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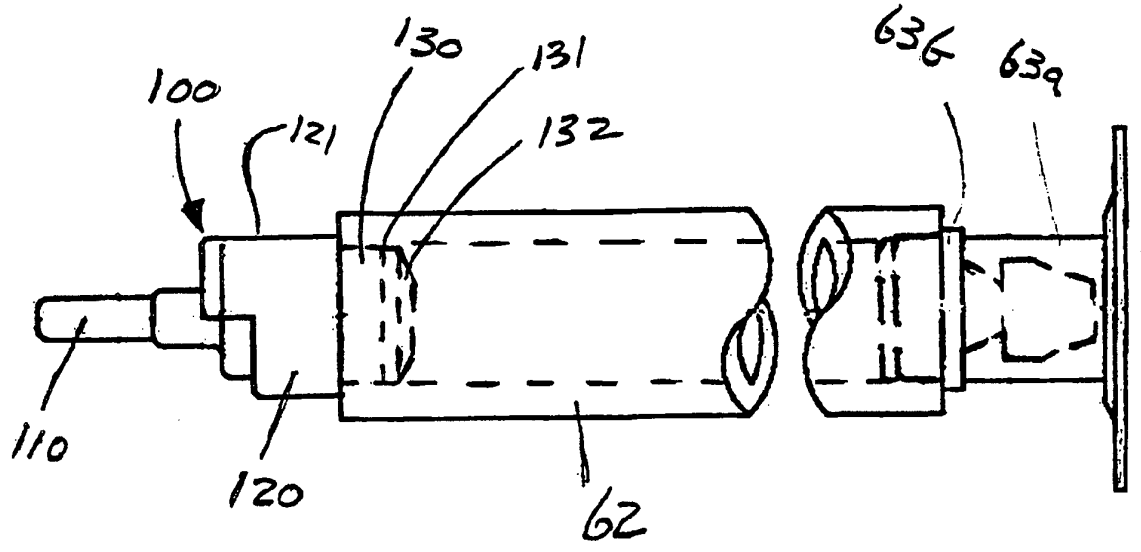


(57) Abstract

A dispenser pump for a fluid dispenser system using a pump tube (62). The pump tube (62) has a pump tip (100) with a longitudinally extended exterior surface (130) for a hard interface with the dispenser for improved rigidity and lateral support. An end cap (132) on the tube coupling where the check valve (128) is installed which is sealed and mechanically restrained from longitudinal separation by its bond to the pump tube wall (62). An upper check valve (74) is held in an assembled relationship by a bond to the pump tube wall (62).

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# IMPROVED DISPENSER PUMP

The present application is a continuation-in-part of pending U.S. application serial number 08/357,392 filed 16 December 1994 by the same inventor, which is a continuation-in-part of pending U.S. application serial number 29/023,628 filed 27 May 1994 by the same inventor.

## BACKGROUND OF INVENTION

### FIELD OF INVENTION

The present invention relates to fluid dispensers; particularly to fluid dispenser systems that use internal fluid vessels having a collapsible, resilient, pump tube through which the fluid is dispensed; more particularly to dispenser systems having a pump tip at the end of the pump tube which restricts the flow of fluid between dispenses and regulates or directs the flow of fluid during dispenses, and most particularly to liquid soap dispensers using disposable soap vessels known in the industry as "bag-in-a box" vessels.

### DESCRIPTION OF PRIOR ART

The art of metered dispensing of single-use portions of fluids from dispensers has at least three distinct variations. One class of dispensers uses a permanent, refillable fluid reservoir. This type of open system readily accumulates scum and bacteria in and around the reservoir, requiring a significant amount of service to be kept reasonably clean and operable.

A second class of dispensers is loaded and reloaded with disposable cartridges of fluid. These solid containers or vessels are typically inverted and inserted into position in the dispenser, and incorporate or are engaged with the pumping or dispensing system. The upper surface of the inverted cartridge is then pierced to allow air to replace the fluid as it is

consumed. This type of open system, while being an improvement over refill reservoirs in some respects, is still prone to the growth of bacteria, and introduces a disposal problem as big as the cartridge itself.

A third class of dispensers uses a collapsible bag and integral pump tube to which pressure is applied for flow control. The most significant benefit of this closed-system methodology is that the subject fluid is totally contained and dispensed from disposable components, assuring a much greater degree of sanitation, and ease of loading and maintenance. Additionally, the bag is collapsed into a tight, small knot of plastic at the end of the pump tube as the fluid is consumed. This reduces the immediate disposal problem immensely over cartridge type systems.

Liquids and semi-liquids such as food materials, medicines, and cleaning materials are commonly dispensed from countless numbers of existing such dispensers in use around the world. New dispensers are being added to existing markets and new markets constantly.

Wall-mounted liquid soap dispensers which dispense small portions of detergent upon application of pressure to a dispensing arm or member are commonly found in business, industry and institutional restrooms, and constitute a significant specialty industry. The installed base of soap dispensers in the United States alone is estimated to be in the millions. Many of these still use a fixed reservoir which is refilled as required, but the industry trend is overwhelming in favor of dispensers that use sealed, disposable containers of soap having integral pump tubes and tips.

However, little of the published art focuses on the subject of the manual metering or pumping mechanism within the dispensers, particularly on the dispenser pump assembly, including the pump tip and pump tube as operated in the most

common dispensers, and the optional upper check valves found on some pumps.

The pump tip performs several important functions; it has a nozzle to dispense the soap in the right direction, it opens on demand to dispense a metered portion of soap and closes off the flow of soap between dispenses.

The pump tips of the prior art are typically inserted into and supported by the pump tube, the lower end of the tube when installed being nested in a recess in the back plate of the dispenser. The lower end of some pumps are totally unsupported, and are susceptible to movement in any direction, caused by movement of the dispenser actuator or by the user's palm deflecting the pump tip nozzle. This can lead to misdirected dispenses, jams, and leaks.

Some pump tips have keyed surfaces that extend from below the lower edge of the pump tube to mate with corresponding surfaces in the lower end of the tube recess of compatible dispensers. The keyed surfaces act primarily to restrict the degree of cross-brand compatibility of soap containers to dispensers, but may contribute to some degree to prevent pump tubes and tips from being twisted or drawn up into the dispenser as the pump tube is manipulated by the pumping mechanism.

The "bag-in-a-box" containers hold the liquid soap or other desired material, in a collapsible, flexible bag within a cardboard or paperboard box which is closed for shipping and storage. The box is installed on a shelf in the dispenser, opened for use by tearing out a perforated section in the front and bottom of the box which leaves a slot through which the collapsible pump tube connected to the bottom of the bag is extracted and positioned in it's respective upper and lower tube locator recesses. The tube may be attached to the bag by a rotatable fitment which allows the tube and tip to be rotated as

necessary to mate any keyed surfaces on the tip to the corresponding surfaces in the lower tube recess.

The pump tube is typically made of extruded or molded latex or similar material, and is typically two to four inches long, depending on the dispensers it is intended to fit. The pump tube is attached to or terminated by the pump tip and nozzle from which the fluid is dispensed.

Within the pump tip there may be a check valve that resists the free flow of fluid from the bag, but which will yield to the fluid pressure created by a manually-actuated pumping mechanism which squeezes the pump tube in a downward direction. The pump tip is generally assembled from two components, one of which includes the tube coupling nipple and provides the upper end seat against which the check valve operates; the other of which includes the outlet nozzle for dispensing, and provides the lower end support for the check valve means.

The pump tip component halves are commonly joined by an ultrasonic welding process. The welded joints are not highly reliable. Acceptance testing at high ratio sampling for air and water leak tests, check valve open and check valve closed, is required to maintain quality control of the assembled pump tips. There is typically a two percent (2%) reject rate, the rejects being unsalvageable.

The pump lever pinches off the tube closer to the upper end, then squeezes the tube progressively downward to expel the trapped fluid through the pump tip. The pressure produced by aggressive users, and the resulting tube flexure, can cause leaks, ruptures and displacement of the pump tip.

When the pressure on the tube is removed, the lower end check valve shuts, and the tube expands to its full size. It is the expansion of the pump tube after the dispense that draws

more fluid from the bag into the tube, collapsing the bag by a proportionate volume.

The system is sized so that one or two strokes of the pump lever should dispense a sufficient volume of soap for the average user's immediate use.

The check valve may be incorporated into the lower end of the pump tube, rather than in the pump tip. Some designs include a second check valve on the upper end of the pump tube to prevent back flow of fluid into the bag during the pressure stroke on the pump tube. Various manufacturing and operating problems occur, including size, cost, testing, rejects, and performance and reliability in operation.

In some systems the volume requirement necessitates a larger diameter pump tube than the dispenser's lower recess provides for. Some manufacturers use a molded-in, necked-down lower end tube design to provide the desired working volume and still properly fit the tube recess. This necked-down feature creates a complex pump tube design that is inevitably more expensive to manufacture than simple, extruded pump hose that could be cut to length.

A dispenser cover opens to expose the interior of the dispenser for changing soap containers. The box of soap is placed on a supporting shelf in the upper part of the dispenser, and the pump tube is extended downward through a slot in the shelf and typically positioned into an upper pump tube recess and a lower pump tube recess with the working portion of the pump tube lying against a back plate or support wall of the dispenser.

The dispenser cover, when closed, positions a lever or pump arm or related pressure member in close proximity to the pump tube so that upon actuation, the pressure member squeezes the tube against the support wall in a downward direction, thus

forcing a portion of the fluid in the tube through the pump tip and out the nozzle. The tube recovers it's shape when the lever is relaxed, allowing the tube's interior volume to be replenished with fluid from the bag.

Known pump designs for these types of soap dispensers universally extend the tubing into a lower tube recess as a means of providing lateral support to the pump tube during operation in the dispenser. Conversely, the lower tube locator recesses of known soap dispensers are universally designed with the outer diameter of the lower end of the intended pump tube as the size of the recess, clearly intending that the principle means of laterally securing the low end of the pump tube be by virtue of it's external contact with the walls of the recess, and thereby relegating the pump tip to the less rigid support provided by the interior walls of the pump tube.

This design standard has resulted in the problem of a lack of rigidity and structural integrity of the lower termination point of the pump hose, and the further problem that the pump tip and nozzle are not fully supported, secured or laterally restrained by dispenser structure, and may be twisted or misdirected by flexing of the pump tube in operations, or by external means such as user's hands or fingers, causing fluid to be dispensed in an unexpected direction, or possible malfunction or leakage of the dispenser.

Furthermore, in common dispensers there is no structural means provided for directly closing or fully securing the pump tip against forward movement within the lower pump tube recess, thus not excluding the possibility that a pump tip will become dislodged or misaligned during cover closure or operation, causing a malfunction, rupture, or related problem.

Additionally, the exposed joints or mating lines where pump tip body halves are joined, pose a manufacturing problem due to the high reject rate, and to rejects being unsalvageable.

The same joints then pose a further risk of leaking or weeping under the pressure of pump strokes while in operation.

U.S. Patent 5,265,772, Bartasevich et al, November 30, 1993, discloses a typical dispenser system that uses a "bag-in-a-box" disposable container. The illustrations clearly show the reliance on a pump tip and tube combination whereby the outer diameter of the soft wall of the pump tube extends downward into the lower tube recess and provides the majority of contacting surface for lateral restraint of the tube in operation.

Fig. 9 of the Bartasevich '772 disclosure illustrates a two-component pump tip housing with an exposed mating line.

The pump tips and tubes 8A, 8B and 8C of Figure 8 of this specification illustrate examples of the prior art of pump tip designs that presume pump tubes to extend into the lower recess of a common dispenser, the vertical height of the recess being the excess tube length illustrated in Fig. 8 by length L. Figures 1, 2 and 6 further illustrate a typical dispenser loaded with a fluid container or vessel with a pump tube and tip of the prior art wherein the tube extends into the lower tube recess and provides only a soft contact surface for lateral support.

In summary, the box, bag, pump tube and pump tip portion of typical dispensing systems, in the present practice and direction the industry is heading, are disposable and consequently very price sensitive. Subtle improvements that will improve performance or reliability, lower unit cost of the disposable package, or reduce the waste bulk of the depleted package become very important. Also, the large installed base of dispensers means that improvements to the disposable portion of the hardware that will work with the existing installed dispensers will reach and benefit more users faster than improvements to dispenser design.

Finally, the present scheme of pump tubes and tips is not the product of a clean design, but the result of an evolving industry. The pump tips of the prior art, having exposed joints or mating lines between body halves, are difficult and expensive to product, and may leak or rupture in the field. The pump tip as installed, supported mainly by the exterior walls of the excess length of the soft latex pump tube wall have been known to allow the lower end of the pump to become disengaged, to rupture, and to misdirect the dispensed materials. The size and bulk of pump tip and upper fitment components, to the extent that they extend into the pump tube, limits the volume available in the pump tube. The bulk of the waste product, the empty fluid container and pump, contributes to disposal costs. As always, the cost of disposable hardware being consumed in very large quantities, including extruded pump tube material, is important.

SUMMARY OF THE INVENTION

An object of the invention is to provide a fluid dispenser pump, the pump tip of which is less susceptible to rejects in manufacturing cycle or leaks in operation relating to faulty welds or mating lines between components of the pump tip.

Another object is to provide greater rigidity for the pump tube's termination point at the pump tip in the lower fitment recess of the dispenser, for more reliable operation and less risk of displacement or malfunction of the pump.

Yet another object is to reduce the length, and thereby the cost, of the pump tube required in a given dispenser.

Still yet another object of the invention is to provide means to reduce the likelihood of twisting and upward movement of the pump and pump tip in operation.

An additional object is to provide keying surfaces that will enable and promote the use of pumps and pump components designed for corresponding dispensers.

Another additional object is to reduce the bulk and manufacturing complexity of check valves used in dispenser pumps and fluid dispensers.

Still other objects and advantages of the present invention will become readily apparent to those skilled in this art from the following detailed description, wherein I have shown and described only a preferred embodiment of the invention, simply by way of illustration of the best mode contemplated by me on carrying out my invention. As will be realized, the invention is capable of other and different embodiments, and its several details are capable of

modifications in various obvious respects, all without departing from the invention.

The objects and advantages of the invention may be further realized and attained by means of the instrumentality's and combinations particularly pointed out in the appended claims. Accordingly, the drawing and description are to be regarded as illustrative in nature, and not as restrictive.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is a sectional view of a typical liquid hand soap dispenser with pump tube and prior art pump tip.

FIG. 2 is a front elevation view of the dispenser with the cover removed.

FIG. 3 is a perspective view of the preferred embodiment of the pump tip of the invention.

FIG. 4 is a second perspective view thereof.

FIG. 5 is an exploded sectional view thereof.

FIG. 6 is a perspective view of a prior art pump tip installed in a typical dispenser.

FIG. 7 is a perspective view of a preferred embodiment of the invention installed in a typical dispenser.

FIG. 8 is a comparison of prior art pump tips 8a, 8b, and 8c to a preferred embodiment of the pump tip of the invention, 8d, illustrating the corresponding areas normally engaged in a lower pump tube recess within a dispenser.

FIG. 9 is a side elevation of a preferred embodiment of the invention.

FIG. 10 is a side elevation of a preferred embodiment of the invention with dotted line illustration of principal interior components.

FIG. 11 is an exploded view of the optional upper check valve, with a cross sectional view of the valve body and a quarter section removed from the valve cage for clarity.

FIG. 12 is a perspective view of the optional upper check valve assembled for installation in the pump.

DESCRIPTION OF PREFERRED EMBODIMENT

The preferred embodiment of the invention is a pump for fluid dispenser systems using as components pump tubes and pump tips, such as in common hand soap dispensers. Key elements of the invention include a pump tip body with a longitudinally-extended exterior surface that provides for a hard interface with the lower fitment recess of the dispenser, and works with a correspondingly shorter pump tube, an end cap on the pump tip tube coupling for installation of an internal check valve mechanism, where the mating line between the end cap the end of the tube coupling is sealed by the pump tube wall when the pump is assembled, the wall of the pump tube providing the structural link that holds the end cap from separating from the body of the pump tip.

The longer exterior surface on the pump tip body enables the pump tip to be installed directly into the lower tube locator recess of the dispenser in close fit and direct contact with the vertical structural wall of the recess, thereby providing a pump tube lower end termination with improved security, rigidity and lateral support for the tip and tube, greater security for the exposed pump tip nozzle, and enables the use of shorter pump tubes of different diameter without need for a necked-down lower end.

The joint line or mating line on the tube coupling of the pump tip where the end cap is aligned with the pump tip body is a simple, push-in assembly that is secured and sealed from risk of leaks or rupture by the joint when the wall of the pump tube is bonded to the end cap and tube coupling of the pump tip. The bond between the wall of the pump tube and the tube coupling and the end cap creates the primary mechanical link or structural bond that keeps the end cap from being longitudinally separated from the tube coupling under the pressure of the fluid being pumped.

The invention extends to include an optional upper check valve keeps fluid under pressure in the pump tube from flowing back up into the fluid vessel. The check valve components, a valve body with a valve seat which is circumferential to the passageway for fluid flow is configured to be placed in close proximity to a downstream cage structure that is of open construction to allow fluid flow but restrain the check ball. Together the valve body and cage form a chamber that holds the ball valve loosely contained so that it can open for full flow or close against the valve seat in response to change in fluid pressure in the pump tube.

A section of the outer diameter of the valve body and the valve cage correspond with the inner diameter of the pump tube so that the two parts can be bonded by suitable means in their proper relationship within the tube. The wall of the pump tube then provides the primary structural support to resist the cage and body being pulled apart by pressure or fluid flow.

It will be apparent to one skilled in the art that the invention extends to variations of pump tube and pump tip combinations beyond the particular bag-in-a-box soap container and pump system and wall-mounted dispenser described in detail in this section.

For example, the invention extends to a pump connected to the bottom any fluid vessel so that the fluid in the vessel flows freely into the tube as it expands after being compressed in a pressure stroke. The pump tip may have a means for resisting the free flow of fluid but permitting or opening the flow when a pump mechanism or lever incorporated into the dispenser strokes the pump tube, thereby dispensing a portion of the fluid through the tip nozzle.

The pump tip may have an extended external vertical mating or mounting surface that is directly engagable or can be inserted or connected directly to a lower pump tube locator

recess or other mounting point in the dispenser that would ordinarily grip or hold the soft exterior wall of the lower end of the pump tube. The hard interface between the pump tip and recess insures that the tip is rigidly held in place and provides better lateral support to both the pump tube and the tip nozzle, during installation and operation of the dispenser, than if the soft exterior wall of the tube itself was the point of primary lateral support.

As another example, the invention extends to a pump where the pump tip has keyed surfaces that are intended to correspond to mating surfaces in the wall or structure of the lower tube locator recess, and may provide resistance to unwanted twisting of the tip and tube, or upward creeping or movement caused by the elasticity or working of the soft wall of the pump tube in operation.

As yet another example, the invention extends to a pump tip with a generally cylindrical or round shape matching that of the recess, and having one or more protruding tabs corresponding to slots in the wall or structure of the recess and one or more stepped surfaces on the body of the pump tip corresponding to stepped surfaces on or in the wall or structure of the recess, which may again contribute to reduced twisting and upward movement.

As still yet another example, the invention extends to a pump with a pump tip incorporating a spring and ball check valve as the means by which the flow of fluid is regulated.

As a further example, the invention extends to an pump tip designed and fabricated in component parts so that the spring and ball check valve or other check valve or flow regulation means can be inserted or installed through the tube coupling end of the pump tip before or as the parts are assembled into final form.

As a yet further example, the invention extends to liquid soap dispensers as are commonly wall-mounted in public and private lavatories, baths, rest rooms and utility rooms to provide a ready supply of soap for washing or cleaning body parts or other tangible items. The invention contemplates applicability to dispensers with refillable soap reservoirs, cartridge-type soap containers, and so called bag-in-box collapsible, disposable soap containers or vessels.

As a still yet further example, the invention extends to optional incorporation of a check valve at or near the upper end of the pump tube to prevent back flow of fluid into the fluid vessel when fluid in the pump tube is under pressure. The back pressure on the check valve forces a ball valve against the valve seat, closing the passageway to fluid flow.

Referring first to FIGS. 1, 2, and 6 of the drawings for context, it will be seen that a typical liquid hand soap dispenser 10 generally includes a back plate 20, a cover 30 and a pressure member 40; the pressure member 40 pivotally connected to the cover 30. The dispenser 10 holds therein a disposable fluid vessel 60 which contains liquid hand soap.

The fluid vessel 60 is of the conventional "bag-in-box" construction and includes interiorly thereof a flexible, collapsible bag 61 which contains the liquid hand soap. A collapsible resilient pump tube 62, made of extruded or molded latex, extends from the bottom of the bag and has upper fitment 63 and prior art pump tip 64. Pump tip 64 may be any variation of prior art pump tips 8a, 8b, and 8c of FIG. 8 where length L represents the portion of tube 62 normally engaged in lower pump tube locator recess 55a.

Upper fitment 63 is comprised of two components, a bag component 63a, which is attached to the bag, and a tube coupling component 63b, which is attached to the tube. Bag component 63a is attached in a rotatable manner to tube

coupling component 63b, thereby connecting tube 62 to bag 61 while allowing the pump to be rotated.

Pump tip 64 may have an integral spring and ball check valve, and has nozzle 68 on its bottom. Nozzle 68 projects through aperture 32 in cover 30 when tube 62 is properly positioned within closed dispenser 10. Tube 62 is normally stored within the box 60 during shipping and storage and a tear strip is provided in the box so that, when the box 60 is to be installed in the dispenser 10, the tear strip is simply removed along line 60a and the tube 62 extracted and the box and tube properly positioned in the dispenser.

A vessel and pump support member 50 projects outwardly from backplate 20, and includes support shelf 52. Vessel 60 rests on support shelf 52 with the pump depending therefrom. Support member 50 also includes a first vertical wall 53 and a second, recessed, vertical pressure support wall 54 extending downwardly from support shelf 52 and against which the tube 62 can be collapsed upon actuation of pressure member 40.

Extending outwardly from the bottom of support member 50 is a third vertical wall 55 lying in substantially the same vertical plane as the first vertical wall 53. First vertical wall 53 includes upper fitment locator recess 53a located just beneath the bottom support shelf 52 for receipt of upper fitment 63. Third vertical wall 55 includes lower pump tube locator recess 55a for receipt of tube 62 and pump tip 64.

Referring to FIG. 1 of the drawings, it will be seen that the dispenser combination is fully loaded and the pressure member 40 is in the at rest position with pressure pad 42 engaging tube 62. By exerting pressure on pressure member 40 and moving it against tube 62, the tube 62 will be collapsed and the material contained therein will be dispensed out of nozzle 66.

Referring to FIGS. 3, 4, 8d, 9 and 10 of the drawings, it will be seen that the preferred embodiment of the pump includes pump tip 100 with nozzle 110, body 120 and tube coupling 130. Body 120 has longitudinally-extended external section 121, which height is indicated as length L in FIG. 8 of the drawings, approximately equal or greater in length as the vertical height of lower pump tube locator recess 55a.

As shown in FIGS. 7, 8d, 9 and 10 of the drawings, the lower end of pump tube 62 is attached to pump tip 100 via tube coupling 130, and is consequently shorter than the pump tubes of the prior art pump tips of FIGS. 8a, 8b and 8c used in the same dispenser.

Referring now to FIGS. 5 and 10, end cap 132 with orifice 134 is used to retain ball and spring check valve 128 within interior chamber 126 of pump tip 100. Interior chamber 126 communicates with nozzle opening 112. With the check valve in place, end cap 132 is sized for a simple push-fit onto tube coupling 130 at mating line 131, the exterior diameter of end cap 132 matching that of tube coupling 130, thereby providing tube coupling surface area extending beyond mating line 131 to include end cap 132.

Referring to FIGS. 9 and 10, pump tube 62 is then bonded to assembled pump tip 100 at tube coupling 130 using cynoacrylate adhesive to create a highly reliable joint that fully encompasses end cap 132 and mating line 131. The interior wall of pump tube 62, actually provides the primary structural support resisting longitudinal separation of the two parts, as well as the seal which prevents leakage at their mating line.

Referring again to FIGS. 9 and 10, upper fitment tube coupling component 63b is similarly attached with cynoacrylate adhesive to the upper end of pump tube 62. Upper fitment bag component 63a may be optionally attached first to bag 61, then

later mated in a rotatable manner to the pump via tube coupling component 63b. Alternatively, upper fitment bag component 63a may be first mated in a rotatable manner to tube coupling component 63b, the pump thus configured then later attached to bag 61.

Referring to FIGS. 11 and 12, upper fitment tube coupling component 63b of FIG. 10, may in some cases incorporate a conventional back flow check valve in the form of ball 74 which is loosely confined at the lower end of valve body 72 by three prong valve cage 76. When pump tube 62 is placed under compression, fluid pressure forces ball 74 up against valve seat 72a to stop back flow of fluid into bag 61. When the pressure in tube 62 subsides, ball 74 falls into the open position on valve cage 76, allowing forward or downward flow.

The back flow check valve version of upper fitment tube coupling component 63b is assembled and incorporated into the pump in the same manner as ball and spring check valve 128 in pump tip 100. That is, valve cage 76 is sized for a simple push-fit into the lower end of valve body 72, thereby caging the ball 74. Cage 76 and valve body 72 are secured in their relative positions by gluing or bonding the upper end of pump tube 62 to circular section surface 76b of cage 76 and circular section surface 72b of valve body 72 using cynoacrylate adhesive to create a highly reliable bond joint that secures cage 76 in it's position relative to valve body 72. As with pump tip 100, the interior wall of pump tube 62 actually provides the medium through which the two parts are bonded, resisting longitudinal separation due to fluid pressure or flow.

Referring to FIG. 7 of the drawings, external section 121 of body 120 is directly engaged and closely-fitting in pump tip locator recess 55a, thereby providing a hard interface with accurate placement and resistance to lateral movement, and thus elevating tube coupling 130 and the lower

termination of tube 62 above the upper edge of recess 55a. The diameter of tube 62 is not constrained by the diameter of recess 55a.

Referring to FIGS. 3, 4 and 7, body 120 has tabs 122 and step surface 124 which corresponds with slots and stepped surfaces 55b at the lower end of recess 55a as are common to many existing dispensers. Tube 62 may be rotated about the rotatable coupling between upper fitment components 63 and 64, to present opposing side keyed surfaces of body 120 for dispenses so configured.

It can be seen from FIGS. 1, 2, 6 and 7 that the method of operation of the dispenser is not altered by introduction of the pump of the invention. Spring and ball check valve 128 regulates the flow of fluid, normally resisting the free flow of fluid when the dispenser is not being used, and yielding to increased fluid pressure when pressure member 40 of the dispenser 10 is activated.

In summary, the benefits of the invention derive from the extended mating surface of the pump tip of the pump which provides improved security, rigidity and lateral support for the pump tip and tube as well as use of a shorter tube; the end cap on the pump tip being fully enclosed and secured in place by the glue joint bond to the pump tube and hence to the pump tip, which reduces manufacturing costs, and eliminates manufacturing rejections for bad weld joints and the risk of leaking or weeping weld joints in operation; and the optional upper check valve configuration secured by bonding to the pump tube wall, which provides simplicity, small size and reduced manufacturing cost.

Although the drawings and the specification present a detailed disclosure of a preferred embodiment of the present invention, it is to be understood that the invention is not limited to the specific form disclosed, but covers all

modifications, changes and alternative constructions falling within the scope of the appended claims in light of this disclosure.

## CLAIMS

What is claimed is:

1. A pump tip for use with a pump tube and fluid vessel in a fluid dispenser wherein upper end of said pump tube is connectable to lower end of said fluid vessel such that fluid contained therein may be drawn from said vessel into said pump tube, said dispenser having means to apply a downward pump stroke to said pump tube thereby placing any said fluid therein under pressure, said pump tip comprising:

a body containing an interior chamber, a nozzle projecting downward from lower end of said body, and a tube coupling projecting upward from upper end of said body,

said chamber communicating with an output opening at lower end of said nozzle and further communicating with an input opening in an end cap at upper end of said tube coupling whereby a continuous passageway is formed through said pump tip,

said end cap having same outer diameter as said tubing coupling and being positionable with respect to said tube coupling so as to form an extension thereto,

lower end of said pump tube being bondable to said tube coupling and said end cap whereby said wall of said pump tube provides structural resistance to longitudinal separation of said tube coupling and said end cap, and

said interior chamber containing a check valve configured to resist free flow of said fluid from said pump tube into said chamber and yield to flow of said fluid under said pressure from said pump tube into said chamber thereby dispensing said fluid out of said nozzle until said pressure is relieved.

2. The pump tip of claim 1, said pump tip comprising at least one longitudinally-extending external section, said mating surface directly engagable and closely fitting within a lower tube locator recess of said fluid dispenser thereby

providing a rigid interface and lateral support means to said pump tip and extending said tube coupling above said tube locator recess whereby said pump tube does not extend downward into said tube locator recess when attached to said tube coupling.

3. The pump tip of claim 2, said body further comprising keyed surfaces corresponding to mating surfaces in said tube locator recess, said keyed surfaces cooperating with said mating surfaces to provide resistance to twisting and upward movement of said pump tip when said pump tip is engaged with said tube locator recess.

4. The pump tip of claim 3, said external section having a generally cylindrical shape, said keyed surfaces comprising at least one tab extending outward from said body corresponding to at least one mating slot in said tube locator recess and further comprising at least one step surface on said body corresponding to at least one mating step surface in said tube locator recess.

5. The pump tip of claim 4, said check valve comprising a spring and ball, said end cap being configured to seat said ball under upward pressure from said spring thereby resisting said free flow of said fluid from said pump tube.

6. The pump tip of claim 1, said fluid being liquid soap.

7. A check valve for use with a tube, said check valve comprising:

a ball valve,

a valve body having a valve seat circumferential to a passageway open to flow of said fluid, said valve seat configured to receive said ball valve in a close fitting relationship when forced there into by back pressure thus closing said passageway to said flow of said fluid, external

size of said valve body having at least one circular section corresponding to inner diameter of said tube whereby said valve body may be bonded to interior wall of said tube in a fixed position, and

a valve cage open to said flow of said fluid and configured to fit in close proximity to said valve body and define therewith a chamber within which said ball valve is loosely retained, external shape of said valve cage having at least one circular section corresponding to said inner diameter of said tube whereby said valve cage may be bonded to said interior wall of said tube in a fixed position in said close proximity to said valve seat, whereby said wall of said tube provides structural that resists longitudinal separation of said valve body and said valve cage.

8. The check valve of claim 7, upper end of said valve body terminating in a means for connecting to a fluid vessel whereby said passageway communicates with said vessel.

9. The check valve of claim 8, said fluid being liquid soap.

10. A pump for dispensing fluid from a fluid vessel in a fluid dispenser, said pump comprising:

a pump tube, said dispenser having means to apply a downward pump stroke to said pump tube thereby placing any said fluid therein under pressure,

means for connecting upper end of said pump tube to said fluid vessel, and

a pump tip,

said pump tip comprising a body containing an interior chamber, a nozzle projecting downward from lower end of said body, and a tube coupling projecting upward from upper end of said body,

said chamber communicating with an output opening at lower end of said nozzle and further communicating with an input opening in an end cap at upper end of said tube coupling

whereby a continuous passageway is formed through said pump tip,

said end cap having same outer diameter as said tubing coupling and being positionable with respect to said tube coupling so as to form an extension thereto,

lower end of said pump tube being bondable to said tube coupling and said end cap whereby said wall of said pump tube provides structural support to resist longitudinal separation of said tube coupling and said end cap, and

said interior chamber containing a check valve configured to resist free flow of said fluid from said pump tube into said chamber and yield to flow of said fluid under said pressure from said pump tube into said chamber thereby dispensing said fluid out of said nozzle until said pressure is relieved.

11. The pump of claim 10, said pump tip comprising at least one longitudinally-extending external section, said mating surface directly engagable and closely fitting within a lower tube locator recess of said fluid dispenser thereby providing a rigid interface and lateral support means to said pump tip and extending said tube coupling above said tube locator recess whereby said pump tube does not extend downward into said tube locator recess when attached to said tube coupling.

12. The pump of claim 11, said body further comprising keyed surfaces corresponding to mating surfaces in said tube locator recess, said keyed surfaces cooperating with said mating surfaces to provide resistance to twisting and upward movement of said pump tip when said pump tip is engaged with said tube locator recess.

13. The pump of claim 12, said external section having a generally cylindrical shape, said keyed surfaces comprising at least one tab extending outward from said body corresponding to at least one mating slot in said tube locator recess and

further comprising at least one step surface on said body corresponding to at least one mating step surface in said tube locator recess.

14. The pump of claim 13, said check valve comprising a spring and ball, said end cap being configured to seat said ball under upward pressure from said spring thereby resisting said free flow of said fluid from said pump tube.

15. The pump of claim 10, said fluid being liquid soap.

16. The pump of claim 10, upper end of said pump tube incorporating a check valve, said check valve comprising:

a ball valve,

a valve body having a valve seat circumferential to a passageway open to flow of said fluid, said valve seat configured to receive said ball valve in a close fitting relationship when forced there into by back pressure thus closing said passageway to said flow of said fluid, external size of said valve body having at least one circular section corresponding to inner diameter of said pump tube and being bonded to interior wall of said pump tube in a fixed position, and

a valve cage open to said flow of said fluid and configured to fit within said pump tube in close proximity to said valve body defining therewith a chamber within which said ball valve is loosely retained, external shape of said valve cage having at least one circular section corresponding to said inner diameter of said pump tube and being bonded to said interior wall of said pump tube in a fixed position in said close proximity to said valve seat whereby said wall of said pump tube provides structural support to resist longitudinal separation of said valve body and said valve cage.

17. The pump of claim 16, upper end of said valve body terminated within means for connecting to a fluid vessel whereby said passageway communicates with said vessel.

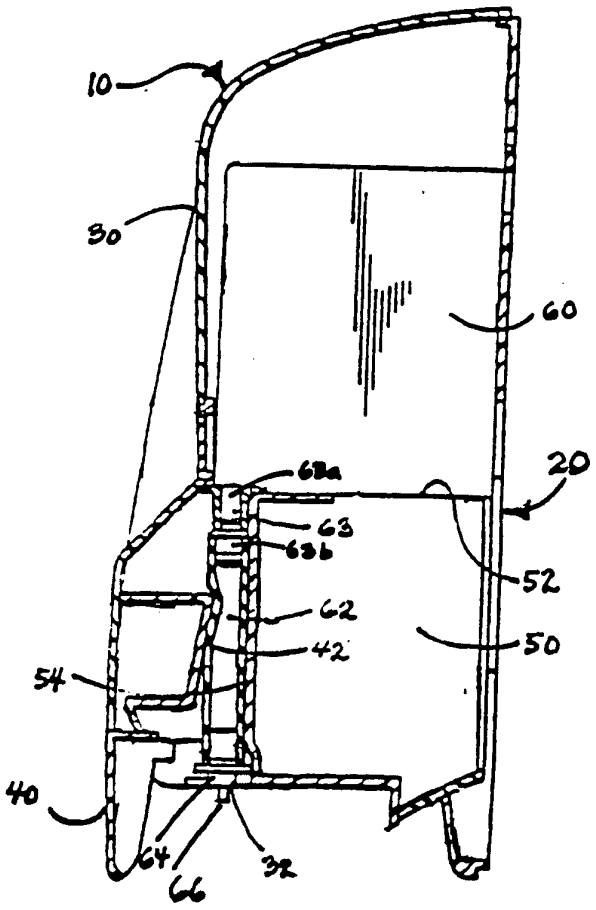


FIG. 1
(PRIOR ART)

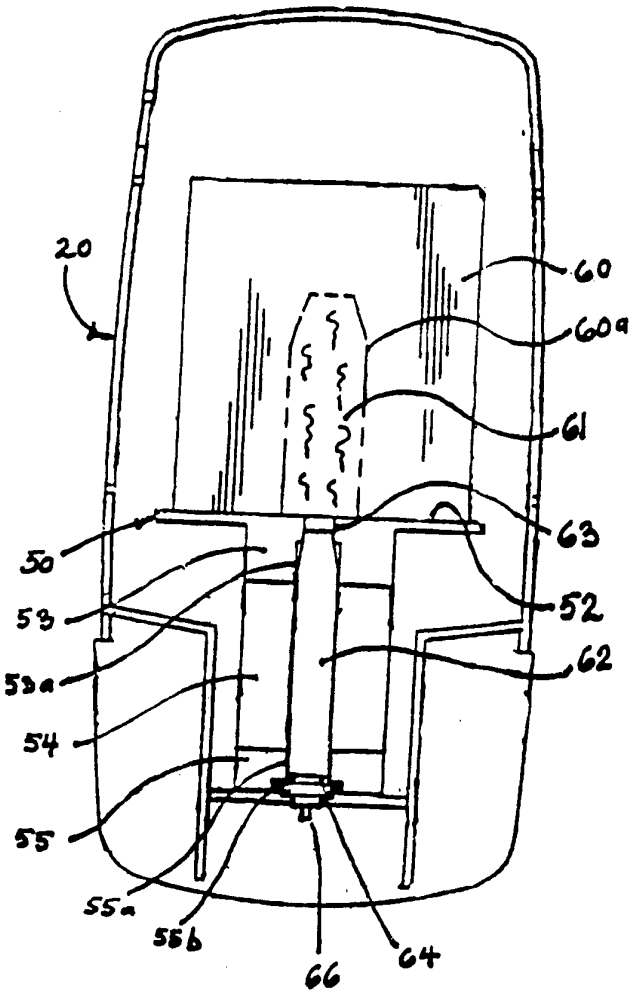


FIG. 2
(PRIOR ART)

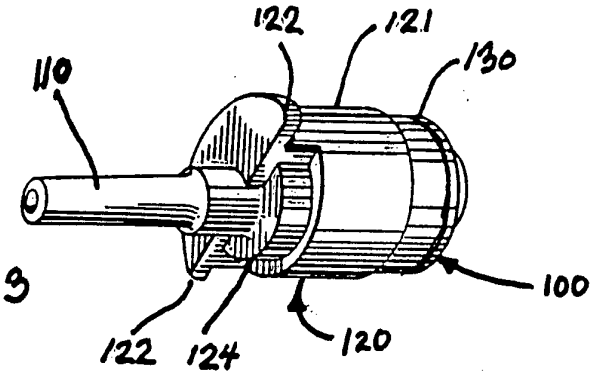


FIG. 3

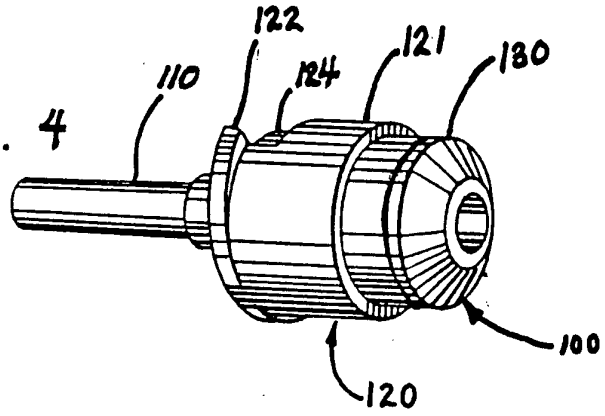


FIG. 4

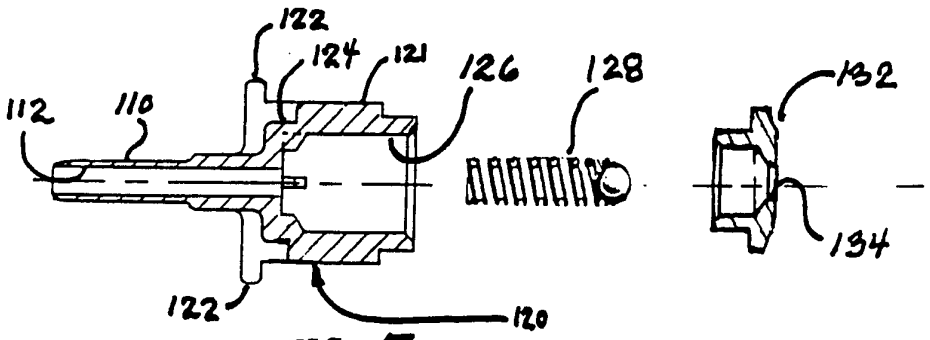


FIG. 5

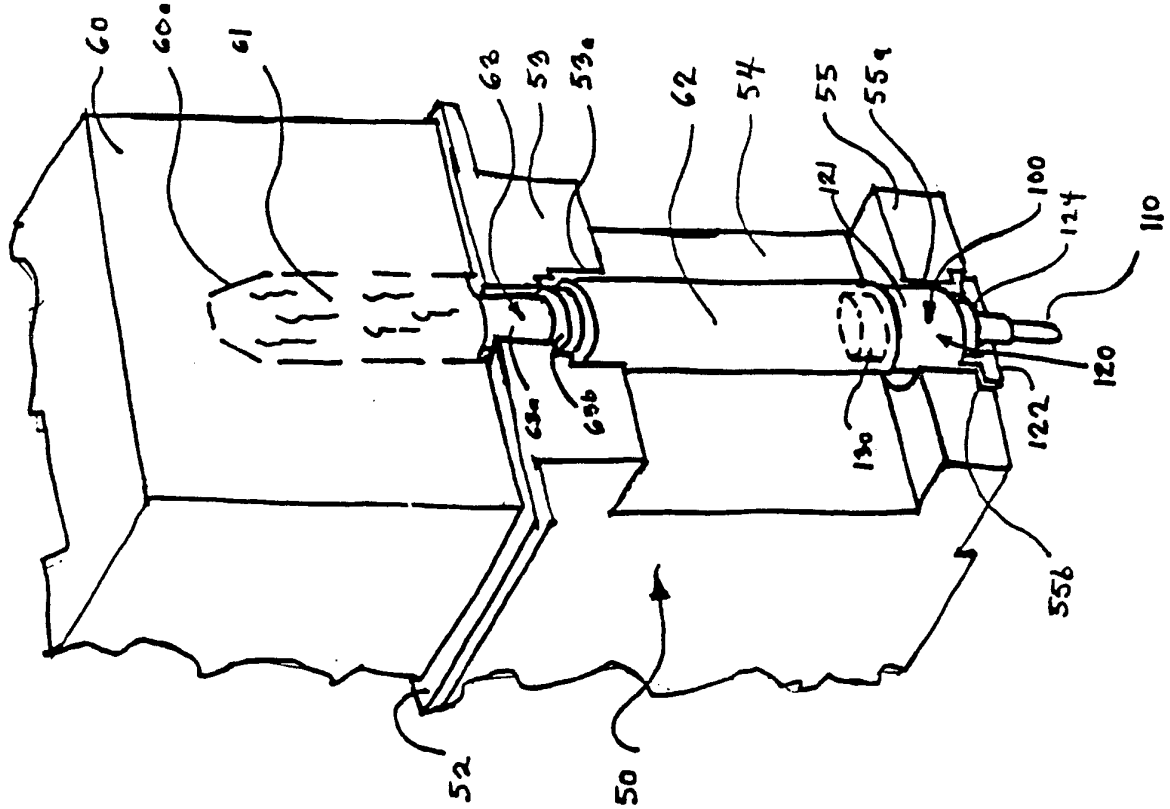


FIG. 7

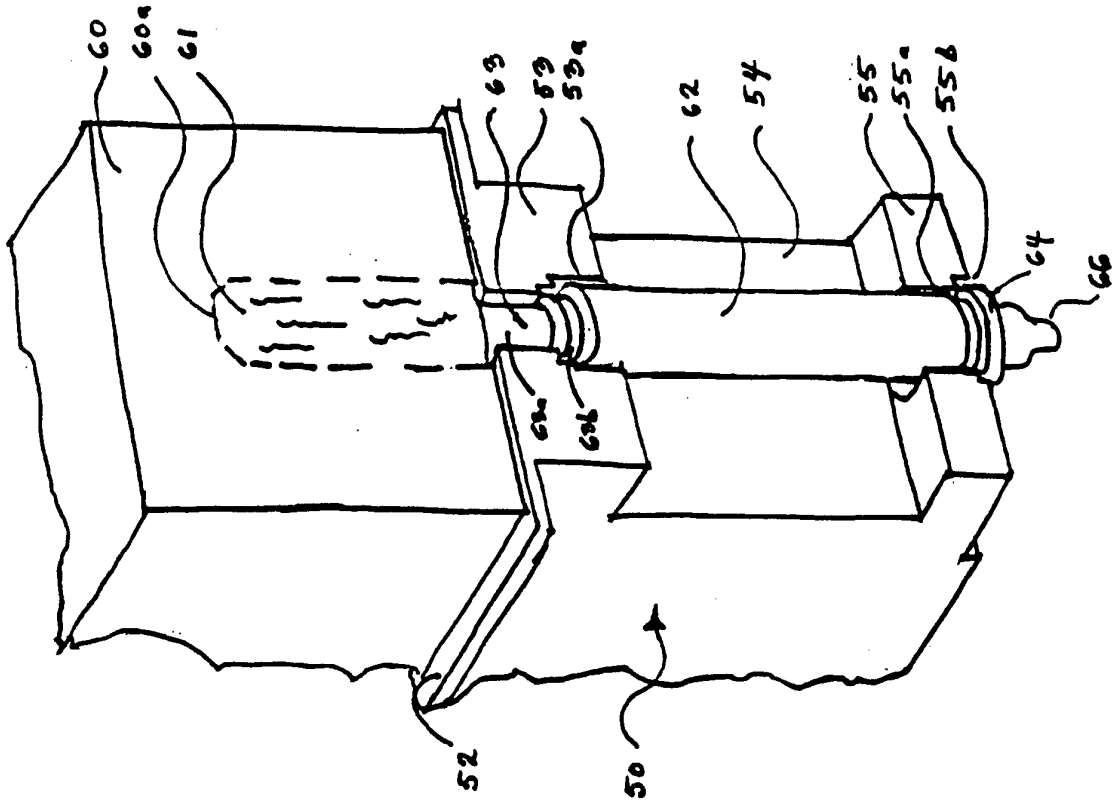


FIG. 6
(PRIOR ART)

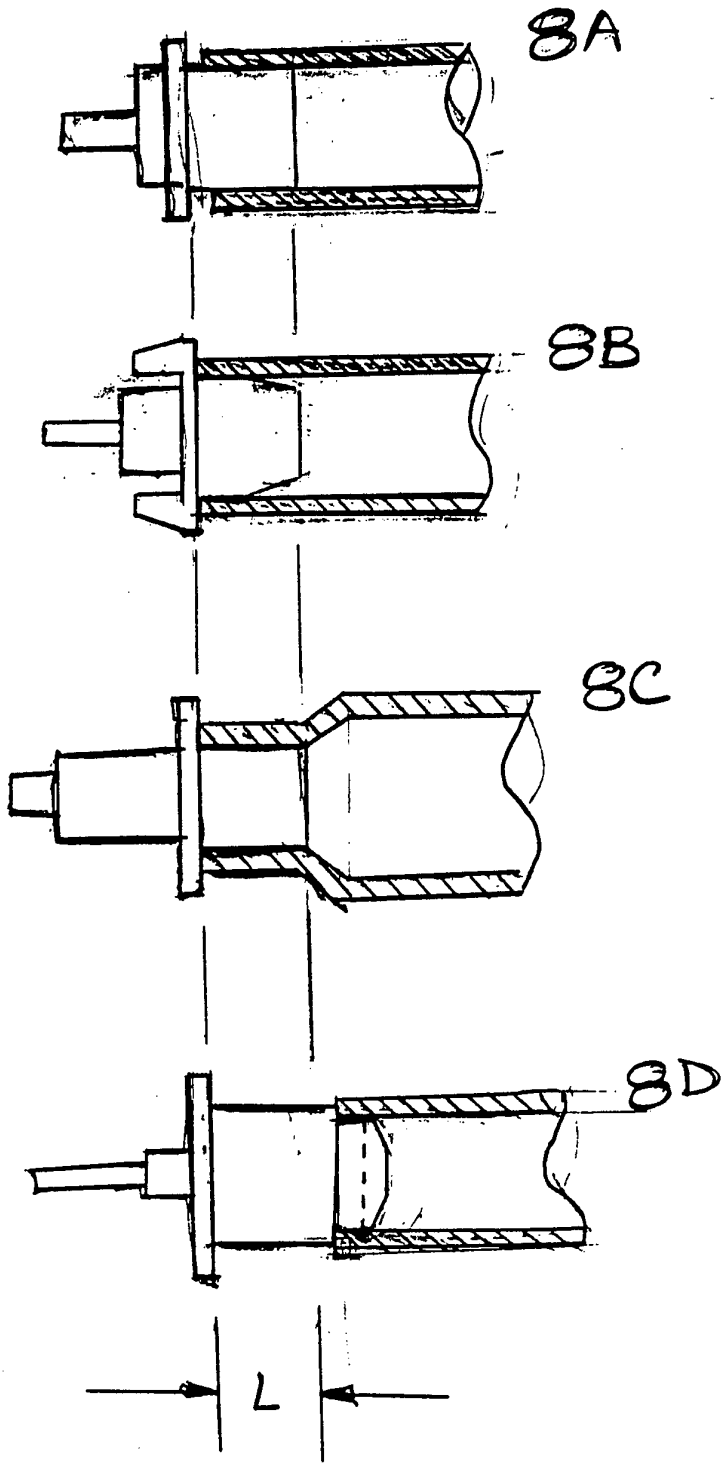


FIG. 8

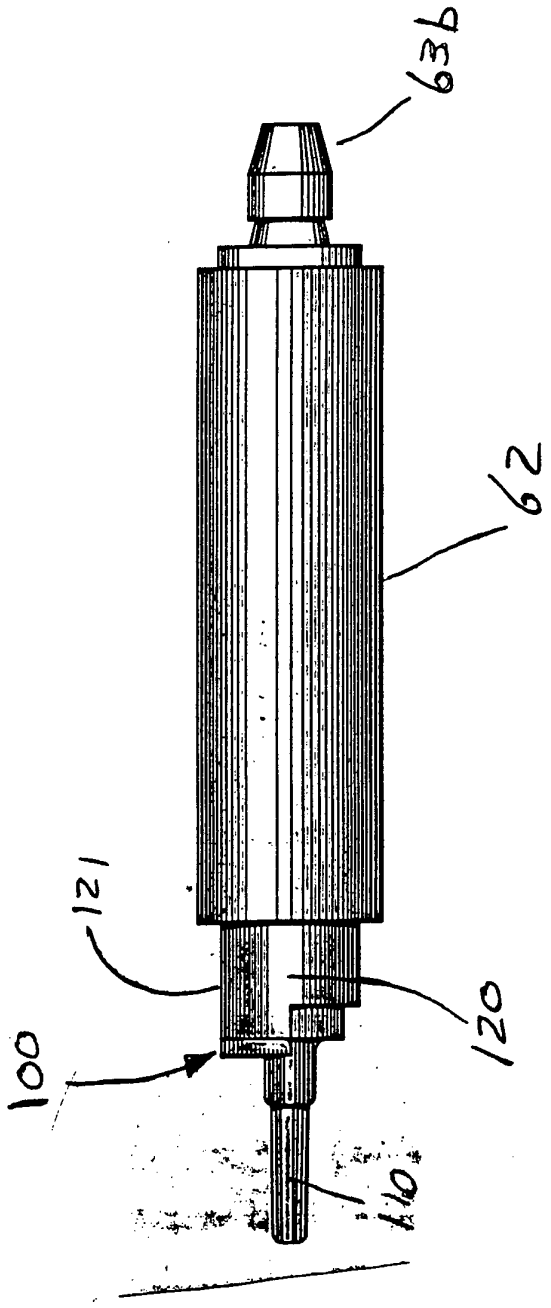


FIG. 9

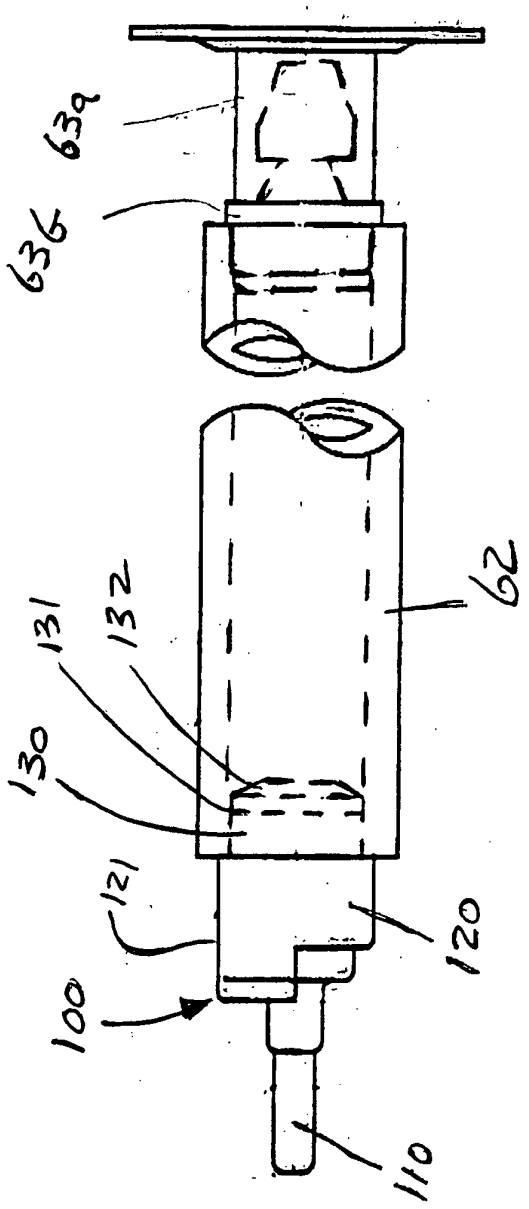


FIG. 10

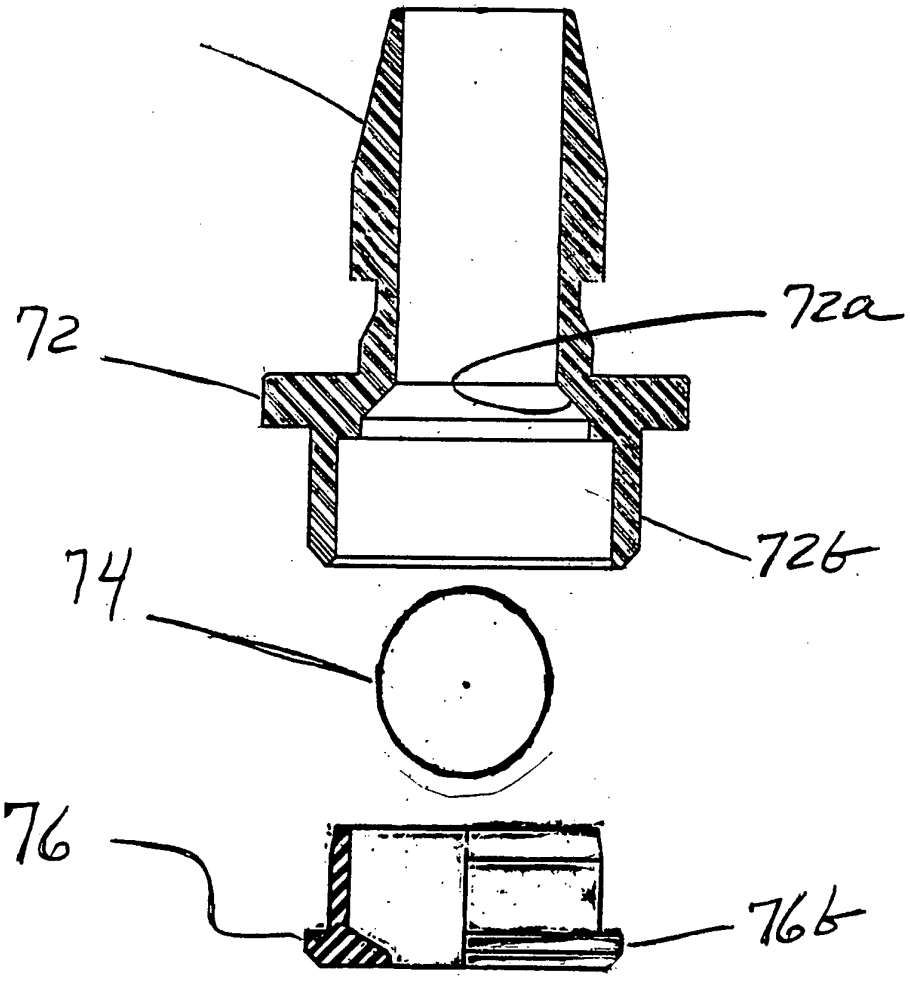


FIG 11

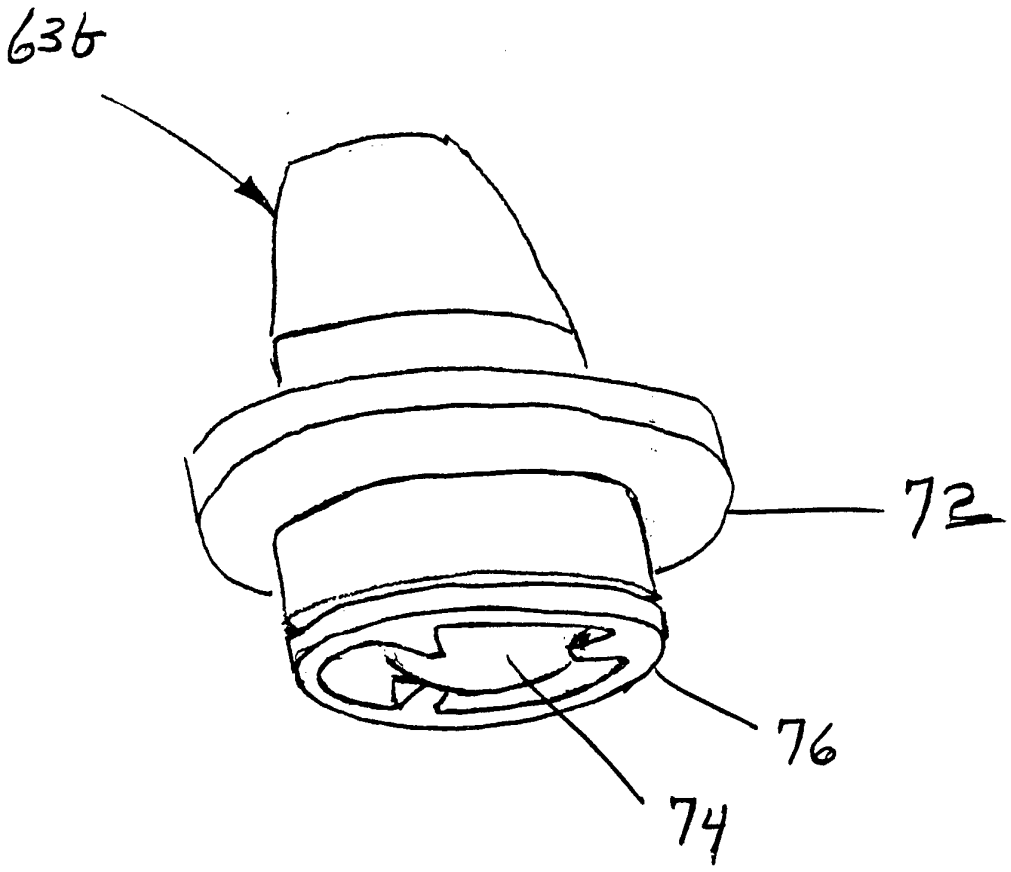


FIG 12

# INTERNATIONAL SEARCH REPORT

International application No.
PCT/US95/06778

A. CLASSIFICATION OF SUBJECT MATTER
IPC(6) :B67D 5/06; G01F 11/02
US CL :222/181.3, 207, 214
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)
U.S. : 222/105,181.3, 207, 214

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

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| Y | US, A, 4,394,938 (FRASSANITO) 26 July 1983, see the entire document. | 1-3, 6-12, 15-17 |
| Y | US, A, 4,741,461 (WILLIAMSON ET AL.) 03 May 1988, see the entire document. | 1-3, 6-12, 15-17 |
| Y | US, A, 4,515,294 (UDALL) 07 May 1985, see the entire document. | 1-3, 6-12, 15-17 |
| A | US, A, 4,621,749 (KANFER) 11 November 1986. | |
| A | US, A, 4,722,372 (HOFFMAN ET AL.) 02 February 1988. | |

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

| | | | |
|---|---|---|---|
| * | Special categories of cited documents: | "T" | 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 |
| "A" | document defining the general state of the art which is not considered to be of particular relevance | "X" | document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone |
| "E" | earlier document published on or after the international filing date | "Y" | 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 |
| "L" | document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) | "&" | document member of the same patent family |
| "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 | | |

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 01 SEPTEMBER 1995 | 15SEP1995 |
| Name and mailing address of the ISA/US<br>Commissioner of Patents and Trademarks<br>Box PCT<br>Washington, D.C. 20231 | Authorized officer<br>KEVIN P. SHAVER |
| Facsimile No. (703) 305-3230 | Telephone No. (703) 308-1113 |

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