the desired tilting/swaying of the pickup tube 404 relative to the sprayhead. Further, increasing the diameter of the suction chamber 408' increases the flexibility of the flexible connector.

A further embodiment of a flexible membrane connector 414'' is shown in Figure 42C. In this embodiment, the flexible membrane connector 414'' comprises a flexible web portion 416'', an outer tension sealing ring 418'' and an inner tension sealing ring 420''. The outer tension sealing ring 418'' seals against the outer surface of the suction chamber 408'' by means of tension, and the inner tension sealing ring 420'' seals against the outer surface of the proximal end of said pickup tube 404.

In the embodiments shown in Figures 42C and 42D, a piston Ρ for the pump mechanism moves up and down as indicated by the arrow. In the conventional sprayhead of this type, the piston Ρ is provided with an opening for receiving and rigidly connecting
to the proximal end of the pickup tube, thus, the pickup tube moves up and down during operation. However, in the embodiments shown in Figs. 42C, the pickup tube 404 is no longer rigidly connected to the piston P due to the use of the flexible membrane connector 414". This may be significant with respect to the substantially complete evacuation of the liquid bottle, since the up and down movement of the distal end of the pickup tube may interfere with the evacuation of a significant level of liquid. Specifically, in the conventional arrangement the distal end of the pickup tube would pickup air as it moves upwardly during the pumping stroke withdrawing the distal end from the remaining fluid level causing the suction of air into the pickup tube and impairing the pumping operation.

Another embodiment of the flexible connection according to the present invention is shown in Fig. 43 as a ball and socket connector 422.

The ball and socket connector 422 comprises a ball 424 having an opening 426 therein sealingly disposed within a socket 428. The ball 424 seals to the proximal end of the pickup tube 404, and socket 428 seals to the suction chamber 408".

A further embodiment of the flexible connector according to the present invention is shown in Fig. 44A. In this embodiment, a different type of conventional sprayhead is provided a downtube 430 wherein suction is created to draw up liquid through the pickup tube 404. A flexible section of tubing 432 connects the pickup tube 404 to the downtube 430. Specifically, one end of the flexible section of tubing 432 is fitted inside the end of the down tube 430, and an opposite end is fitted around the proximal end of the pickup tube 404. The flexible section of
tubing 432 must be selected to be sufficiently flexible to allow the pickup tube 404 to adequately tilt relative to the sprayhead. For example, a short length of silicone tubing would adequately seal and provide the flexibility necessary to allow proper tilting functioning.

An alternative to the flexible tubing embodiment is shown in Fig. 44B. In this embodiment, one end of the flexible section of tubing 432 is fitted around the outside of the downtube 130, and an opposite end is fitted around the outside of the proximal end of the pickup tube 404. For the same piece of tubing (i.e. same material and wall thickness), the configuration shown in Fig. 44A appears to provide a more flexible connection than the configuration shown in Figure 44B under limited testing.

The flexible section of tubing 432 can be made from cutting a length of stock tubing and subsequently assembling the pickup tube and sprayhead. Alternatively, a layer of elastomeric material such as neoprene can be formed between said pickup tube and sprayhead, specifically the suction chamber, to define said flexible section of tubing 432, for example by a dipping operation.

A still further embodiment of the flexible connector according to the present invention is shown in Figure 45A. In this embodiment, a sprayhead 402' is modified with a downtube 432 for providing air into the liquid bottle as liquid is depleted from the liquid bottle 434 during operation. The downtube 432 can extend from a conventional air port present in all sprayheads of this type. A flexible membrane 436 or gasket is provided between the sprayhead 402' and the liquid bottle 434. Specifically, the flexible membrane 436 is gripped around its
perimeter by an upper portion of neck 438 of the liquid bottle 434 and a lower surface portion of a cap 440. Further, the flexible membrane 436 can be a separate unit or connected in some manner to the cap 440 and/or the bottle neck 440.

The proximal end of pickup tube 404 is received within an opening 442 and downtube 432 is received within an opening 443 in flexible membrane 436. Specifically, the proximal end of the pickup tube 404 extends through the opening 442 and is retainer therein during operation. The flexible membrane 436 is made of a material selected to be sufficiently flexible to allow tilting of the pickup tube 404 relative to the sprayhead due to the influence of gravity on the pickup tube 404.

The proximal end of the pickup tube 404 is positioned sufficiently below the rigid connector 406' and the suction chamber 410 to allow tilting of the pickup 404 without coming into contact therewith. The rigid connector 406' is disabled in the modified sprayhead 402' no longer serving as a connector between the pickup tube 404 and sprayhead 402', however, it remains since it is provided with the ball check valve 412' to allow proper operation of the pump assembly of the sprayhead 402'.

The modified sprayhead 402' must also be provide with sealing means for sealing the joint between the sprayhead 402' and the cap 440, since none is provided in the conventional sprayhead shown in Fig. 41. Preferably, a sealing means is provided which still allows rotation the cap 440 relative to the sprayhead 402' such as an elastic sealing washer.
In an alternative embodiment, the pickup tube 404 and downturn tube 432 are combined into a one piece tube structure having a liquid passageway and air passageway with appropriate modification of the spray head to link these passageways with the suction chamber and air port in the conventional sprayhead.

Another flexible membrane embodiment is shown in Figure 45B. In this embodiment, the pickup tube 404 and liquid bottle 434' are provided as one unit. The pickup tube 404 is flexible connected to the liquid bottle by a flexible membrane 436', and the flexible membrane 436' is connected to the neck 438' of the liquid bottle 434'. The flexible membrane 436' can be permanently or removably attached to the neck 438' by adhesive, welding, snap connection, etc., or combinations thereof. Alternatively, the flexible membrane could be replaced with a rigid connector such as a plastic circular plate, and tilting or bending of the downturn tube could be achieved with a weighted pickup tube such as the ones described hereinbelow.

A rigid membrane embodiment is shown in Fig. 45C. In this embodiment, a rigid membrane 436'' is provided with a semi-rigid or rigid coupler tube 433. A flexible connection is provided between the downturn tube 404 and the coupling tube 433a by means of a section of flexible tubing 433b. The upper end of the coupling tube 433a releasably connects into the rigid coupling of the conventional sprayhead 402, shown in Fig. 41.

A conventional sprayhead would need to be modified in order to properly interface the liquid and air passageways of the sprayhead into the liquid bottle 434'. For example, the sprayhead shown in Fig. 45A would be suitable.
This embodiment provides a number of important advantages including a spill-proof and somewhat child-proof bottle even when the sprayhead is removed, since limited quantities of liquid could flow from the pickup tube 404 or opening (i.e. restricted flow) when the liquid bottle, as opposed to the entire neck being open in conventional arrangements.

Further, a modified spray head without a connected pickup tube could be readily transferred from one bottle to the next. This would make it much more likely for consumers to reuse a sprayhead over numerous times while purchasing liquid bottles with connected pickup tubes sealed by a removably cap for storage and display during sale. Thus, the consumption and waste of sprayheads and materials utilized in the production thereof would be greatly reduced.

The use of flexible connectors with conventional or novel sprayheads provides a number of other possible advantages. For example, a flexible connector can be provided for increasing the volume of the suction chamber to provide a liquid reservoir. The liquid stored in the reservoir can be consumed during intermittent periods of upside down operation of the spray bottle without the occurrence of drawing air and failure of the pumping operation which readily occurs with conventional sprayheads.

[WEIGHTED SEMI-FLEXIBLE PICKUP TUBE]

An embodiment of a weighted semi-flexible pickup tube is shown in the embodiment of the spray bottle shown in Figure 46. In this embodiment, a sprayhead 402' is connected to a liquid
bottle 434 with a pickup tube 404 extending from the sprayhead 402 down into the liquid bottle 434. Further, a weight 448 is disposed at the distal end of the pickup tube 404.

The pickup tube 404 is made of semi-flexible plastic tubing of a type that is standard with most spray bottles utilized in the marketplace today. The semi-flexible plastic tubing of this type does not substantially move under the influence of gravity when tilting a conventional bottle. In order to provide a tilting or bending the semi-flexible pickup tube made with this type of tubing, the pickup tube must be weighted in some manner such as the embodiments shown in Figs. 46-49.

The use of semi-flexible tubing verses a flexible tubing is very desirable for the following reasons. Since this type of semi-flexible tubing is being utilized currently to make pickup tubes in conventional spray bottles, it is readily available and can be adapted to the invention with little modification. Further, this type of tubing is significantly less expensive than flexible types of tubing such as silicone tubing. In addition, the semi-flexible tubing currently available allow for secure connections with the sprayhead whereas more flexible types of tubing can more easily pull off or from a fluid connector.

Further, the semi-rigid downtube due to its somewhat rigid nature maintains the distal end in close proximity to the bottom of the spray bottle in contrast to flexible type tubing wherein the distal end is substantially free to move around and possibly tangle up or contact with the inside of the liquid bottle and impair its movement during tilting of the bottle. In contrast, the semi-flexible pickup tube maintains the entire length of the pickup tube, particularly its distal end, from contacting the
inner wall of the bottle in any significant manner that may impair movement thereof. Specifically, due to the semi-rigid properties of the desired pickup tube, the semi-rigid pickup tube is somewhat self-centering within the liquid bottle even when weighted.

In the embodiment shown in Figure 46, the proximal end of the semi-flexible pickup tube 404' is rigidly connected to the sprayhead 402', thus, the semi-rigid pickup tube bends due to the influence of gravity acting on both the mass of the pickup tube and the weight 448. The resiliency of the pickup tube 404' must be overcome in order for proper tilting or bending functioning of the pickup tube. The plastic material of the semi-flexible pickup tube 404', diameter, wall thickness and length should be properly selected to allow sufficient tilting and throw of the distal end within the liquid bottle.

In alternative embodiments of the weighted pickup tube, a weighted pickup tube having a stiffness in the range of semi-rigid to rigid can be attached to the sprayhead by a flexible connector. The combination of both a weighted pickup tube and a flexible connector operationally connecting the pickup tube and sprayhead should provide a pickup tube that readily tilts and reacts quickly to changes in tilt angle and direction of the spray bottle such as when a person operating the spray bottle is quickly working with the spray bottle at varying angles and orientations thereof.
A detailed view of the weight 448 is shown in Figure 47. The weight 448 is provided with a tubing connector section 450 for attachment to the distal end of the pickup tube 404' with a liquid passageway 452 extending through the tubing connector section 450 and main portion 454.

An alternative embodiment of a distal end weight is shown in Fig. 48. The main portion 454' of the weight is the same diameter as the diameter of the pickup tube 404' in this embodiment.

Other ways of weighing the pickup tube can be suitably achieved. For example, one or more weights can be added at different positions along the length of the pickup tube either by connecting weights to the outside diameter of the tube, embedding weight in the material of the tube, providing sections of weighted conduit at one or more positions along the pickup tube. Further, the pickup tube can be made without the addition of weight of different material by selecting sufficient density, stiffness, wall thickness, length, distribution of mass (i.e. heavier towards distal end), in order for the pickup tube to bend sufficiently under its own weight to cause suitable bending functioning.

Another embodiment of a weight pickup tube 404'' is shown in Fig. 49. In this embodiment, the pickup tube 404'' comprises an upper section 456, a middle section 458, and a lower section 460. The middle section 458 is defined by an expanded diameter section of tubing providing a reservoir for liquid. The reservoir 462 builds up a mass of fluid, which acts as a weight when the fluid
level within the liquid bottle drops below the level of the reservoir 462 (i.e. fluid buoyancy removed) to cause tilting of the pickup tube under the influence of gravity.

It is to be understood that the present invention is not limited to the embodiment described above, but encompasses any and all embodiments within the scope of the following claims.
WE CLAIM:

1. For use with a receptacle defining a liquid storage chamber therein, a spray apparatus comprising spray head means including nozzle means and pump means ejecting liquid in spray form and forcing a gas into the receptacle, swivel joint means including at least one spherical member, and fluid pickup means extending into the receptacle,

    said spray head means comprising attachment means enabling ready attachment of said spray head means to the receptacle,

    said swivel joint means being attached to and located between said spray head and the receptacle,

    said swivel joint means including means defining therein first and second passages, one of said first and second passages conducting liquid from the receptacle into said spray head, and the other of said first and second passages conducting air from said spray head into the receptacle.

2. The spray apparatus according to claim 1, said fluid pickup means comprising a flexible hose having a proximal and a distal end, said proximal end being connected to said spray apparatus, and said distal end being attached to a weight whereby said distal end is constrained to remain submerged within liquid being contained within the receptacle, regardless of receptacle attitude with respect to an upright orientation.
3. The spray apparatus according to claim 1, said fluid pickup means comprising a bending hose having a proximal and a distal end, said proximal end being connected to said spray apparatus, and said distal end being attached to a weight whereby said distal end is constrained to incline in response to gravity when the receptacle is tipped and approaches the horizontal.

4. The spray apparatus according to claim 1, further comprising a retention cap, said at least one spherical member being captively retained by said cap, said cap being threaded to the receptacle, whereby variable pressure is exerted on said at least one spherical member, force required to flex said swivel joint means thus being varied by a user upon tightening said cap.

5. The spray apparatus according to claim 1, said at least one spherical member being two spherical members joined by a common neck, one of said spherical members being secured to said spray head, and the other said two spherical members being secured to the receptacle.

6. The spray apparatus according to claim 1, wherein said swivel joint means a bore therethrough, said bore having a diameter, said fluid pickup means further having a diameter of lesser dimension than said bore diameter, said fluid pickup means being disposed within said bore, said bore and said fluid pickup means defining an annulus therebetween, whereby said first and second passages are provided by said annulus and said fluid pickup means.
7. The spray apparatus according to claim 1, said at least one spherical member having
   a threaded throughbore having one spherical member further defining a keyway therein, said keyway extending outside said
   threaded throughbore and also extending from said throughbore proximal end to said throughbore distal end, and
   a stem comprising a threaded rod having an axis, a head section having a diameter, a top surface defining a stem proximal
   end, and a bottom surface having a threaded shank depending therefrom, said shank having a diameter of dimension less than
   said head section diameter, said shank further defining a stem distal end being located on said stem further defining stem
   distal end being located on said stem opposite said stem proximal end,
   said stem defining a first passage extending therethrough and extending from said stem proximal end to said stem distal
   end, and a second passage extending only through said head section and being located to align with said keyway,
   said threaded shank having threads corresponding to said threaded throughbore, whereby said threaded shank is screwed into
   said at least one spherical member, and upon alignment of said head section second passage with said keyway, two segregated flow
   paths are established extending between said spray head and the liquid storage chamber, and flow of liquid is enabled from the
   liquid storage chamber into said spray head, and of air from said spray head into the liquid storage chamber.
8. The spray apparatus according to claim 1, further comprising, in combination, a cap, said at least one spherical member being solidly secured to said cap, the cap and spherical member combination being fixed to the receptacle, and a socket member partially surrounding and pivoting about said at least one spherical member, said socket spray head and said socket member pivot in unison about said at least one spherical member.

9. A spray apparatus having a swiveling spray head, swivel joint means, fluid pickup means, and receptacle means defining a liquid storage chamber therein, said spray apparatus comprising, spray head means including nozzle means and pump means ejecting liquid in spray form and forcing a gas into said receptacle means, swivel joint means being attached to said spray head means, said swivel joint means including at least one spherical member, and fluid pickup means comprising attachment means and extending into said receptacle means, said spray head means comprising attachment means enabling ready attachment of said spray head means to said receptacle means, said swivel joint means, and further including said spray head and said receptacle means, and further including means defining therein first and second passages, one of said first and second passages conducting liquid from said receptacle means into said spray head, and the other of said first and second passages conducting air from said spray head into said receptacle means.
10. The spray apparatus according to claim 9, said swivel joint means comprising a spherical member having a threaded throughbore having a distal and a proximal end defined therein, said spherical member further defining a keyway therein, said keyway extending outside said threaded throughbore and also extending from said throughbore proximal end to said throughbore distal end, and

  said stem being a threaded rod having an axis, a head section having a diameter, a top surface defining a stem proximal end, and a bottom surface having a threaded shank depending therefrom, said shank having a diameter of dimension less than said head section diameter and defining a stem distal end being located on said stem opposite said stem proximal end,

  said stem defining a first passage extending therethrough and extending from said stem proximal end to said stem distal end, and a second passage extending only through said head section and being located to align said keyway,

  said threaded shank having threads corresponding to said threaded throughbore, whereby said threaded shank is screwed into said spherical member, and upon abutment of said head section bottom surface against said spherical member, and upon alignment of said head section second passage with said keyway, two segregated flow paths are established extending between said spray head and said liquid storage chamber, and flow of liquid is enabled from said liquid storage chamber into said spray head, and of air from said spray head into said liquid storage chamber.
11. The spray means apparatus according to claim 9, said fluid pickup means comprising a flexible hose having a proximal and a distal end, said proximal end being connected to said swivel joint means, and said distal end being attached to a weight whereby said distal end is constrained to remain submerged within liquid being contained within said receptacle means, regardless of receptacle attitude with respect to an upright orientation.

12. The spray apparatus according to claim 9, further comprising a cap, said swivel joint means being captively retained by said cap to said receptacle means, whereby variable pressure is exerted on said swivel joint means, force required to flex said swivel joint means thus being varied by a user upon tightening said cap.

13. A pickup hose for a spray apparatus, said pickup hose comprising:

   a substantially rigid main section having proximal and distal ends,

   a short section of flexible hose also having proximal and distal ends, said flexible hose distal end being dimensioned and configured to slip over and hold said main section proximal end, and

   a weight attached to said main section distal end, whereby said pickup hose is attached to the spray apparatus by said flexible hose proximal end being slipped over a cooperating member mounted on the spray apparatus, and, upon its associated spray apparatus being inclined from an upright orientation, said
pickup hose will bend in response to gravity so that said distal end remains immersed in liquid stored in the spray apparatus container.

14. A liquid pickup apparatus for retrieving liquid stored within a container for delivery to an associated dispensing apparatus, said pickup apparatus comprising:

  a first section of conduit having a connection end and a pickup end, said pickup end being immersed in the stored liquid and being open thereto, whereby the liquid flows into said first conduit section, and

  a flexible second section of conduit having proximal and distal ends, whereby said flexible second conduit section proximal end is joined to said first conduit section connection end, and said flexible second conduit section distal end is attached to a liquid dispensing apparatus at said distal end, said flexible section providing a flexible joint, thus enabling said first conduit section to swing relative to the liquid container.

15. The liquid pickup apparatus according to claim 14, wherein a joint exists where said first conduit section and said flexible second conduit section are joined in tight abutment, whereby said joint is leaktight.
16. The liquid pickup apparatus according to claim 15, said flexible second conduit section being resilient, said joint being formed by said flexible second conduit section being friction fit over said first conduit section, and resiliently adhering thereto.

17. The liquid pickup apparatus according to claim 15, said joint comprising a fused joint, wherein said first conduit section is fused to said flexible second conduit section.

18. The liquid pickup apparatus according to claim 15, said joint comprising adhesive means.

19. The liquid pickup apparatus according to claim 14, a liquid to be dispensed being selected and having a known density, said first conduit section being made from material selected to be denser than the liquid to be dispensed.

20. The liquid pickup apparatus according to claim 19, said first conduit section material being metallic.

21. The liquid pickup apparatus according to claim 19, said first conduit section material comprising glass.

22. The liquid pickup apparatus according to claim 19, said first conduit section material comprising a synthetic polymer.

23. The liquid pickup apparatus according to claim 19, said first conduit section material comprising a synthetic polymer.
24. The liquid pickup apparatus according to claim 23, said synthetic polymer having density and further including a second constituent material having a density greater than said density of said synthetic polymer.

25. The liquid pickup apparatus according to claim 14, further including weight means disposed upon said first conduit section.

26. The liquid pickup apparatus according to claim 25, wherein said weight means comprise a section of tube disposed externally to said first conduit section.

27. The liquid pickup apparatus according to claim 25, wherein said weight means comprise a section of tube disposed internally of said first conduit section.

28. The liquid pickup apparatus according to claim 25, wherein said weight means provide a liquid pickup terminal having screen means.

29. The liquid pickup apparatus according to claim 25, wherein said weight means provide a liquid pickup terminal having screen means.

30. The liquid pickup apparatus according to claim 25, wherein said first conduit section includes means surrounding said weight means.
31. The liquid pickup apparatus according to claim 25, wherein said first conduit section is dimensioned and configured to grip said weight means resiliently.

32. The liquid pickup apparatus according to claim 25, further comprising adhesive material means for attaching together said first conduit section and said weight means.

33. A liquid dispenser having a liquid storage container and a liquid pickup apparatus for retrieving liquid stored within said container, said pickup apparatus having proximal and distal ends, said pickup apparatus comprising:
   a first section of conduit having a connection end and a pickup end, said pickup end being immersed in the stored liquid and being open thereto, whereby the liquid flows into said first conduit section, and
   a bellows joint having proximal and distal ends, whereby said bellows joint proximal end is joined to said first conduit section connection end,

   said liquid pickup apparatus being attached to said liquid dispensing apparatus, thus enabling said first conduit section to swing relative to said liquid storage container.

34. The liquid dispenser according to claim 33, said liquid pickup apparatus further comprising a second conduit section joined to said bellows joint distal end, whereby said bellows joint is located intermediate said liquid pickup apparatus proximal and distal ends, being surrounded by two section of conduit section.
35. The liquid dispenser according to claim 33, said bellows joint further including means rendering said bellows joint selectively extensible and contractible.

36. The liquid dispenser according to claim 34, said bellows joint further including means rendering said bellows joint selectively extensible and contractible.

37. The liquid dispenser according to claim 33, a liquid to be dispensed being selected to have a known density, said first conduit section being made from material selected to be denser than the liquid to be dispensed.

38. The liquid dispenser according to claim 37, said first conduit section material being metallic.

39. The liquid dispenser according to claim 37, said first conduit section material comprising a synthetic polymer.

40. The liquid dispenser according to claim 39, said synthetic polymer having density and further including a second constituent material having a density greater than said density of said synthetic polymer.
41. For use with a liquid dispensing apparatus having a container holding liquid to be dispensed, a liquid pickup apparatus comprising: a conduit section; and means defining a bellows joint in said conduit section, for allowing that portion of said conduit section below said joint to sway independently of said bellows joint.

42. The liquid pickup apparatus according to claim 41, there further being weight means on said conduit portion below said bellows joint.

43. The liquid pickup apparatus according to claim 40, wherein said weight means comprises a tubular weight section disposed internally of said conduit section.

44. The liquid pickup apparatus according to claim 42, wherein said weight means define a liquid pickup terminal having means defining lateral ports.

45. The liquid pickup apparatus according to claim 42, wherein said weight means define a liquid pickup terminal having screen means.

46. The liquid pickup apparatus according to claim 42, wherein said conduit section includes means surrounding said weight means.
47. The liquid pickup apparatus according to claim 42, wherein said conduit section is dimensioned and configured to grip said weight means resiliently.

48. The liquid pickup apparatus according to claim 42, further comprising adhesive material means for attaching together said conduit section and said weight means.

49. The liquid pickup apparatus according to claim 42, said conduit section having an outer diameter having dimension and said weight comprising a body having means defining a bore therethrough, said bore having an inner diameter having dimension, said body partially surrounding said conduit section and moving axially thereon.

50. The liquid pickup apparatus according to claim 49, said body means also defining a hollow interior therein and further comprising at least one through pin means penetrating said conduit section, thereby retaining said weight thereon, said bore inner diameter being of dimension greater than said conduit section outer diameter dimension, said body hollow interior filling with liquid when being placed in liquid disposed within the container, and this acting as a weight.
51. The liquid pickup apparatus according to claim 49, said body means also defining a hollow interior therein, said liquid pickup apparatus further comprising at least one through pin means penetrating both said weight and said conduit section, thereby retaining said weight upon said conduit section, said weight bore inner diameter being of dimension greater than said conduit section outer diameter dimension, said body hollow interior filling with liquid when being placed in liquid disposed within said container, thus acting as a weight.

52. The liquid pickup apparatus according to claim 49, said weight comprising sponge means defining a bore there-through, whereby said sponge means swells when immersed in a liquid being held in the container.

53. A liquid dispensing device, comprising:

a liquid container having an opening and bottom;

a dispensing unit connected to said container at said opening;

a pickup tube in the range of stiffness from semi-rigid to rigid connected to said dispensing unit and extending through said opening into said container, said pickup tube having a distal end and arranged so that said distal end moves in close proximity to said bottom of said liquid container to accommodate sway of the device during operation and enable substantially or complete evacuation of liquid stored in said liquid container.
54. A device according to Claim 53, wherein said pickup tube is semi-rigid and is rigidly connected to said dispensing unit at a proximal end thereof, said pickup tube is weighted to cause ending of said pickup tube due to the influence of gravity so that said distal end moves in close proximity to said bottom to accommodate sway of the device during operation.

55. A device according to Claim 54, wherein said pickup tube is weighted by providing a weight at said distal end of said pickup tube.

56. A device according to Claim 55, wherein said weight includes a fluid inlet and passageway leading into a passageway through said pickup tube.

57. A device according to Claim 56, wherein said weight is made of at least one selected from the group of metal, ceramic or plastic.

58. A device according to Claim 53, wherein said pickup tube is connected to said dispensing unit by a flexible connection to provide tilting of said pickup tube relative to said dispensing unit to accommodate sway of the device during operation.

59. A device according to Claim 58, wherein said pickup tube is made of a denser material than the liquid stored in said container so that said pickup tube tilts due to the influence of gravity.
60. A device according to Claim 58, wherein said pickup tube is weighted so that said pickup tube tilts due to the influence of gravity.

61. A device according to Claim 58, wherein said flexible connection is defined by a flexible membrane connector sealing a suction chamber of said dispensing unit, said flexible membrane connector provided with an opening for accommodating and sealing with said proximal end of said pickup tube.

62. A device according to Claim 58, wherein said flexible membrane is defined by a membrane disc sealing a cylindrical end portion of said suction chamber.

63. A device according to Claim 62, wherein said membrane disc is provided with an inner tension ring positioned around said opening in said membrane disc to ensure proper sealing with said proximal end of said pickup tube.

64. A device according to Claim 63, wherein said membrane disc is provided with an outer compression ring positioned around its perimeter in order to connect to and seal with said cylindrical portion of said suction chamber of said dispensing unit.

65. A device according to Claim 63, wherein said membrane disc is provided with an outer tension ring positioned around its perimeter in order to connect to and seal with said cylindrical portion of said vacuum chamber of said sprayhead.
66. A device according to Claim 58, wherein said flexible connection is defined by a flexible section of conduit connecting said pickup tube to said dispensing unit.

67. A device according to Claim 58, wherein said flexible connection is defined by a ball and socket connection between said pickup tube and said dispensing unit.

68. A device according to Claim 58, wherein said flexible connection is defined by a flexible bladder provided with an opening for accommodating said proximal end of said pickup tube.

69. A device according to Claim 68, wherein said dispensing unit is provided with means extending through said flexible bladder into said liquid container for providing air transfer in said liquid container for liquid displaced from said liquid container during operation.

70. A spray bottle, comprising:
   a liquid container with a neck and a bottom;
   a sprayhead with a pump mechanism having a suction chamber, said sprayhead connected to said neck of said liquid container;
   a pickup tube having a proximal end and a distal end, said proximal end of said pickup tube operationally connected to said suction chamber of said pump mechanism; and
   a flexible connector connecting said pickup tube to said suction chamber of said sprayhead to provide tilting of said pickup tube relative to said sprayhead to accommodate sway of the device during operation.
71. A flexible connector for connecting a pickup tube to a dispensing unit of a liquid dispensing device, said flexible connector comprising:

first connector means for connecting said flexible connector to said pickup tube;

second connector means for connecting said flexible connector to said dispensing unit; and

a flexible connection means disposed between said first connector means and said second connector means for allowing tilting of the said pickup tube relative to said dispensing unit.

72. A flexible connector according to Claim 71, wherein said flexible connection means comprises a flexible membrane.
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

IPC(5) : Please See Extra Sheet.
US CL. : 239/333, 587.3, 588; 222/464

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

222/464, 382, 211, 383, 324, 526; 285/160, 166, 184

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
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<td>J.P., A, 317.484 (HANADA) 26 DECEMBER 1988, SEE FIGURES 1-10</td>
<td>14-16, 19, 53-60, 66</td>
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[X] Further documents are listed in the continuation of Box C. [ ] See patent family annex.

*Special categories of cited documents:
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O. document referring to an oral disclosure, use, exhibition or other means
P. document published prior to the international filing date but later than the priority date claimed

X. later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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X. document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
X. document member of the same patent family

Date of the actual completion of the international search 13 January 1994

Date of mailing of the international search report FEB 07 1994

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Form PCT/ISA/210 (second sheet) (July 1992)
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A. CLASSIFICATION OF SUBJECT MATTER:
IPC (5):
B05B 9/043, 15/08