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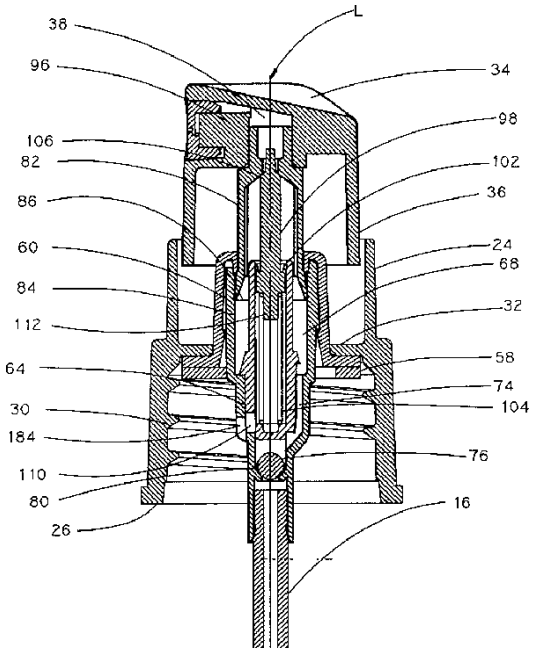
(54)【発明の名称】手動で作動するポンプアセンブリ

(57)【要約】
指で作動されるポンプアセンブリは、外側のハウジング（６２、１６２）及び内側のハウジング（６６、１６６）を支持しそれらの間に圧縮室（６８）の第１ 部分を形成する基部（６４、１６４）を有するポンプ本体（６０、１６０）を備える。ピストン（８２）は環状のリップ及び揚弁弁座によって形成されたピストン出口を有する。揚弁（９８）が内側のハウジング（６６、１６６）に収納され、ばね（１０４）によって基部から揚弁弁座と係合するように付勢される。揚弁（９８）と内側のハウジング（６６、１６６）は内部空洞（１００）を形成する。周辺の通路（７４）は圧縮室（６８）に繋がり、逆止弁（７６）を含む。通気ポート（１１０）が揚弁（９８）の作動中揚弁（９８）が周囲の圧力で作動できるように内部空洞（１００）内に設けられている。



【特許請求の範囲】
【請求項１】
指で作動するポンプアセンブリであって、
外側のハウジング及び内側のハウジングを支持する基部を有するポンプ本体であって、前記外側のハウジング及び前記内側のハウジングはそれらの間に少なくとも部分的に圧縮室を形成するポンプ本体と、
前記ポンプ本体を支持する閉鎖部であって、容器の注ぎ口との係合を容易にするための機構を備える閉鎖部と、
少なくとも部分的に前記ポンプ本体に受け入れられ、前記外側のハウジングに沿って前記ポンプ本体に対して摺動可能であるピストンであって、前記ピストンは前記ポンプ本体に密封係合を供給するための環状のリップを有し、前記ピストンにはピストン出口を形成する揚弁弁座が設けられたピストンと、
前記ピストン出口に連結されたアクチュエータであって、製品の噴霧を容易にするための前記ピストン出口に繋がる排出口を備えるアクチュエータと、
前記内側のハウジングに収納された揚弁であって、前記ポンプ本体の前記基部からばねによって離れる方へ付勢され、前記揚弁弁座と係合し前記ピストン出口を通常閉じて製品の流れを防止し、前記揚弁、前記基部及び前記内側のハウジングは内部空洞を形成し、前記内部空洞には前記揚弁の作動中、前記内部空洞が周囲の圧力で作動するための通気ポートが設けられた揚弁と、
前記圧縮室に繋がる通路であって、製品を前記通路に沿って前記圧縮室の方へ流れさせる入口及び逆止弁を有する通路と、を備えた指で作動するポンプアセンブリ。
【請求項２】
前記揚弁が環状の密封及び誘導面を有し、前記内側のハウジングの内側に向いた面に沿って前記揚弁の摺動密封係合を容易にすることを特徴とする、請求項１記載の指で作動するポンプアセンブリ。
【請求項３】
前記揚弁に、ピストン出口を形成する前記揚弁弁座と係合するための揚弁肩部が設けられ、前記揚弁が前記ピストン出口から延出し前記揚弁を前記ピストン出口に揃えることを容易にするための付属体を有することを特徴とする、請求項１記載の指で作動するポンプアセンブリ。
【請求項４】
前記内側のハウジング内に受け入れられた前記揚弁の端部が、前記ばねの第１端部と係合する延長部を支持し、前記指で作動するポンプアセンブリの長さ方向の軸に沿って前記揚弁の誘導を確実に行わせることを特徴とする、請求項１記載の指で作動するポンプアセンブリ。
【請求項５】
前記ポンプ本体が小塔に連結され、前記小塔は前記閉鎖部に接続され、前記閉鎖部の遠隔自由端部が前記閉鎖部の基部から離れる方に延出する環状のスカートを支持することを特徴とする、請求項１記載の指で作動するポンプアセンブリ。
【請求項６】
前記小塔が環状の側壁を有し、前記側壁の自由端の部分には前記ポンプ本体を前記小塔に堅固に接続するための環状の保持縁が設けられていることを特徴とする、請求項５記載の指で作動するポンプアセンブリ。
【請求項７】
前記アクチュエータに、前記閉鎖部の前記環状のスカートと係合する環状の側壁が設けられ、前記ポンプアセンブリの長さ方向の軸に沿って前記アクチュエータの作動を容易に行わせることを特徴とする、請求項５記載の指で作動するポンプアセンブリ。
【請求項８】
前記閉鎖部には環状のフランジが設けられ、前記小塔には対となる環状のフランジが設けられ、前記閉鎖部の前記環状のフランジとガスケットが前記小塔の前記環状のフランジを

サンドイッチ状に挟み、前記指で作動するポンプアセンブリと所望の容器との密封係合を容易にすることを特徴とする、請求項５記載の指で作動するポンプアセンブリ。
【請求項９】
前記アクチュエータが前記排出口と繋がる中央の穴を有し、前記ピストンが前記ピストンを前記アクチュエータに接続するために前記アクチュエータの前記中央の穴と摩擦力で係合する環状のハウジング側壁を有し、前記ピストンから前記排出口へ噴霧すべき製品の供給を容易にすることを特徴とする、請求項１記載の指で作動するポンプアセンブリ。
【請求項１０】
前記内側ハウジングの内側に向いた面には、少なくとも１つの突起が設けられ、前記揚弁が前記内側のハウジングの内側に向いた面に沿って実質的に完全に変位すると、圧縮室内に生成された圧力を解放し、解放された圧力は内部空洞を通りポンプ本体の基部に設けられた通気ポートから排出されることを特徴とする、請求項１記載の指で作動するポンプアセンブリ。
【請求項１１】
少なくとも１つの溝が、圧力同等化のために前記ポンプ本体の外側面と前記小塔の内側に向いた面との間に設けられ、指で作動するポンプアセンブリが容器に接続され作動すると、指で作動するポンプアセンブリに取り付けられた容器が少なくとも部分的に真空になるのを防止することを特徴とする、請求項５記載の指で作動するポンプアセンブリ。
【請求項１２】
前記圧縮室に繋がる前記通路が、ポンプアセンブリの長さ方向の軸に実質上平行に延びているが、ポンプアセンブリの前記長さ方向の軸から半径方向に離されていることを特徴とする、請求項１記載の指で作動するポンプアセンブリ。
【請求項１３】
弁が前記圧縮室に繋がる前記通路に沿って配置され、前記弁は前記通路に沿った製品の流れを妨げるためにボール弁座に通常置かれているケージ内に拘束されたボールを有し、前記ポンプアセンブリの吸い上げ活動の間、前記ボールが製品を流すために前記弁座から変位することを特徴とする、請求項１２記載の指で作動するポンプアセンブリ。
【請求項１４】
汲み上げ管が通路の入口に接続され、容器の基部から噴霧すべき製品の吸い上げが容易に行われることを特徴とする、請求項１２記載の指で作動するポンプアセンブリ。
【請求項１５】
指で作動するポンプアセンブリであって、
外側のハウジング及び内側のハウジングを有するポンプ本体であって、前記外側のハウジング及び前記内側のハウジングはそれらの間に少なくとも部分的に圧縮室を形成するポンプ本体と、
前記ポンプ本体を支持する閉鎖部であって、容器の注ぎ口との係合を容易にするための機構を備える閉鎖部と、
少なくとも部分的に前記ポンプ本体に受け入れられ、前記外側のハウジングに沿って前記ポンプ本体に対して摺動可能であるピストンであって、前記ピストンは前記ポンプ本体に密封係合を供給するための環状のリップを有し、前記ピストンにはピストン出口を形成する揚弁弁座が設けられたピストンと、
前記ピストン出口に連結されたアクチュエータであって、製品の噴霧を容易にするための前記ピストン出口に繋がる排出口を備えるアクチュエータと、
前記内側のハウジングに収納された揚弁であって、ばねによって付勢され、前記揚弁弁座と係合前記ピストン出口を通常閉じて製品の流れを防止し、前記揚弁及び前記内側のハウジングは内部空洞を形成し、前記ポンプ本体に形成された通気ポートが前記揚弁の作動中、内部空洞が周囲の圧力で作動するように前記内部空洞と容器の内部との間の連通を確実にする揚弁と、
前記圧縮室に繋がる通路であって、製品を前記通路に沿って前記圧縮室の方へ流れさせる入口及び逆止弁を有する通路と、を備えたことを特徴とする指で作動するポンプアセンブ

リ。
【請求項１６】
前記揚弁が環状の密封及び誘導面を有し、前記内側のハウジングの内側に向いた面に沿って前記揚弁の摺動密封係合を容易にし、前記揚弁に、ピストン出口を形成する前記揚弁弁座と係合するための揚弁肩部が設けられ、前記揚弁が前記ピストン出口から延出し前記揚弁を前記ピストン出口に揃えることを容易にするための付属体を有し、
前記内側のハウジング内に受け入れられた前記揚弁の端部が、前記ばねの第１端部と係合する延長部を支持し、前記指で作動するポンプアセンブリの長さ方向の軸に沿って前記揚弁の誘導を容易にすることを特徴とする、請求項１５記載の指で作動するポンプアセンブリ。
【請求項１７】
前記ポンプ本体が小塔に連結され、前記小塔は前記閉鎖部に接続され、前記閉鎖部の遠隔自由端が前記閉鎖部の基部から離れる方に延出する環状のスカートを支持し、
前記小塔が環状の側壁を有し、前記側壁の自由端の部分には前記ポンプ本体を前記小塔に堅固に接続するための環状の保持縁が設けられていることを特徴とする、請求項１５記載の指で作動するポンプアセンブリ。
【請求項１８】
前記閉鎖部には環状のフランジが設けられ、前記小塔には対となる環状のフランジが設けられ、前記閉鎖部の前記環状のフランジとガスケットが前記小塔の前記環状のフランジをサンドイッチ状に挟み、前記指作動ポンプアセンブリと所望の容器との密封係合を容易にすることを特徴とする、請求項１７記載の指で作動するポンプアセンブリ。
【請求項１９】
前記アクチュエータが前記排出口と繋がる中央の穴を有し、前記ピストンが前記ピストンを前記アクチュエータに接続するために前記アクチュエータの前記中央の穴と摩擦力で係合する環状のハウジング側壁を有し、前記ピストンから前記排出口へ噴霧すべき製品の供給を容易にすることを特徴とする、請求項１５記載の指で作動するポンプアセンブリ。
【請求項２０】
前記内側ハウジングの内側に向いた面には、少なくとも１つの突起が設けられ、前記揚弁が前記内側のハウジングの内側に向いた面に沿って実質的に完全に変位すると、圧縮室内に生成された圧力を解放し、解放された圧力は内部空洞を通りポンプ本体の基部に設けられた通気ポートから排出されることを特徴とする、請求項１５記載の指で作動するポンプアセンブリ。
【請求項２１】
少なくとも１つの溝が、圧力同等化のために前記ポンプ本体の外側面と前記小塔の内側に向いた面との間に設けられ、指で作動するポンプアセンブリが容器に接続され作動すると、指で作動するポンプアセンブリに取り付けられた容器が少なくとも部分的に真空になるのを防止することを特徴とする、請求項１７記載の指で作動するポンプアセンブリ。
【請求項２２】
前記圧縮室に繋がる前記通路が、ポンプアセンブリの長さ方向の軸に実質上平行に延びているが、ポンプアセンブリの前記長さ方向の軸から半径方向に離されていることを特徴とする、請求項１５記載の指で作動するポンプアセンブリ。
【請求項２３】
弁が前記圧縮室に繋がる前記通路に沿って配置され、前記弁は前記通路に沿った製品の流れを妨げるためにボール弁座に通常置かれているケージ内に拘束されたボールを有し、前記ポンプアセンブリの吸い上げ活動の間、前記ボールが製品を流すために前記弁座から変位することを特徴とする、請求項２２記載の指で作動するポンプアセンブリ。
【請求項２４】
汲み上げ管が通路の入口に接続され、容器の基部から噴霧すべき製品の吸い上げが容易に行われることを特徴とする、請求項２２記載の指で作動するポンプアセンブリ。
【請求項２５】

指で作動するポンプ装置であって、
所望の噴霧すべき製品を収納する容器であって、一端が閉じられ、他端に噴霧すべき製品を確実に噴霧するための注ぎ口を有する容器と、
外側のハウジング及び内側のハウジングを支持する基部を有するポンプ本体であって、前記外側のハウジング及び前記内側のハウジングはそれらの間に少なくとも部分的に圧縮室を形成するポンプ本体と、
前記ポンプ本体を支持する閉鎖部であって、容器の注ぎ口と密封状態で敬語する閉鎖部と、
少なくとも部分的に前記ポンプ本体に受け入れられ、前記外側のハウジングに沿って前記ポンプ本体に対して摺動可能であるピストンであって、前記ピストンは前記ポンプ本体に密封係合を供給するための環状のリップを有し、前記ピストンにはピストン出口を形成する揚弁弁座が設けられたピストンと、
前記ピストン出口に連結されたアクチュエータであって、製品の噴霧を容易にするためのピストン出口に繋がる排出口を備えたアクチュエータと、
前記内側のハウジングに収納され、ばねによって付勢され、前記揚弁弁座と係合前記ピストン出口を通常閉じて製品の流れを防止し、前記揚弁及び前記内側のハウジングは内部空洞を形成し、前記ポンプ本体に形成された通気ポートが前記揚弁の作動中、内部空洞が周囲の圧力で作動するように前記内部空洞と容器の内部との間の連通を容易にする揚弁と、
前記圧縮室に繋がる通路であって、製品を前記通路に沿って前記圧縮室の方へ流れさせる入口及び逆止弁を有する通路と、
前記通路の入口を前記容器に接続しポンプアセンブリによって噴霧される製品の吸い上げを容易にする吸い上げ管と、を備えた、指で作動するポンプ装置。

【発明の詳細な説明】

【０００１】

発明の分野

本発明は、高圧の下で製品を噴霧するための蓄圧式ポンプに類別される改良された手動のポンプアセンブリに関する。ポンプアセンブリは、噴霧すべき製品を圧縮する圧縮室と、ポンプのピストン出口を通る製品の放出を制御するための実質上周囲の気圧で作動するリリーフ弁とから構成されている。

【０００２】

発明の背景

手動で手で持つポンプアセンブリには種々の従来技術が知られており、個人的な介護及び薬剤用、芳香製品などのような液体の種々の製品の噴霧に用いれれている。この型のポンプは、製品を受け入れ噴霧するための圧縮室を形成するハウジング本体及び摺動できるピストンから構成されている。本体及び本体に含まれる内部構成部品は小塔に保持されている。本体の基部にある入口が汲み上げ管を介して噴霧すべき製品に繋がっている。従来のスプレー式アクチュエータは、ピストン出口に繋がりポンプの作動を容易にし、操作者による所望の製品を噴霧する機械的な機構を提供している。

【０００３】

容器内部から本体の圧縮室への噴霧すべき製品の方向のある流れは、通常本体入口と汲み上げ管との連結部あるいはその近傍に配置された第１逆止弁によって制御される。第２逆止弁が噴霧すべき製品を圧縮室からピストン出口を通ってアクチュエータの供給通路に送り込む。最後に、製品がアクチュエータの排出口から噴霧される。

【０００４】

噴霧すべき製品を圧縮室から放出するのに先立ち、排出口から噴霧された製品が一定で一様なスプレー特性を有するために、ポンプを特定の圧力にすることが望ましい。例えば、あるスプレーは一様な寸法の粒子、例えば製品の噴霧を適切に行うために狭い粒子寸法範囲内にある粒子から構成されなければならない。又、アクチュエータの１回の作動で特定の適量を噴霧することが望ましい。ばねの構成がこうして製品を本体から排出口を通って噴霧する圧力を決定する。製品は第２逆止弁及びばね付勢力に打ち勝って放出されるので

、ばね圧力は製品への高い反力に変換される。
【０００５】
ポンプアセンブリが液体を適切に噴霧するためには、アセンブリのポンプ部で圧縮室内にある空気が最初に取り除かれなければならないことは明らかである。この最初の除去ステップは普通ポンプの「充填」と呼ばれている。アクチュエータが操作者によって最初に押し下げられるとき、製品が汲み上げ管を介して本体の圧縮室に吸い上げられるためには、本体の圧縮室内にある空気は最初に除去されなければならない。アクチュエータを押し下げることによりピストンが本体の基部の方向へ動かされ、それによりばねと圧縮室内に含まれた空気を圧縮する。圧縮空気は第１逆止弁を閉位置に保持することを助けている。圧縮空気は又、第２逆止弁に開力を誘発するが、大抵の場合、圧縮空気により誘発された力は第２逆止弁のばね閉力に打ち勝つ程の高圧には達しないかもしれない。この理由から、従来技術のポンプは小さいリブ又は圧縮行程の終端近傍に配置された他の機械的な装置を用いて、本体の内側部分とピストンとの間の密封を中断させ圧縮空気を圧縮室から解放する。圧縮空気を圧縮室から解放するには２つの方法がある。第１の方法は、空気をピストンの周囲から解放する方法であり、残存する製品が解放経路に沿って乾燥しピストンの固着に至ることがある。第２の方法は、空気を汲み上げ管から下方に解放する方法であり、空気と製品が管の中でピストンの往復行程で噴霧されることになり、これも又望ましいことではない。
【０００６】
第２逆止弁及びばねの両方が本体の内部空間を占めるため、これらの部品はポンプの充填操作の間空気の圧縮に影響を及ぼし、従って第２逆止弁の操作に影響を及ぼす。これは又、汲み上げ管を介してポンプ本体に吸い上げられた製品が、ピストンが往復運動すると、逆の方向にシステムを通して押し戻されることを意味する。この空気と製品の往復運動は、ポンプの効率を低減させシステムを操作するのに要する力を増加させる。その上、圧縮室内に含まれた空気を取り除くために必要なストローク数が増加する。
【０００７】
発明の概要
本発明の目的は、従来技術のポンプアセンブリ設計に関連した前述の問題と欠点とを克服することである。
本発明の別の目的は、少ない数の構成部品を用いてポンプアセンブリの高噴霧効率を確保する一方効率的に充填され操作されるポンプアセンブリを設計することである。
【０００８】
本発明の他の目的は、揚弁の機能が本質的に圧縮室内部の噴霧すべき製品の流れ又は循環によって影響されないように周囲の圧力で作動する運動可能な揚弁を提供することである。
本発明の更に別の目的は、ポンプアセンブリの圧縮効率を増加させ、製品の噴霧流れ経路と繋がった位置には配置されていないのでばねがが邪魔にならず噴霧すべき製品とも干渉しないばねを設けることにより、ポンプアセンブリに「充填する」ために必要な行程数を最小化することである。
【０００９】
又、本発明の別の目的は、低揮発性の溶剤、水ベースの製品、アルコールベース及び／あるいは他の処方に対して同一のスプレー特性を供給する、簡単で、低価格、高品質および効率的なスプレーポンプアセンブリを提供することである。
本発明の更に別の目的は、約１２０－２５０ｍｌの製品噴霧容量、約５．５－７．５ポンドの作動力及び約１００～１７０ｐｓｉの圧縮室の内部作動圧力を備えたポンプアセンブリを提供することである。
【００１０】
本発明による手動ポンプアセンブリは、広範囲の製品を噴霧することができる。本発明による非常に効率的な内部容積と充填システムは、手動ポンプアセンブリを個人的な介護製品、薬剤、芳香製品などの使用に最適なものにしている。本発明による手動ポンプアセン

ブリの構成部品の大部分は、圧縮室の外側に配置されているので、圧縮室を形成する内側に向いた面の間にこれらの面が完全に作動した位置に動かされたとき最小の間隙を生成する。ポンプアセンブリのそのような設計は、ポンプアセンブリの充填及び通常の操作両方に役に立つ。

【００１１】

充填は、汲み上げ管を下げるか又は圧縮ピストンの廻りに行うよりもむしろ、捕捉された空気を排出口を通じて又は揚弁と内側の円筒型ハウジングとの間に形成されたシールを通じて通気させることにより行われる。汲み上げ管を通じて充填する従来技術の噴霧システムは、ゲル又は高含水製品を噴霧する際あるいは長い汲み上げ管を用いる際に困難な場合があった。上述のように、圧縮ピストンの廻りに充填するポンプアセンブリは製品残滓の乾燥によって閉塞又は固着する傾向がある。

【００１２】

本発明によれば通常の操作中、ポンプアセンブリは圧縮室直径とピストン行程長さとの比に起因する高い操作圧力を有している。約１３０ｐｓｉ程度の操作圧力で本発明による手動ポンプは現在市販されている従来のポンプより約３０％高圧で作動する。本発明による高圧設計の別の利点は、各噴霧行程の間一様なスプレーが一貫して得られることである。その上、ばねと弁構成部品を圧縮室の外側に配置することにより内部容積の変動が少なくなる。最後に、構成部品の改善された形状が圧縮室から排出口までの実質上制約のない製品の流れを提供している。

【００１３】

最終的に、本発明は指で作動するポンプ装置に関するもので、容器、ポンプ本体、閉鎖部、ピストン、アクチュエータ、揚弁、通路及び汲み上げ管から構成される指で作動するポンプ装置であって、前記容器は、噴霧するための所望の製品を収納し、一端が閉じられ、噴霧すべき製品を確実に噴霧するための注ぎ口を有し、前記ポンプ本体は、外側のハウジング及び内側のハウジングを支持する基部を有し、前記外側のハウジング及び前記内側のハウジングはそれらの間に少なくとも部分的に圧縮室を形成し、前記閉鎖部は、前記ポンプ本体を支持し、容器の注ぎ口と密封状態で係合し、前記ピストンは、少なくとも部分的に前記ポンプ本体に受け入れられ、前記外側のハウジングに沿って前記ポンプ本体に対して摺動可能で、前記ピストンは前記ポンプ本体に密封係合を供給するための環状のリップを有し、前記ピストンにはピストン出口を形成する揚弁弁座が設けられ、前記アクチュエータは、前記ピストン出口に連結され、製品の噴霧を容易にするための前記ピストン出口に繋がる排出口を備え、前記揚弁は前記内側のハウジングに収納され、ばねによって前記ポンプ本体の基部から離されるように付勢され、前記揚弁弁座と係合前記ピストン出口を通常閉じて製品の流れを防止し、前記揚弁、前記基部及び前記内側のハウジングは内部空洞を形成し、前記内部空洞には前記揚弁の作動中前記内部空洞が周囲の圧力で作動するように容器の内部と繋がる通気ポートが設けられ、前記通路は、前記圧縮室に繋がり、製品を前記通路に沿って前記圧縮室の方へ流れさせる入口及び逆止弁を有し、前記汲み上げ管は、前記通路の入口を前記容器に接続しポンプアセンブリによって噴霧される製品の吸い上げを容易にすることを特徴とする指で作動するポンプ装置である。

【００１４】

好ましい実施例の説明

本発明には種々の実施例が可能であるが、明細書と添付図面は本発明の実施例として２つの形態を示す。説明を簡単にするために、本発明の実施例であるポンプアセンブリは通常の操作位置で記述され、この位置に関して上方、下方、水平などの用語が用いられる。しかしながら、本発明の実施例であるポンプとその部品は記述された位置以外の姿勢で製造され、貯蔵され、運搬され、使用され及び販売されてもよいことが分かるであろう。

【００１５】

図１に、従来の容器１２と組み合わされて用いられた本発明による改善されたポンプアセンブリ１０を示す。図から分かるように、容器１２は通常容器の上面に形成された（詳細には示さない）注ぎ口を備えた樹脂製の閉じられた容器である。注ぎ口には外ねじが設け

られ容器１２の内部に通じるために成形された開口部が備えられている。容器１２は、所望の量の液体、流体又は噴霧すべき製品１４を収納する。噴霧すべき製品１４は、一般に容器１２の内部から汲み上げ管１６を介してポンプアセンブリ１０の入口に供給される。よく知られたことであるが、汲み上げ管１６の下端は通常容器が図１に示すようにほぼ直立姿勢にあるときは液体又は収納物の中に浸されている。汲み上げ管１６の機能については後で詳細に述べる。

【００１６】

ポンプアセンブリ１０には取り外しできるキャップあるいは閉鎖部１８が備えられており、閉鎖部１８にはポンプアセンブリ１０の閉鎖部１８に対する作動を容易にするための押し下げ可能なアクチュエータ２０が設けられているが、圧縮作動については後で更に詳細に述べる。必要ならば取り外しできるフード又は覆いキャップ２２にアクチュエータ２０を入れて不慮の作動を防止することができる。覆いキャップ２２は、中空の殻部材であり一般に閉鎖部１８の上端面から延びる中空で環状のスカート２４に摩擦嵌合される周辺縁部を有する。このような覆いキャップの特性は従来から周知であるのでこれ以上の詳細な説明は行わない。

【００１７】

図２から図６について、本発明による改善されたポンプアセンブリ１０の第１実施例に関する詳細な説明を行う。図３～図６から分かるように、例えば閉鎖部１８の基部には容器１２の（詳細には示していない）対をなすフランジ面と当接するように位置決めされた環状の基部フランジ２６が設けられている。更に、閉鎖部１８には改善されたポンプアセンブリ１０の長さ方向の軸Ｌに沿って閉鎖部１８を貫通して延びる中心貫通穴２８が設けられている。閉鎖部１８の基部の内側に向いた面２９には容器１２の注ぎ口に備えられた外ねじ（又は別の従来からある保持用の窪み、リップあるいは機構）とかみ合うための内ねじ３０（又は別の従来からある保持用の窪み、リップあるいは機構）が設けられている。閉鎖部１８には又、実質上閉鎖部１８の中央部に位置し、閉鎖部の基部を環状のスカート２４から分離する半径方向で内側へ水平に延びる閉鎖環状フランジ３２が設けられている。閉鎖環状フランジ３２は、改善されたポンプアセンブリ１０の種々の構成要素を後でより詳細に述べるように保持する機能を有している。

【００１８】

アクチュエータ２０の上端面には、操作者の人差し指をかけて作動させるのに都合良く成形され又は輪郭で作られた指窪み３４が設けられている。このような成形又は輪郭は周知であるのでこれ以上の説明は行わない。アクチュエータ２０には更に、下方に延びる環状の側壁３６が設けられ、その直径は閉鎖部１８の環状のスカート２４の内径より僅かに小さく、アクチュエータ２０の環状の側壁３６が環状のスカート２４にに対して相対的に動くように即ち閉鎖部１８の環状のスカート２４によって囲まれた空間でこれらの２つの部品の間に過度の摩擦又は接触を生ずることなく動くようにされている。本発明の好ましい実施例では、環状の側壁３６の外側に向いた面と環状のスカート２４の内側に向いた面との間には、アクチュエータ２０が閉鎖部１８の方へ作動されるか圧縮されたときに、アクチュエータ２０の誘導を円滑にするための相対的なスライド運動が生じる。このようなスライド運動は、アクチュエータ２０がその正しい直立の噴霧姿勢を維持することを容易にしている。

【００１９】

内部の長さ方向の中央の穴３８がアクチュエータ２０の内部に形成され、中央の穴３８は横の半径方向の穴４０に繋がっている。横の半径方向の穴４０は、アクチュエータの外側面に形成され挿入部材４２で密封又は閉じられた開口部で終わっている。挿入部材４２はその中に排出口４４を有する。排出口４４は、アクチュエータから外部環境中に噴霧すべき製品１４の噴霧を容易にしている。挿入部材４２は横の半径方向の穴４０の中に収納され、挿入部材４２の外周は横の半径方向の穴４０の内面と摩擦嵌合し横の半径方向の穴４０の中に永久的に保持される。挿入部材４２の基部に配置され内側に向いた面が半径方向の穴４０の中に収納された中央の柱４６の外側に面した平坦な端末面と係合する。柱４６

の端末面は、複数の従来からある半径方向で内側に向いた溝４８を有し、溝４８は柱４６の端末面の中心に形成された従来からある混合室（別符号を付していない）に通じている。当業者には分かるように、複数の半径方向で内側に向いた溝４８と混合室は、柱４６の実質的に平坦な端末面と係合するためには、柱４６の代わりに挿入部材４２の内側に面した基部表面に配置され支持されてもよい。混合室は、完全に混合され及び／又は渦を巻いた噴霧すべき製品が排出口４４を通って噴霧及び排出されるために直接排出口４４に繋がっている。この噴霧装置は従来から周知であるので、それについて更に詳細な説明は行わない。

【００２０】

閉鎖部１８の閉鎖環状フランジ３２は、小塔５２（例えば図３参照）の環状フランジ５０と係合し、ガスケットあるいはライナー５８をも支持する。ガスケットあるいはライナー５８は中心に開口部を有し、閉鎖部１８が容器１２に固定されるとき、小塔５２の環状フランジ５０を閉鎖部１８の閉鎖環状フランジ３２に付勢するために用いられる。閉鎖部１８の閉鎖環状フランジ３２とガスケットあるいはライナー５８は、閉鎖部１８が容器の注ぎ口に固定されるとき、小塔５２の環状フランジ５０を挟む。このようなサンドイッチ構造は従来から周知である。

【００２１】

小塔５２の環状の側壁５４は、閉鎖環状フランジ３２に設けられた中央の開口部を通って延び、実質上閉鎖部１８の環状のスカート２４に平行に延びており、アクチュエータ２０の環状の側壁３６との間に充分な空間を開けているのでアクチュエータ２０が作動するとき小塔５２の環状の側壁５４とアクチュエータ２０の環状の側壁３６との間に不都合な干渉は生じない。小塔５２の上端自由部分には環状の保持縁５６が設けられている。環状の保持縁５６は、まず半径方向で内側へ延び次ぎに長さ方向の軸Ｌに沿って閉鎖部１８の基部の方へ僅かな距離だけ延びている。環状の保持縁５６の目的については後で詳細に述べる。小塔５２の環状の側壁５４の内側面にはポンプ本体６０の保持を容易にするために環状のリップ５９（図２参照）が設けられている。リップ５９の目的については後述する。

【００２２】

ポンプ本体６０は、図２に詳細に示すように、ポンプ本体６０の基部６４に接続され単一の構成要素又は構造を形成する外側の円筒型ハウジング６２を備えている。内側の円筒型ハウジング６６はポンプ本体６０の基部６４に一体的に接続され、外側の円筒型ハウジング６２と同心状に間隔を開けて配置されている。ポンプ本体６０の外側面は、小塔５２の環状のリップ５９と係合し、ポンプ本体６０を小塔５２に固定するために配置された環状の突起６９を支持している。ポンプ本体６０の下方部分には基部の端末面に形成された入口開口部７２を有する円筒型の延長部７０が設けられている。汲み上げ管１６の第１端末は従来から行われているように入口開口部７２の中に摩擦力でもって受け入れられ保持されている。

【００２３】

入口開口部７２は、内側の円筒型ハウジング６６の外側面と外側の円筒型ハウジング６２の内側に向いた面との間に形成された圧縮室６８の第１部分に長さ方向の通路７４を介して繋がっている。長さ方向の通路７４は、ポンプアセンブリの長さ方向の軸Ｌに平行であるが軸Ｌから隔たって延びている。逆止弁が長さ方向の通路７４に沿って配置されており、逆止弁はケージ７８の中に拘束されている金属製のボール７６を有している。ケージ７８は、逆止弁の開閉を容易にするためにボール７６に限られた上下方向の運動を行わせる。この逆止弁はボール７６が環状のボール座８０（図６参照）から離れているときに長さ方向の通路７４に沿って製品を流す。ボール７６は通常、図３～図５から分かるように、長さ方向の通路７４を通る製品の流れを遮断するために環状のボール座８０に当接している。汲み上げ管１６を入口開口部７２の中に挿入するに先立ち、金属製のボール７６が入口開口部７２の中に強制的に入れられ、環状のボール座８０を通って逆止弁を作動させるために永久的に保持され利用されるケージ７８の中に入れられる。

【００２４】

ボール７６は通常環状のボール座８０によって形成された開口部の密封位置に重力によって保持され、圧縮された流体が汲み上げ管１６の中に逆流することを防止している。アクチュエータの作動中即ちポンプの汲み上げ中又は製品の噴霧中、圧縮室内に発生した圧力はボール７６を環状のボールシート８０に対する密封係合状態に保持するのに更に役立っている。これらについては以下に更に詳細に述べる。

【００２５】

ピストン８２は、少なくとも部分的にポンプ本体６０の中に収納され、ポンプ本体６０に対して摺動できるようにされている。ピストン８２の第１下端部８４には、環状の密封リップ８６が設けられている。環状の密封リップ８６は、環状の密封リップ８６と外側のハウジング６２の内面との間に漏れのない密封係合を供給するために、外側のハウジング６２の内径よりも僅かに大きい外径を有している。ピストン８２の操作中、更に詳細に述べるように、圧縮室８６内に生じた圧力はピストン８２の環状の密封リップ８６を外側の円筒型ハウジング６２の内側に向いた面と密封係合状態にすることを助けている。環状の密封リップ８６に隣接したピストン８２の外側面には、環状の肩部８８が設けられている。環状の肩部８８は、ポンプ本体６０の中でピストン８２の少なくとも第１下端部８４を拘束するために小塔５２の環状の保持縁５６に当接している。

【００２６】

ピストン８２は通常、第１下端部８４から第２遠隔端部９０へ僅かに先細りとなった外部側壁を有する中空の部材である。ピストン出口９２は、ピストン８２の第２遠隔端部９０に隣接して設けられている。ピストン出口９２に隣接して配置されたピストン８２の第２遠隔端部９０には、小さい直径の環状の円筒型側壁９４が設けられている。環状の円筒型側壁９４はアクチュエータ２０の中央の穴３８に摩擦力を生じるように挿入されピストン８２の第２遠隔端部９０とアクチュエータ２０との間に確実な保持係合を供給する大きさになっている。ピストン出口９２を形成するピストン８２の環状の表面は揚弁弁座９６を形成している。ピストン出口９２は、ばね１０４によって揚弁弁座９６に付勢されている細長いほぼ円筒型の揚弁９８の肩部１０６によって通常閉じられている。円柱型の揚弁９８がポンプアセンブリの作動中に揚弁弁座９６から離されると、ピストン出口９２が開かれ噴霧すべき製品１４を圧縮室６８からアクチュエータ２０の中央の穴３８に流入させる。以下に更に詳細に述べる。

【００２７】

上述のように、圧縮室６８の第１部分は内側の円筒型ハウジング６６と外側の円筒型ハウジング６２との間に形成される。圧縮室６８の残りの第２部分はピストン８２の内側に向いた面と揚弁９８の外側面との間に形成される。ピストン８２の中空の内径は内側の円筒型ハウジング６６の外径より僅かに大きく、ピストン８２及び／あるいは内側の円筒型ハウジング６６はそれらの上に形成された溝を有しているので、圧縮室６８の第１部分は圧縮室６８の残りの部分と内側の円筒型ハウジング６６に対するピストン８２の位置に関係なく連通している。

【００２８】

円柱型の揚弁９８は、内側の円筒型ハウジング６６によって形成される中央の空洞１００に収納されている。揚弁９８は、第１下端部に隣接した環状の密封及び誘導面１０２を支持する堅くて細長いほぼ円柱型の部材である。環状の密封及び誘導面１０２は、内側の円筒型ハウジング６６の内側に向いた面と僅かに干渉して摺動する大きさになっている。環状の密封及び誘導面１０２は、内側の円筒型ハウジング６６の内側に向いた面に沿ってポンプアセンブリの作動中に密封状態で滑り、揚弁９８をポンプアセンブリ１０の長さ方向の軸Ｌに関して揃えられた状態を維持する。揚弁９８は、中心に配置された内部空洞１００内に収納されたばね１０４によって通常閉位置に付勢されているので、揚弁９８の肩部１０６はピストン８２に形成された揚弁弁座９６に当接しピストン出口９２を通る流れを遮断している。図２に示すように、例えば、揚弁９８はピストン出口９２から延出し、ポンプアセンブリの作動中にピストン出口９２に対して揚弁９８の適切な配置を維持する、先細り又はより小さい一定外径の付属体１０８を有する。

【００２９】
ばね１０４が収納され、中心に配置された内部空洞１００の底部には通気ポート１１０が設けられている。通気ポート１１０は、中心に配置された内部空洞１００と容器１２の内部空間との間の通気を行い中心に配置された内部１００が周囲の圧力となるようにされている。通気ポート１１０は、ポンプアセンブリ１０の作動中、中心に配置された内部空洞１００に過大な圧力や真空が生成されることを防止する。揚弁９８の付属体１０８とは反対側にある最下端部には、ばね１０４の一端を受け、更に揚弁９８とばね１０４との間の適切な配列と係合を容易にする円柱型の延長部分１１２が設けられている。
【００３０】
本発明の好ましい実施例では、内側の円筒型ハウジング６６の内側に向いた面には少なくとも１個の突起又は突出部１１４が設けられているので、揚弁９８の環状の密封及び誘導面１０２が突起又は突出部１１４とかみ合うとき圧縮室６８の中の残存圧力が解放され中心に配置された内部空洞１００を通って下方へ流れ基部６４に設けられた通気ポート１１０から容器１２の内部空間に送られる。突起又は他の突出部１１４が、内側の円筒型ハウジング６６の内側に向いた面で、揚弁９８の行程の終点即ち揚弁が内側の円筒型ハウジング６６の中でその通常の作動行程の約９５～９８％動いた位置の近傍に形成されているので、圧縮室６８の汲み上げ効率が著しく劣化することはないことが明らかである。
【００３１】
突出物又は突起１１４を用いることは、製造工程に続くポンプアセンブリの圧縮室６８内に通常含まれている空気を「充填する」のに非常に有用である。空気は圧縮可能な流体であるので、アクチュエータ２０の全圧縮行程の後でさえ圧縮空気は一般に揚弁肩部１０６を揚弁弁座９６から離してそれにより圧縮空気を圧縮室６８からアクチュエータ２０の中央の穴３８に排出するのに充分な圧力を生じさせなくてもよい。本発明では、もしもアクチュエータ２０が実質上完全に排気され揚弁肩部１０６が未だ揚弁弁座９６から離されずそれによりピストン出口９２が開かれていないならば、環状の密封及び誘導面１０２が突起又は突出物１１４と係合するとき、空気は環状の密封及び誘導面１０２と内側の円筒型ハウジング６６の内側に向いた面との間に形成されたシールの裂け目によって直ちに放出される。この放出された空気は中央の空洞１００を通って運ばれ通気ポート１１０から外へ出る。しかしながら、アクチュエータ２０の戻り行程において環状の密封及び誘導面１０２が突起又は突出物１１４から外れ再び内側の円筒型ハウジング６６とシールを形成すると直ちに圧縮室６８内に吸い上げ活動が生じ、噴霧すべき製品の一定量が汲み上げ管１６と通路７４を通して圧縮室６８の方へ吸い上げられる。この吸い上げられた製品は最終的には圧縮室６８に流れ込み、そこで通常非圧縮性の流体である製品は充分な回数即ち４回の充填ストロークの後揚弁９８を意図した噴霧方法で作動させる。
【００３２】
もしもポンプの通常の操作中に交換用の空気が容器１２に入れられず噴霧された製品１４の容積を新たな空気と交換しないならば、容器１２は噴霧すべき製品のかなりの部分が噴霧されると次第に真空になり最終的には内側へ変形及び／あるいは崩壊することは明らかである。この問題を多少なりとも解決するために、少なくとも１つの溝１１６がポンプ本体６０の外側面又は小塔５２の内側に向いた面に沿って設けられている。この溝１１６は、通常環状の保持縁５６と係合するピストン肩部８８によって外部の環境から遮断され、それらの間にシールを供給している。ピストン８２が充分押し下げられると、ピストン８２の外側面は環状の保持縁５６から僅かに離されて周囲の空気がピストン８２の外側面に沿って環状の保持縁５６の廻りに、ポンプ本体６０の外側面と小塔５２の内側に向いた面との間に配置された溝１１６に沿って下方へ流れ、アクチュエータ２０によって噴霧されたばかりの製品の容積に入れ替わる。この通気用の溝１１６は又、容器内部の圧力を実質的に外部の周囲環境と同じ圧力に保っている。
【００３３】
本発明によるポンプアセンブリの基本的な構成要素に関する詳細な説明を行ったので、ポンプアセンブリの作動に関する詳細な説明を以下に行う。

最初に、ポンプアセンブリ１０はまず噴霧すべき製品を入れた望ましい容器１２の注ぎ口に、閉鎖部１８の内ねじ３０と螺合するねじか、あるいは容器１２の注ぎ口の外側面に設けられた別の従来からある保持機構とかみ合わせることによって取り付けられる。これが行われると、ポンプアセンブリの汲み上げ管１６は噴霧すべき製品の中に汲み上げ管の入口が容器１２の底に近接するように浸される。ポンプアセンブリ１０の作動準備が完了する。

【００３４】

作動させたいときは、操作者が彼又は彼女の人差し指を指窪み３４に置いてアクチュエータ２０を図３の矢印Ａの方向に、アクチュエータ２０を長さ方向の軸Ｌに沿って閉鎖部１８の方へ付勢するように押し下げる。アクチュエータ２０をこのように押し下げると、次にはピストン８２が押し下げられ、その結果環状の密封リップ８６が外側の円筒型ハウジング６２の内側に向いた面に沿ってポンプ本体６０の基部６４の方向へ密封を保ちながら摺動する。この作用は圧縮室６８内に収納された噴霧すべき製品１４に圧力を加える。即ち、液体は一般に非圧縮性であることに注目すべきである。噴霧すべき製品の圧力が増加するにつれて、この圧力増加はボール７６を環状のボール座８０に付勢し、それによって製品が汲み上げ管１６に沿って下方へ脱落することを防止する。前述のように、ピストン８２の内側に向いた面は、内側の円筒型ハウジング６６の外側に向いた面から充分な間隔が取られており、噴霧すべき製品がそれらの間をピストン８２の位置に関係なく流れることができる。圧縮室６８の中の圧力が、充分な圧力例えば約１３０ｐｓｉの作動圧まで増加すると、噴霧すべき製品１４に発生した圧力がばね１０４の付勢力に勝り、揚弁９８を内部空洞１００の基部６４の方向へばね１０４の作用に逆らって押し下げる。この運動はばね１０４を圧縮し、その結果揚弁肩部１０６が揚弁弁座９６から離され、それにより、図４に示すように、ピストン出口９２を通る製品の流れが形成される。

【００３５】

揚弁肩部１０６が揚弁弁座９６から充分離されると、噴霧すべき製品はピストン出口９２を勢いよく通り抜け中央の穴３８、半径方向の穴４０、内側に向いた溝４８を通って上方へ流れ、排出口４４を通ってアクチュエータ２０から実質的に均一な放出スプレー形状を生ずるように噴霧される。ピストン８２は、アクチュエータを矢印Ａの方向へ更に押し下げている間、図５に示すように、ピストン８２の環状の密封リップ８６がポンプ本体６０の基部６４に当接するまで、噴霧すべき製品１４をアクチュエータ２０を通じて噴出し続ける。ポンプアセンブリが完全に押し下げられた位置になると、ポンプ本体６０の基部６４の内側に向いた面はピストン８２の環状の密封リップ８６を密封状に収納し実質上その形状に一致し、それにより圧縮室６８に残存している噴霧すべき製品の量を最小にする。このようにすると、例えば、圧縮室の容積を最小にすることができる。図５から明らかなように、圧縮室６８の容積は、圧縮室６８内に蓄えられていた噴霧すべき製品の大部分がアクチュエータ２０の作動行程によって噴霧されてしまうようにかなり縮小された。

【００３６】

図５に見られる環状の密封及び誘導面１０２が、内側の円筒型ハウジング６６の下部近傍に形成された突起又は突出物１１４と係合するとき、それらの間のシールが破られ、噴霧すべき製品の残りの大部分又はポンプアセンブリの最初の充填中の空気は、内部空洞１００を通って通気ポート１１０から放出され圧力室６８に生成された圧力が急速に除去されることが明らかである。

【００３７】

作動行程が終了すると、操作者の指による作動圧力が例えば操作者の指が指窪み３４から外されて除去される。その後、ばね１０４が直ちに揚弁９８を図６の矢印Ｂの方向にピストン８２の揚弁弁座９６に付勢してピストン出口９２を急速に閉じ、それにより噴霧すべき製品１４のその通路を通るそれ以上の流れが防止される。ばね１０４は又、揚弁９８を矢印Ｂの方向に付勢することによりピストン８２とアクチュエータ２０を閉鎖部１８から上方へ付勢する。ポンプアセンブリのこの戻り行程の間、追加の噴霧すべき製品１４が汲み上げ管１６の第２端部に形成された入口に吸い上げられる。吸い上げられた噴霧すべき

製品１４は汲み上げ管１６を流れ、ボール７６をボール座８０から動かして噴霧すべき製品１４を長さ方向の通路７４に沿って通過させる。

【００３８】

ケージ７８がボール７６を捕捉することは明らかであり、例えばこの逆止弁を開くがポンプアセンブリの戻り行程が終了するとボール７６は重力によってボール弁座８０に戻りこの逆止弁を閉じるように拘束される。噴霧すべき製品１４は、長さ方向の通路７４を通って圧縮室６８に流入し、そこで噴霧すべき製品１４は図３から分かるように蓄積及び貯蔵される。ばね１０４が揚弁９８を、矢印Ｂの方向に、ピストン８２の肩部８８が環状の保持縁５６に当接するだけの距離付勢すると、ボール７６は再びボール弁座８０上に据えられ、それによりアクチュエータ２０が再び押し下げられるとき圧縮室６８のそれ以上の流れと圧縮が防止される。

【００３９】

図７と図８は、本発明の第２実施例である。この第２実施例は多くの点で第１実施例に類似しているので、第２実施例と第１実施例との相違点だけを詳細に述べる。実際のところ、閉鎖部１８、アクチュエータ２０、ボール７６、ピストン８２、揚弁９８及びばね１０４は両方の実施例において同一であるのでそれらについての更に詳細な説明は行わない。

【００４０】

２つの実施例の間の主な相違点は図７から容易に分かる。第１の相違点はポンプ本体６０が２つの別部品で形成されていることである。即ち、第１構成要素はポンプ本体１６０の基部１６４と一体的に形成された外側の円筒型ハウジング１６２からなり単一の構成要素又は構造を形成する一方、内側の円筒型ハウジング１６６は完全に別の部品である。ポンプ本体１６０の内側には、各々異なる直径を有する３個の明確に識別できる部分がある。即ち、ポンプ本体１６０の基部に近接して配置された第１小径部１７７、ポンプ本体１６０の開口端に近接して配置された第３大径部１７９及び小径部１７７と大径部１７９との間に配置された第２中径部１７８である。内側の円筒型ハウジング１６６の下部円筒部分１８０は、ポンプ本体１６０の第２中径部１７８と例えば数千分の一インチ程度干渉する大きさに作られているので、内側の円筒型ハウジング１６６が外側の円筒型ハウジング１６２に対して同心状に配置されポンプ本体１６０に組み付けられるとそこに捕捉される。

【００４１】

第２の相違点は、ポンプ本体１６０の下側の側壁部には開口部１８４が設けられており、この開口部１８４は、内側の円筒型ハウジング１６６がポンプ本体１６０の基部１６４の内径の中に収納されると、内側の円筒型ハウジング１６６の側壁に形成された通気ポート１１０と一致するように配置されている。第１実施例のように、通気ポート１１０は中央に配置された内部空洞１００と容器１２の内部空間との間を連通して、中央に配置された空洞１００がポンプアセンブリ１０の操作中に周囲の圧力状態になり中央に配置された空洞１００に過剰な圧力又は真空が形成されることを防止する。

【００４２】

第３の相違点は金属製のボール７６の拘束に関するものである。本実施例では、組み付け中に金属製のボール７６は最初ポンプ本体１６０の中に置かれ、内側の円筒型ハウジング１６６をポンプ本体１６０の基部１６４の内径の中に設置する前に、第１小径の穴１７７に収納される。その後、内側の円筒型ハウジング１６６がポンプ本体１６０の基部１６４の内径の中に収納されると、内側の円筒型ハウジング１６６の基部１８１は金属製のボール７６が第１小径の穴１７７から取り除かれることを防止するための停止装置として機能し、それにより第１実施例におけるケージ７８を不要のものにしている。

【００４３】

第４の相違点は、入口開口部７２及び第１小径の穴１７７に対する中央に配置された内部空洞１００に関するものである。第１実施例では、中央に配置された内部空洞１００はポンプアセンブリの長さ方向の軸Ｌと一致する長さ方向の軸を有する一方、入口開口部７２と金属製のボール７６を収納する穴は各々平行に延びる軸を有しているがポンプアセンブリの長さ方向の軸Ｌに対しては偏心している。第２実施例では、中央に配置された内部空

洞１００は入口開口部７２及び第１小径の穴１７７と共に全てポンプアセンブリの長さ方向の軸Ｌに一致する長さ方向の軸を有する。

【００４４】

ポンプ本体１６０の外側面は、小塔５２の環状のリップ５９と係合し、ポンプ本体１６０を小塔５２に固定するために配置されている環状の突起６９を支持している。ポンプ本体１６０の下側の部分には、基部の端面に形成された入口開口部７２を有する円筒型の延長部分が設けられている。汲み上げ管１６の第１端部は、従来から行われているように、入口開口部７２の中に摩擦力を生ずるように収納及び保持されている。

【００４５】

入口開口部７２は、内側の円筒型ハウジング１６６の外側面と外側の円筒型ハウジング１６２の内側に向いた面との間に、長さ方向の通路７４を介して圧縮室６８の第１部分に繋がっている。長さ方向の通路７４は平行に延びているが、ポンプアセンブリの長さ方向の軸Ｌからは半径方向に離れている。金属製のボール７６は、ポンプ本体１６０の第１小径部の中を上下に動き逆止弁を形成する。この逆止弁は、ボール７６が環状のボール座８０から離されるとき製品を長さ方向の通路７４に沿って流す。第１実施例と同じように、ボール７６は通常環状のボール座８０に当接し製品の長さ方向の通路７４を通る流れを遮断する。

【００４６】

ピストン８２は、少なくとも部分的にポンプ本体１６０の中に収納され、ピストン８２はポンプ本体１６０に対して摺動することができる。ピストン８２の第１下端部８４には外側ハウジング６２の内径より僅かに大きい外形を有する環状の密封リップ８６が設けられ、環状の密封リップ８６と外側の円筒型ハウジング１６２の内側に向いた面との間に漏れのない密封係合を供給している。ピストン８２の作動中、圧縮室８６内に生じた圧力は、ピストン８２の環状の密封リップ８６が外側の円筒型ハウジング１６２の内側に向いた面と密封状に係合することを助けている。環状の密封リップ８６に近接するピストン８２の外側面には、小塔５２の環状の保持縁５６に当接して少なくともピストン８２の第１下端部８４をポンプ本体１６０の中に捕捉する環状の肩部８８が設けられている。

【００４７】

第１実施例と同じように、圧縮室６８の第１部分は内側の円筒型ハウジング１６６と外側の円筒型ハウジング１６２との間に形成されている。圧縮室６８の残りの第２部分はピストン８２の内側に向いた面と揚弁９８の外側面との間に形成されている。ピストン８２の中空の内部寸法は、内側の円筒型ハウジング１６６の外径より僅かに大きく、ピストン８２及び／あるいは内側の円筒型ハウジング１６６はそれらの上面に形成された溝を有するので、圧縮室６８の第１部分は内側の円筒型ハウジング１６６に対するピストン８２の位置に関係なく圧縮室６８の残りの部分に繋がっている。

【００４８】

円筒型の揚弁９８は、内側の円筒型ハウジング１６６によって作られる中央に配置された内部空洞１００の中に収納されている。揚弁９８は、第１下端部に近接する環状の密封及び誘導面１０２を支持する堅く細長いほぼ円筒型の部材である。環状の密封及び誘導面１０２は、内側の円筒型ハウジング１６６の内側に向いた面とわずかに干渉し摺動する大きさに作られている。環状の密封及び誘導面１０２は、ポンプアセンブリの作動中密封状態で内側の円筒型ハウジング１６６の内側に向いた面に沿って滑り、揚弁９８がポンプアセンブリ１０の長さ方向の軸Ｌに対して揃えられた状態を維持させる。揚弁９８は、中央に配置された内部空洞１００の中に収納されているばね１０４を介して通常閉位置に付勢されているので、揚弁９８の肩部１０６がピストン８２上に形成された揚弁弁座９６に当接しピストン出口９２を通る流れを遮断している。

【００４９】

本発明の好ましい実施例では、内側の円筒型ハウジング１６６の内側に向いた面の下部には少なくとも１つの突起又は他の突出部１１４が設けられているので、揚弁９８の環状の密封及び誘導面１０２が突起又は他の突出部とかみ合うとき圧縮室６８の中の残留圧力が

解放され中央に配置された内部空洞１００を通って下方へ流れ、基部１６４に設けられた通気ポート１１０及び開口部１８４から容器１２の内部空間に流入する。

【００５０】

本発明の好ましい実施例では、圧縮室の横方向の最大寸法又は直径は０．２２５～０．２７５インチであり、約０．２５０インチの直径が好ましく、ピストン行程の長さは０．２７５～０．３２５インチであり、約０．３００インチのピストン行程の長さが好ましい。このことは、圧縮室の直径とピストン行程との比が約４～５と２～３の間になり、約１３０ｐｓｉの操作圧を確実に達成できることになる。

【００５１】

本発明の設計では、アクチュエータ２０を閉鎖部１８のほうへ押し下げる間、もしも指の作動圧力が何らかの理由によりピストン出口９２を通る流れを途切れさせることになると、ばね１０４が直ちに揚弁９８を図６の矢印Ｂの方向に揚弁弁座９６に向けて付勢する。この付勢作用がピストン出口９２を急速に閉じ、それにより噴霧すべき製品１４のそれ以上のピストン出口を通る流れが防止される。

【００５２】

本発明では、圧縮室６８に通じる通路７４は、ポンプアセンブリの長さ方向の軸Ｌに対して偏心している実際上平行な第２長さ方向の軸ＬＰに沿って延びている。この配置は、中央の空洞１００の基部６４の容器１２の内部への通気を容易にするので、中央の空洞１００は周囲圧力又は圧縮室の操作圧力とは異なる圧力で操作される。

【００５３】

上述の指で操作されるポンプアセンブリは、本発明の思想及び範囲から逸脱しない範囲である程度の変更を行うことが可能であるので、これまで述べてきたことの全て及び添付図面は本発明の概念を単に説明しているに過ぎず本発明を制約するものではないと解釈されるべきである。

【図面の簡単な説明】

【図１】本発明による改善されたポンプアセンブリを支持する容器の前面を示す図である。

【図２】本発明による改善されたポンプアセンブリの第１実施例の断面図で、覆いキャップ、アクチュエータ、閉鎖部、ガスケットあるいは汲み上げ管を含まない静的位置を示す図である。

【図３】本発明による改善されたポンプアセンブリの第１実施例の断面図で、覆いキャップ、アクチュエータ、閉鎖部、ガスケットあるいは汲み上げ管が取り付けられた静的位置を示す図である。

【図４】図３の改善されたポンプアセンブリの第１実施例の断面図で、半ば押し下げられた位置で揚弁が揚弁の環状の座から変位して製品の噴霧を始めようとする状態を示す図である。

【図５】図３の改善されたポンプアセンブリの第１実施例の断面図で、ポンプアセンブリが完全に押し下げられた状態を示す図である。

【図６】図３の改善されたポンプアセンブリの第１実施例の断面図で、半ば戻った位置で改善されたポンプアセンブリの戻り行程の間、揚弁が揚弁の環状の座に付勢され製品の圧縮室への吸入を容易にする状態を示す図である。

【図７】本発明による改善されたポンプアセンブリのポンプ本体の第２実施例を示す断面図である。

【図８】本発明による改善されたポンプアセンブリの第２実施例を示す断面図で覆いキャップ、アクチュエータ、閉鎖部、ガスケットあるいは汲み上げ管が取り付けられた静的位置を示す図である。

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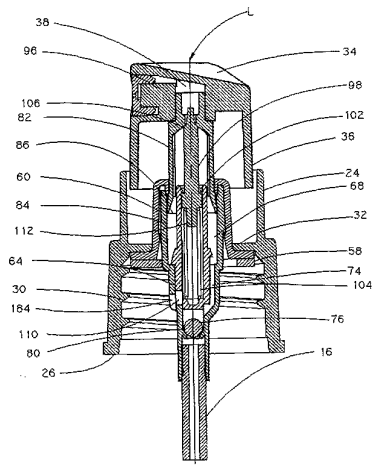
(54) Title: MANUALLY ACTUATED PUMP ASSEMBLY



(57) Abstract: A finger operated pump assembly comprising a pump body (60, 160) having a base (64, 164) supporting an outer housing (62, 162) and an inner housing (66, 166) and defining a first portion of a compression chamber (68) therebetween. A piston (82) has an annular lip and has a piston outlet defined by a poppet valve seat. A poppet (98) is accommodated by the inner housing (66, 166) and biased away from the base into engagement with the poppet valve seat by a spring (104). The poppet (98) and inner housing (66, 166) define an interior cavity (100). A peripheral passageway (74) communicates with the compression chamber (68) and includes a one-way valve (76). A ventilation port (110) is provided in the interior cavity (100) so that during operation of the poppet (98), it may operate at ambient pressure.

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MANUALLY ACTUATED PUMP ASSEMBLY

Field of the Invention

The invention relates to an improved manually operated pump assembly, categorized as an accumulative pump, for dispensing a product under high pressure. The pump assembly comprises a compression chamber for pressurization of the product to be dispensed and a relief valve operating, substantially at ambient atmosphere, for controlling the release of product through a piston outlet of the pump.

Background of the Invention

A variety of prior art manually operated hand-held pump assemblies are well known and used for dispensing a variety of products such as liquids for personal care and pharmaceutical uses, fragrance products and the like. Pumps of this type comprise a housing body and a slidable piston which together define a compression chamber for receiving and dispensing of the product. The body, as well as the internal components contained within the body, are retained by a turret. An inlet in the base of the body communicates, via a dip tube, with the product to be dispensed. A conventional spray actuator communicates with an outlet of the piston to facilitate operation of the pump and provides a mechanical mechanism for dispensing the product, as desired, by an operator.

Directional flow of product to be dispensed, from the interoir of the container into the compression chamber of the body, is controlled by a first one-way valve, typically located at or adjacent to the coupling of the body inlet to the dip tube. A second one-way valve enables the product to be dispensed from the compression chamber through the piston outlet and into a supply passage of the actuator. Finally, the product is dispensed out through a discharge orifice of the actuator.

It is desirable for the pump to reach a specified pressure, prior to releasing the product to be dispensed from the compression chamber, to ensure that the product dispensed out the discharge orifice exhibits consistent and uniform spray characteristics. For example, some sprays need to consist of particles of uniform size, e.g. particles lying within a narrow particle size range, in order for proper dispensing of the product. It is also desirable to dispense a specific dosage of

product during a single actuation of the actuator. To accomplish both the desired dosage and particle size requirements, the construction and function of the pump assembly require accurately designed internal components which must be precisely controlled during operation of the pump assembly. Because the body, the piston, the spring, the valve, etc., determine the configuration and operating pressure of the compression chamber, these components are very important in controlling the function of the pump assembly.

Product dispensing requirements are increasingly more demanding. With an increase in the use of low volatile solvents, as the main carrier component for the product to be dispensed, and as well as using more viscous gel-type liquids, the design requirements for dispensing such products are more critical. In particular, the low volatile solvents and the viscous gel-type liquids require higher discharge pressures, to facilitate proper dispensing thereof, versus products that include solvents which are readily converted into vapor upon discharge. In an attempt to overcome this problem and facilitate control of the resulting spray configuration, many prior art pump assemblies use a single spring to both actuate the piston and also bias a second one-way valve. This single spring forces the piston back into its initial static position, once the actuator has actuated the piston, and holds the second one-way valve closed until a desired operating pressure is reached.

Other prior art designs use a first spring for returning the piston and a second spring for biasing the second one-way valve independently of the piston. The intended advantage of the two spring arrangement is that the second one-way valve spring can be independently adjusted to facilitate opening of the piston valve at a desired operating pressure. In either case, the second one-way valve and the spring(s) are all contained within the compression chamber of the body and are subjected to the generated operating pressure within the compression chamber. The spring(s) (or other known conventional biasing members) are typically located to bias the second one-way valve against a piston valve seat. The amount of pressure required to compress the spring, and thus move the second one-way valve away from its associated valve seat, determines the

operating pressure of the pump assembly. The construction of the spring thus determines the pressure at which the product is displaced from the body out through the discharge orifice. The spring pressure translates into a high reaction force upon the product as it is released by the second one-way valve and overcomes the spring bias.

It is to be appreciated that in order for the pump assembly to dispense liquid properly, the pump section of the assembly must be initially purged of any air contained within the compression chamber–this initial purging step is commonly referred to as "priming" of the pump. When the actuator is initially depressed by an operator, any air contained within the compression chamber of the body must be displaced in order for product to be siphoned into the compression chamber of the body via the dip tube. By depressing the actuator, the piston is moved toward a base of the body thereby compressing the spring as well as any air contained within the compression chamber. The compressed air assists with maintaining the first one-way valve in a closed position. The compressed air also induces an opening force on the second one-way valve but, in most cases, the induced force of the compressed air may never reach a high enough pressure to overcome the spring closing force of the second one-way valve. For this reason, prior art pumps use a small rib(s), or some other mechanical device located near the end of the compression stroke, to disrupt the seal between an inner part of the body and the piston and allow the compressed air to escape from the compression chamber. Two methods are used for allowing the compressed air to escape from the compression chamber. The first method is to allow the air to escape around the piston which can result in residual product drying along the escape path and seizing the piston. The second method is to allow air to escape down the dip tube which results in the air and the product to be dispensed reciprocating back and forth within the tube, which is also undesirable.

Because both the second one-way valve and the spring occupy space inside the body, these components effect the compression of the air during the priming operation of the pump, and thus effect the operation of the second one-

way valve. This also means that the product, siphoned via the dip tube into the body, is then pushed back through the system in the reverse direction as the piston reciprocates. This to and fro movement of the air and the product reduces the efficiency of the pump and increases the force needed to operate the system. In addition, the number of strokes required in order to remove the air contained within the compression chamber is increased.

Summary of the Invention

Wherefore, it is an object of the present invention to overcome the aforementioned problems and drawbacks associated with the prior art pump assembly designs.

Another object of the present invention to design a pump assembly, utilizing a smaller number of components, which is efficiently primed and operated while still ensuring a high dispensing efficiency for the pump assembly.

A further object of the invention is to provide a movable poppet which operates at ambient pressure so that the function of the poppet is essentially unaffected by the flow or circulation of the product to be dispensed within the compression chamber.

Still another object of the invention is to increase the compression efficiency of the pump assembly and also minimize the number of strokes required to "prime" the pump assembly by providing a spring which is not located along or in communication with the product dispensing flow path so that the spring is not hindered by and does not hinder or interfere with the flow of the product to be dispensed.

Yet another object of the invention is to provide a simpler, lower cost, higher quality and efficient spray pump assembly that provides the same spray characteristics for low volatile solvents, water based products, alcohol base and/or other formulas.

A still further object of the invention is provide a pump assembly having a dispensing dosage of between about 120-250 ml of product, or so, an actuation force of between about 5.5-7.5 lbs., or so, and an internal operating pressure of the compression chamber of between about 100 to 170 psi, or so.

The manually actuated pump assembly, according to the present invention, is capable of dispensing a wide range of products. The highly efficient internal volume and priming system, according to the present invention, renders the manually actuated pump assembly ideal for use with personal care products, pharmaceuticals, fragrances, etc. A majority of the structural components of the manually actuated pump, according to the present invention, are located outside of the compression chamber thereby allowing minimal clearance between the inwardly facing surfaces defining the compression chamber when those surfaces are moved into the fully actuated position. Such design of the pump assembly aids in both priming and normal operation of the pump assembly.

Priming is accomplished by venting the trapped air either out through the discharge orifice or past a seal formed between the poppet and an inner cylindrical housing, rather than down the dip tube or around the compression piston. The prior art dispensing systems, that prime through the dip tube, experience difficulties when dispensing gels or high water content products or when utilizing a long length dip tube. As note above, the pump assemblies that prime around the compression piston have a tendency to become clogged or seized due to drying of the product residue.

During normal operation, according to the present invention, the pump assembly has a high operating pressure due to the ratio of the compression chamber diameter to the piston stroke length. With an operation pressure of approximately 130 psi or so, the manually actuated pump according to the present invention operates about 30% higher than conventional pumps currently available on the market today. Another advantage of the high compression design, of the present invention, is the uniform spray consistently achieved during each dispensing stroke. In addition, less variation in the internal volume results by locating the spring and valving components external of the compression chamber. Lastly, the improved profile of the components provides substantially unrestricted flow of the product from the compression chamber to the discharge orifice.

Finally, the present invention relates to a finger pump apparatus comprising a container for housing a desired product to be dispensed, said container being

closed at one end and having a spout to facilitate dispensing of the product to be dispensed; a pump body having a base supporting an outer housing and an inner housing, and said outer housing and said inner housing at least partially defining a compression chamber therebetween; a closure supporting said pump body, and said closure sealingly engaging with the spout of the container; a piston being at least partially received within said pump body and being slidable relative to said pump body along said outer housing, said piston having an annular lip for providing a sealing engagement with the pump body, and said piston being provided with a poppet valve seat defining a piston outlet; an actuator being coupled to said piston outlet, and said actuator having a discharge outlet communicating with piston outlet for facilitating dispensing of a product; a poppet being accommodated by said inner housing, said poppet being biased away from said base of said pump body by a spring into engagement with said poppet valve seat to normally close said piston outlet and prevent flow of product therethrough, and said poppet, said base and said inner housing defining an interior cavity, and said interior cavity being provided with a ventilation port which allows said interior cavity, during operation of said poppet, to communicate with an interior of the container so that the interior cavity operates at ambient pressure; a passageway communicating with said compression chamber, said passageway including an inlet with a one-way valve which allows the product to flow along said passageway toward said compression chamber; and a dip tube coupling the inlet of the passageway to a base portion of said container to facilitate pumping of the product to be dispensed by the pump assembly.

Brief Description of the Drawings

Fig. 1 is a diagrammatic front perspective view of a container supporting the improved pump assembly according to the present invention;

Fig. 2 is a diagrammatic cross-sectional view of a first embodiment of the improved pump assembly, according to the present invention, shown in a static position without an overcap, an actuator, a closure, a liner, or a dip tube affixed thereto;

Fig. 3 is a diagrammatic cross-sectional view of the first embodiment of the improved pump assembly, according to the present invention, shown in the static position with an actuator, a closure, a liner and a dip tube attached thereto;

Fig. 4 is a diagrammatic cross-sectional view, of the first embodiment of the improved pump assembly of Fig. 3, shown in a partially depressed position in which the poppet has been sufficiently displaced from the poppet annular seat to commence dispensing of product;

Fig. 5 is a diagrammatic cross-sectional view of the first embodiment of the improved pump assembly of Fig. 3 showing the fully depressed position of the pump assembly;

Fig. 6 is a diagrammatic cross-sectional view, of the first embodiment of the improved pump assembly of Fig. 3, shown in its partially returned position in which the poppet is biased against the poppet annular seat to facilitate suction of the product into the compression chamber during the return stroke of the improved pump assembly;

Fig. 7 is a diagrammatic cross-sectional exploded view of a second embodiment of the pump body for the improved pump assembly, according to the present invention; and

Fig. 8 is a diagrammatic cross-sectional view of the second embodiment of the improved pump assembly, according to the present invention, shown in the static position with an actuator, a closure, a liner and a dip tube attached thereto.

Description of the Preferred Embodiment

While this invention is susceptible to various embodiments, the specification and the accompanying drawings disclose two specific forms as examples of the present invention. For ease of description, the pump assembly embodying this invention is described in the normal operating position, in terms such as: upper, lower, horizontal, etc., are used with reference to this position. It will be understood, however, that the pumps and components embodying this invention may be manufactured, stored, transported, used, and sold in an orientation other than the position described.

Turning first to Fig. 1, a brief description concerning the improved pump assembly 10, according to the present invention, used in combination with a prior art container 12 will now be provided. As can be seen in this Figure, the container 12 is a generally closed plastic container which has a spout (not shown in detail) formed on the top surface of the container. The spout is provided with an external thread (not shown) and has an aperture or opening formed therein to provide communication with an interior of the container 12. The container 12 accommodates a desired quantity of liquid, fluid or some other product to be dispensed 14. The product to be dispensed 14 is typically supplied from an interior space or area of the container 12, via a dip tube 16, to an inlet of the pump assembly 10. As is well known in the art, the bottom end of the dip tube 16 is normally submerged in the liquid or product when the container is in a generally in an upright orientation, as illustrated in Fig. 1. A further detailed description concerning the function of the dip tube 16 will be provided below.

The pump assembly 10 is provided with removable cap or closure 18 which accommodates a depressible actuator 20 that is movable relative to the closure 18 to facilitate actuation of the pump assembly 10, and a further detailed description concerning the purpose of such depression will follow below. If desired, a removable hood or overcap 22, can encase or enclose the actuator 20 to prevent inadvertent actuation thereof. The overcap 22 is hollow shell member and typically has a perimeter edge that has a friction fit with a hollow annular skirt 24 extending from a top surface of the closure 18. As such overcap feature in conventional and well known in the art, a further detailed description concerning the same is not provided.

With reference now to Figs. 2-6, a detailed description concerning a first embodiment of the improved pump assembly 10, according to the present invention, will now be provided. As can be seen in Figs. 3-6, for example, the base portion of the closure 18 is provided with an annular base flange 26 which is located to abut against a mating flange surface (not shown in detail) of the container 12. In addition, the closure 18 is provided with a central through bore 28 extending through the closure 18 along a longitudinal axis L of the

improved pump assembly 10. An inwardly facing surface 29 of the base of the closure 18 is provided with an internal thread 30 (or some other conventional retaining recess, lip or mechanism) for engagement with a mating external thread (or some other mating conventional retaining recess, lip or mechanism) provided on the spout of the container 12. The closure 18 is also provided with a substantially centrally located, radially inwardly extending horizontal closure annular flange 32 which separates a base portion of the closure 18 from the annular skirt 24. The closure annular flange 32 facilitates retention of the various components of the improved pump assembly 10 as will be discussed below in further detail.

A top surface of the actuator 20 is provided with a finger recess 34 which is preferably shaped or contoured to facilitate engagement with an index finger of an operator. As such shaping or contouring feature is well known in the art, a further description concerning the same is not provided. The actuator 20 is further provided with a downwardly extending annular side wall 36 which has a diameter that is slightly less than an inside diameter of the annular skirt 24 of the closure 18 to allow the annular side wall 36 of the actuator 20 to move relative to the annular skirt 24, e.g. to move in and out of the space encompassed by the annular skirt 24 of the closure 18 without excess friction or contact occurring between those two components. According to a preferred embodiment of the invention, there is a relative sliding motion between an outwardly facing surface of the annular side wall 36 and an inwardly facing surface of the annular skirt 24 to facilitate guiding the actuator 20 as it is actuated or depressed toward the closure 18. Such sliding motion facilitates maintaining the actuator 20 in its correct upright dispensing orientation.

An internal longitudinal central bore 38 is formed within the interior of the actuator 20 and the central bore 38, in turn, communicates with a transverse radial bore 40. The transverse radial bore 40 terminates at an opening formed in an exterior surface of the actuator which is sealed or closed by insert member 42. The insert member 42 has a discharged orifice 44 formed therein. The discharged orifice 44 facilitates dispensing of the product to the dispensed 14 out

of the actuator into the external environment. The insert member 42 is received within the transverse radial bore 40 and an outer periphery of the insert member 42 has a friction fit with an inner wall defining the transverse radial bore 40 to permanently retain the insert member 42 therein. An inwardly facing surface, located on the base of the insert member 42, engages with an outwardly facing planar end surface of a central post 46 accommodated within the radial bore 40. The end surface of the post 46 has a plurality of conventional radially inwardly directed channels 48 which lead to a conventional mixing chamber (not separately numbered) centrally formed on the end surface of the post 46. It will be apparent to one skilled in the art that the plurality of radially inwardly directed channels 48 and the mixing chamber may also be located on and supported by the inwardly facing base surface of the insert member 42, instead of the post 46, for engagement with a substantially flat end surface of the post 46. The mixing chamber directly communicates with the discharge orifice 44 for dispensing the throughly mixed and/or swirled product to be dispensed 14 out through the discharge orifice 44. As this dispensing arrangement is conventional and well known in the art, a further detailed description concerning the same is not provided.

The closure annular flange 32 of the closure 18 mates with an annular flange 50 of a turret 52 (see Fig. 3 for example) and also supports a gasket or liner 58. The gasket or liner 58 is provided with a central aperture and is employed for biasing the annular flange 50 of the turret 52 against the closure annular flange 32 of the closure 18, when the closure 18 is secured to the container 12. The closure annular flange 32 of the closure 18 and the gasket or liner 58 sandwich the annular flange 50 of the turret 52 therebetween as the closure 18 is secured to the spout of the container. Such sandwiching arrangement is conventional and well known in the art.

An annular side wall 54 of the turret 52 extends through a central aperture, provided in the closure annular flange 32, and the annular side wall 54 extends substantially parallel to the annular skirt 24 of the closure 18 and is spaced therefrom a sufficient distance to allow the annular side wall 36 of the actuator 20

to be readily received therebetween without an undue interference from the side wall 54 during operation of the actuator 20. A top free end portion of the turret 52 is provided with an annular retaining edge 56 which first extends radially inwardly and then extends downwardly a short distance, along the longitudinal axis L, toward the base of the closure 18. A further detailed description concerning the purpose of the retaining edge 56 will be provided below. An annular lip 59 (see Fig. 2) is provided on an inwardly facing surface of the annular side wall 54 of the turret 52 to facilitate retention of a pump body 60 and a further description concerning the purpose of the same will follow.

The pump body 60, as can be seen in further detail with reference to Fig. 2, comprises an outer cylindrical housing 62 which is connected to a base 64 of the pump body 60 to form a single unitary component or structure. An inner cylindrical housing 66 is integrally connected to the base 64, of the pump body 60, and the inner cylindrical housing 66 is located concentric with the outer cylindrical housing 62 but spaced therefrom. A exterior surface of the pump body 60 supports an annular nub 69 which is located to engage with the annular lip 59 of the turret 52 and secure the pump body 60 to the turret 52. A lower portion of the pump body 60 is provided with a cylindrical extension 70 having an inlet aperture 72 formed in a base end surface thereof. A first end of the dip tube 16 is frictionally received and retained within the inlet aperture 72, as is conventionally done in this art.

The inlet aperture 72 communicates with a first portion of a compression chamber 68, formed between an exterior surface of the inner cylindrical housing 66 and an inwardly facing surface of the outer cylindrical housing 62, via a longitudinal passageway 74. The longitudinal passageway 74 extends parallel to but is spaced radially from the longitudinal axis L of the pump assembly. A one way valve is located along the longitudinal passageway 74 and the one-way valve comprises a metal ball 76 that is captively retained within a cage 78. The cage 78 allows limited to and fro movement of the ball 76 to facilitate opening and closing of the one-way valve. This one-way valve allows the product to flow along the longitudinal passageway 74 when the ball 76 is spaced from an annular ball

seat 80 (see Fig. 6). The ball 76 normally rests, as can be seen in Figs. 3-5, against the annular ball seat 80 to shut off product flow through the longitudinal passageway 74. Prior to inserting the dip tube 16 within the inlet aperture 72, the metal ball 76 is forced into the inlet aperture 72, and urged past the annular ball seat 80 into the cage 78 where the ball 76 is thereafter permanently retained and utilized to operate the one-way valve.

It is to be appreciated that the ball 76 is normally held by gravity in a sealing position over the opening defined by the annular ball seat 80 so as to prevent the compressed liquid from being forced back down into the dip tube 16. During actuation of the actuator, i.e. either during priming of the pump or dispensing of product, the generated pressure within the compression chamber additional serves to hold the ball 76 in its sealing engagement against the annular ball seat 80. A further detailed description concerning the purposed of the same will follow below.

A piston 82 is at least partially accommodated within the body 60 and the piston 82 is slidably movable relative to the body 60. A first lower end 84 of the piston 82 is provided with an annular sealing lip 86, having an outer circumference slightly larger than the inner dimension of the outer housing 62 to provide a tight sealing engagement between the annular sealing lip 86 and the inner surface of the outer housing 62. During operation of the piston 82, as will be described below in further detail, the pressure generated within the compression chamber 86 assists with forcing the annular sealing lip 86 of the piston 82 into sealing engagement with the inwardly facing surface of the outer cylindrical housing 62. An exterior surface of the piston 82, adjacent the annular sealing lip 86, is provided with an annular shoulder 88 which abuts against the annular retaining edge 56 of the turret 52 to captively retain at least the first lower end 84 of the piston 82 within the pump body 60.

The piston 82 is a generally hollow member which has an exterior side wall that may taper slightly from the first lower end 84 to a second remote end 90. A piston outlet 92 is formed adjacent the second remote end 90 of the piston 82. The second remote end 90 of the piston 82, located adjacent the piston outlet 92,

is provided with a reduced diameter annular cylindrical side wall 94 which is sized to be frictionally received within the central bore 38 of the actuator 20 and provide a secure retaining engagement between the second remote end 90 of the piston 82 and the actuator 20. An annular surface of the piston 82, defining the piston outlet 92, forms the poppet valve seat 96. The piston outlet 92 is normally closed by a shoulder 106 of an elongate generally cylindrical poppet 98 which is biased against the poppet valve seat 96 via a spring 104. When the cylindrical poppet 98 becomes spaced from the poppet valve seat 96, during actuation of the pump assembly, the piston outlet 92 is opened and allows the product to be dispensed 14 to flow from the compression chamber 68 to the central bore 38 of the actuator 20, and a further detailed description concerning the same will be provided below.

As stated above, a first portion of the compression chamber 68 is formed between the inner cylindrical housing 66 and the outer cylindrical housing 62. A remaining second portion of the compression chamber 68 is formed between an inwardly facing surface of the piston 82 and an exterior surface of the poppet 98. The hollow interior dimension of the piston 82 is slightly larger than the outer diameter of the inner cylindrical housing 66 and either the piston 82 and/or the inner cylindrical housing 66 may have a channel(s) formed thereon so that the first portion of the compression chamber 68 is in constant communication with the remainder of the compression chamber 68 regardless of the position of the piston 82 relative to the inner cylindrical housing 66.

The cylindrical poppet 98 is accommodated within a central cavity 100 defined by the inner cylindrical housing 66. The poppet 98 is a solid elongate generally cylindrical member which supports an annular sealing and guide surface 102 adjacent a first lower end thereof. The annular sealing and guide surface 102 is sized to have an slight interference sliding fit with the inwardly facing surface of the inner cylindrical housing 66. The annular sealing and guide surface 102 slides along the inwardly facing surface of the inner cylindrical housing 66, in a sealed manner during operation of the pump assembly, and maintains the poppet 98 aligned with respect to the longitudinal axis L of the pump

assembly 10. The poppet 98 is biased into a normally closed position, via a spring 104 accommodated within a centrally located interior cavity 100, so that the shoulder 106 of the poppet 98 abuts against the poppet valve seat 96, formed on the piston 82, to shut off flow through the piston outlet 92. As can be seen in Fig. 2, for example, the poppet 98 has a tapered or smaller constant diameter appendage 108 that extends through the piston outlet 92 and facilitates maintaining proper alignment of the poppet 98 with respect to the outlet 92 during operation of the pump assembly.

A base of the centrally located interior cavity 100, accommodating the spring 104, is provided with a ventilation port 110 which provides communication between the centrally located interior cavity 100 and an interior space of the container 12 to ventilate the interior cavity so that the centrally located interior 100 is at ambient pressure. The ventilation port 110 prevents the creation of either excess pressure or vacuum in the centrally located interior 100 during operation of the pump assembly 10. A lower most portion of the poppet 98, opposite the appendage 108, is provided with a cylindrical extension 112 which receives one end of the spring 104 and further facilitates proper alignment and engagement between the poppet 98 and the spring 104.

In a preferred form of the invention, a lower inwardly facing surface of the inner cylindrical housing 66 is provided with at least one nub or some other protrusion 114 so that when the annular sealing guiding surface 102 of the poppet 98 engages with the nub or other protrusion 114, the remaining pressure in the compression chamber 68 is relieved and flows downward through the centrally located interior cavity 100 and out through the ventilation port 110, provided in the base 64, into the interior space of the container 12. It is to be appreciated that the nub or other protrusion 114 is formed on an inwardly facing surface of the inner cylindrical housing 66 at a location near the end of the stroke of the poppet 98, e.g. after the poppet has moved about 95% to 98% of is normal operating stroke within the inner cylindrical housing 66, so as not to compromise significantly the pumping efficiency of the compression chamber 68.

The use of the protrusion or nub 114 is very useful in "priming" the air normally contained within the compression chamber 68 of the pump assembly following the manufacturing process. Since air is a compressible fluid, the compressed air typically may not generate, even after the full compression stroke of the actuator 20, a sufficient pressure to bias the poppet shoulder 106 away from the poppet valve seat 96 and thereby allow discharge of the compressed air out of the compression chamber 68 into the central bore 38 of the actuator 20. According to the present invention, if the actuator 20 is substantially completely depressed and the poppet shoulder 106 still has not been biased away from the poppet valve seat 96 to thereby open the piston outlet 92, the air is immediately released by the breach in the seal formed between the annular sealing and guide surface 102 and the inwardly facing surface of the inner cylindrical housing 66, once the annular sealing and guide surface 102 engages with the nub or the protrusion 114. This released air is conveyed through the central cavity 100 and out the ventilation port 110. On the return stroke of the actuator 20, however, as soon as the annular sealing and guide surface 102 clears the nub or the protrusion 114 and again establishes a seal with the inner cylindrical housing 66, a siphoning action is created within the compression chamber 68 and a quantity of the product to be dispensed 14 is siphoned, via the dip tube 16 and passageway 74, toward the compression chamber 68. This siphoned product will eventually flow into the compression chamber 68 where the product, which is generally an incompressible fluid, will actuate the poppet 98 in its intended dispensing manner after a sufficient number, e.g. four (4), of priming strokes.

It is to be appreciated that if replacement air is not allowed to enter inside the container 12 and replace the volume of dispensed product 14, during normal operation of the pump, the container 12 will progressively become evacuated and eventually deform inwardly and/or collapse once a substantial portion of the product to be dispensed is sprayed. To alleviate this problem, at least one groove 116 is provided along either an exterior surface of the body 60 or an inwardly facing surface of the turret 52. This groove 116 is normally sealed off from the external environment by the piston shoulder 88 engaging with the annular

retaining edge 56 to provide a seal therebetween. Once the piston 82 is sufficiently depressed, the exterior surface of the piston 82 is slightly spaced from the annular retaining edge 56 to allow ambient air to flow along the exterior surface of the piston 82 and around the retaining edge 56 and down along the groove 116, located between the exterior surface of the body 60 and the inwardly facing surface of the turret 52, to replace the volume of the product which was just dispensed by the actuator 20. This ventilation groove 116 also maintains the pressure inside the container at substantially the same pressure as the external surrounding environment.

Now that a detailed description concerning the basic components of the pump assembly, according to the present invention, were provided, a detailed description concerning actuation of the pump assembly will now be described.

Initially the pump assembly 10 is first installed on a spout of a desired container 12, containing a product to be dispensed 14, by engaging the threads 30 of the closure 18 with a mating thread, or some other conventional retaining mechanism, provided on an exterior surface of the spout of the container 12. Once this has occurred, the dip tube 16 of the pump assembly is submerged within the product to be dispensed 14 such that an inlet of the dip tube is located adjacent a base of the container 12. The pump assembly 10 is now ready for actuation.

When actuation is desired, the operator places his or her index finger on the finger recess 34 and depresses the actuator 20, in the direction of arrow A of Fig. 3, so as to bias the actuator 20 downwardly along the longitudinal axis L toward the closure 18. Such depression of the actuator 20, in turn, causes a depression of the piston 82 which results in the annular sealing lip 86 sliding along the inwardly facing surface of the outer cylindrical housing 62 in an sealed manner toward the base 64 of the body 60. This action causes the product to be dispensed 14, contained within the compression chamber 68, to come under pressure, i.e. it is to be noted that a liquid is generally incompressible. As the pressure of the product to be dispensed increases, this increase in pressure serves to bias the ball 76 against the annular ball seat 80 and thereby prevent the

escape of any product downwardly back along the dip tube 16. As noted above, the inwardly facing surface of the piston 82 is spaced a sufficient distance away from the outwardly facing surface of the inner cylindrical housing 66 to allow the product to be dispensed 14 to continuously flow therebetween regardless of the position of the piston 82. Once the pressure within the compression chamber 68 increases to a sufficient pressure, e.g. an operating pressure of about 130 psi, the generated pressure of the product to be dispensed 14 overcomes the biasing force of the spring 104 and forces the poppet 98 downwardly toward the base 64 of the interior cavity 100 against the action of the spring 104. This movement results in a compression of the spring 104 which allows the poppet shoulder 106 to separate away from the poppet valve seat 96 and thereby establishes a product flow path through the piston outlet 92, as can be seen in Fig. 4.

Once the poppet shoulder 106 is sufficiently spaced from the poppet valve seat 96, the product to be dispensed 14 rushes through the piston outlet 92 and flows upwardly through the central bore 38, the radially bore 40, the inwardly directed channels 48 and is dispensed out through the discharge orifice 44 in a manner which generates a substantially uniform discharge spray configuration from the actuator 20. The piston 82 continues to force the product to be dispensed 14 out through the actuator 20, during further downward motion of the actuator in the direction of arrow A, until the annular lip 86 of the piston 82 abuts against the base 64 of the body 60, as seen in Fig. 5. Once the pump assembly is in its fully depressed position, an inwardly facing surface of the base 64 of pump body 60 is contoured to closely accommodate and substantially mirror the inwardly facing surface or profile of the annular sealing lip 86 of the piston 82 and thereby minimize the amount of the product to be dispensed 14 still remaining in the compression chamber 68, e.g. the volume of the compression chamber is minimized by this arrangement. As is apparent from Fig. 5, the volume of the compression chamber 68 has been significantly reduced so that a substantial portion of the product to be dispensed 14, that was previously stored within the compression chamber 68, has been dispensed by the actuation stroke of the actuator 20.

It is to be appreciated when the annular sealing and guide surface 102, seen in Fig. 5, engages with the nub or the protrusion 114, formed near a lower portion of the inner cylindrical housing 66, the seal therebetween is breached and most of the remaining product to be dispensed, or air during initial priming of the pump assembly, is conveyed through the interior cavity 100 and out the ventilation port 110 to quickly relieve the generated pressure of the compression chamber 68.

Once the actuation stroke is completed, the finger actuation pressure of the operator is relieved, e.g. the finger of the operator is removed from the finger recess 34. Thereafter, the spring 104 immediately biases the poppet 98, in the direction of arrow B of Fig. 6, toward and against the poppet valve seat 96 of the piston 82 to quickly close the piston outlet 92 and thereby prevent the further flow of the product to be dispensed 14 therethrough. The spring 104 also biases, due to biasing of the poppet 98 in the direction of arrow B, the piston 82 and the actuator 20 in an upward direction away from the closure 18. During this return stroke of the pump assembly 10, additional product to be dispensed 14 is siphoned into the inlet formed in the second end of the dip tube 16. The siphoned product to be dispensed 14 flows along the dip tube 16 and moves or displaces the ball 76 away from the ball seat 80 to allow passage of the product to be dispensed 14 therepast along the longitudinal passageway 74.

It is to be appreciated that the cage 78 captively retains the ball 76, e.g. opens this one-way valve but retains the ball 76 so that the ball 76 may fall, due to the effects of gravity, back on the ball valve seat 80 following completion of the pump assembly return stroke to close this one-way valve. The product to be dispensed 14 continues to flow along longitudinal passageway 74 into the compression chamber 68 where the product to be dispensed 14 is accumulated and stored, as can be seen in Fig. 3. Once the spring 104 has biased the poppet 98, in the direction of arrow B, a sufficient distance such that the shoulder 88 of the piston 82 abuts against the annular retaining edge 56, the ball 76 is again allowed to settle on ball valve seat 80 to thereby prevent further flow and allow

pressurization of the compression chamber 68 when the actuator 20 is again depressed.

With reference to Figs. 7 and 8, a second embodiment of the present invention will now be discussed. As this second embodiment is very similar to the first embodiment in many aspects, only the differences between the second and the first embodiments will be discussed in detail. In fact, the closure 18, the actuator 20, the ball 76, the piston 82, the poppet 98 and the spring 104 are identical in both embodiments and thus a further detail discussion concerning the same in not generally provided.

The major difference between the two embodiments can be readily seen in Fig. 7. A first difference is that the pump body 60 is formed as two separate components, i.e. the first component comprises the outer cylindrical housing 162 integral formed with the base 164 of the pump body 160 to form a unitary component or structure while the inner cylindrical housing 166 is a completely separate component. The interior of the pump body 160 has three distinct sections each having a different diameter, i.e. a first smaller diameter section 177 located adjacent a base of the pump body 160, a third larger diameter section 179 located adjacent an open end of the pump body 160, and a second intermediate diameter section 178 located between the smaller diameter section 177 and the larger diameter section 179. A lower cylindrical portion 180 of the inner cylindrical housing 166 is sized to have an interference fit, e.g. a few thousands of an inch or so, with the second intermediate section 178 of the pump body 160 so that the inner cylindrical housing 166 can be located concentric with respect to the outer cylindrical housing 162 and be captively retained thereby once engaged with the pump body 160.

A second difference is that a lower side wall section of the pump body 160 is provided with an aperture 184 and this aperture 184 is located to coincide with the ventilation port 110 formed in a side wall of the inner cylindrical housing 166, once the inner cylindrical housing 166 is received within the internal diameter of the base 164 of the pump body 160. As with the first embodiment, the ventilation port 110 provides communication between the centrally located interior cavity 100

and an interior space of the container 12 to ventilate the interior cavity so that the centrally located interior 100 is at ambient pressure and prevents the creation of either excess pressure or vacuum in the centrally located interior 100 during operation of the pump assembly 10.

A third difference relates to the retention of the metal ball 76. According to this embodiment, during assembly, the metal ball 76 is first placed within the pump body 160 and received by the first smaller diameter bore 177, prior to placing the inner cylindrical housing 166 within the internal diameter of the base 164 of the pump body 160. Thereafter, once the inner cylindrical housing 166 is received within the internal diameter of the base 164 of the pump body 160, a base 181 of inner cylindrical housing 166 functions as a stop to prevent the metal ball 76 from being dislodged from the first smaller diameter bore 177 thereby eliminating the need for the cage 78, as with the previous embodiment.

A fourth difference relates to the arrangement of the centrally located interior cavity 100 with respect to the inlet aperture 72 and the first smaller diameter bore 177. In the first embodiment, the centrally located interior cavity 100 has a longitudinal axis which coincides with the longitudinal axis L of the pump assembly while the inlet aperture 72 and the bore accommodating the metal ball 76 each have a longitudinal axis which extends parallel to by is offset with respect to the longitudinal axis L of the pump assembly. According to the second embodiment, the centrally located interior cavity 100 as well as both the inlet aperture 72 and the first smaller diameter bore 177 are all have longitudinal axes which coincide with the longitudinal axis L of the pump assembly.

An exterior surface of the pump body 160 supports an annular nub 69 which is located to engage with the annular lip 59 of the turret 52 and secure the pump body 160 to the turret 52. A lower portion of the pump body 160 is provided with a cylindrical extension 70 having an inlet aperture 72 formed in a base end surface thereof. A first end of the dip tube 16 is frictionally received and retained within the inlet aperture 72, as is conventionally done in this art.

The inlet aperture 72 communicates with a first portion of a compression chamber 68, formed between an exterior surface of the inner cylindrical housing 166 and an inwardly facing surface of the outer cylindrical housing 162, via a longitudinal passageway 74. The longitudinal passageway 74 extends parallel to but is spaced radially from the longitudinal axis L of the pump assembly. The metal ball 76 moves to and fro within the first smaller diameter section of the pump body 160 and forms a one way valve. This one-way valve allows the product to flow along the longitudinal passageway 74 when the ball 76 is spaced from an annular ball seat 80. As with the pervious embodiment, the ball 76 normally rests against the annular ball seat 80 to shut off product flow through the longitudinal passageway 74.

A piston 82 is at least partially accommodated within the pump body 160 and the piston 82 is slidably movable relative to the pump body 160. A first lower end 84 of the piston 82 is provided with an annular sealing lip 86, having an outer circumference slightly larger than the inner dimension of the outer housing 62 to provide a tight sealing engagement between the annular sealing lip 86 and the inner surface of the outer housing 162. During operation of the piston 82, the pressure generated within the compression chamber 86 assists with forcing the annular sealing lip 86 of the piston 82 into sealing engagement with the inwardly facing surface of the outer cylindrical housing 162. An exterior surface of the piston 82, adjacent the annular sealing lip 86, is provided with an annular shoulder 88 which abuts against the annular retaining edge 56 of the turret 52 to captively retain at least the first lower end 84 of the piston 82 within the pump body 160.

As with the first embodiment, a first portion of the compression chamber 68 is formed between the inner cylindrical housing 166 and the outer cylindrical housing 162. A remaining second portion of the compression chamber 68 is formed between an inwardly facing surface of the piston 82 and an exterior surface of the poppet 98. The hollow interior dimension of the piston 82 is slightly larger than the outer diameter of the inner cylindrical housing 166 and either the piston 82 and/or the inner cylindrical housing 166 may have a channel(s) formed

thereon so that the first portion of the compression chamber 68 is in constant communication with the remainder of the compression chamber 68 regardless of the position of the piston 82 relative to the inner cylindrical housing 166.

The cylindrical poppet 98 is accommodated within a centrally located internal cavity 100 defined by the inner cylindrical housing 166. The poppet 98 is a solid elongate generally cylindrical member which supports an annular sealing and guide surface 102 adjacent a first lower end thereof. The annular sealing and guide surface 102 is sized to have an slight interference sliding fit with the inwardly facing surface of the inner cylindrical housing 166. The annular sealing and guide surface 102 slides along the inwardly facing surface of the inner cylindrical housing 166, in a sealed manner during operation of the pump assembly, and maintains the poppet 98 aligned with respect to the longitudinal axis L of the pump assembly 10. The poppet 98 is biased into a normally closed position, via a spring 104 accommodated within the centrally located interior cavity 100, so that the shoulder 106 of the poppet 98 abuts against the poppet valve seat 96, formed on the piston 82, to shut off flow through the piston outlet 92.

In a preferred form of the invention, a lower inwardly facing surface of the inner cylindrical housing 166 is provided with at least one nub or some other protrusion 114 so that when the annular sealing guiding surface 102 of the poppet 98 engages with the nub or some other protrusion, the remaining pressure in the compression chamber 68 is relieved and flows downward through the centrally located interior cavity 100 and out through the ventilation port 110 and aperture 184, provided in the base 164, into the interior space of the container 12.

According to a preferred form of the invention, the compression chamber which has a maximum transverse dimension or diameter of between 0.225 and 0.275 inches, and more preferably a diameter of about 0.250 inches and the piston has a stroke length of between 0.275 and about 0.325 inches, and more preferably a piston stroke length of about 0.300 inches. This results in a compression chamber diameter to piston stroke ratio of between about 4 to 5 and about 2 to 3 which facilitates achievement of an operating pressure of approximately 130 psi or so.

According to the design of the present invention, if, during depression of the actuator 20 toward the closure 18, the finger actuation pressure discontinues for any reason, once flow has been established through the piston outlet 92, the spring 104 will immediately bias the poppet 98 in the direction of arrow B of the Fig. 6, toward and against the poppet valve seat 96. This biasing action quickly closes the piston outlet 92 and thereby prevents the further flow of product to be dispensed 14 therethrough.

According to the present invention, passageway 74 leading to the compression chamber 68 extends along a second longitudinal axis LP which is off set with respect to the longitudinal axis L of the pump assembly but extends substantially parallel thereto. This arrangement facilitates venting of the base 64 of the central cavity 100 to the interior space of the container 12 so that the central cavity 100 operates at ambient pressure or to some other pressure other than the operating pressure of the compression chamber.

Since certain changes may be made in the above described finger operated pump assembly, without departing from the spirit and scope of the invention herein involved, it is intended that all of the subject matter of the above description or shown in the accompanying drawings shall be interpreted merely as examples illustrating the inventive concept herein and shall not be construed as limiting the invention.

I Claim:

1. A finger pump assembly comprising:

a pump body having a base supporting an outer housing and an inner housing, and said outer housing and said inner housing at least partially defining a compression chamber therebetween;

a closure supporting said pump body, and said closure having a mechanism for facilitating engagement with a spout of a container;

a piston being at least partially received within said pump body and being slidable relative to said pump body along said outer housing, said piston having an annular lip for providing a sealing engagement with the pump body, and said piston being provided with a poppet valve seat defining a piston outlet;

an actuator being coupled to said piston outlet, and said actuator having a discharge outlet communicating with said piston outlet for facilitating dispensing of a product;

a poppet being accommodated by said inner housing, said poppet being biased away from said base of said pump body by a spring into engagement with said poppet valve seat to normally close said piston outlet and prevent flow of product therethrough, and said poppet, said base and said inner housing defining an interior cavity, and said interior cavity being provided with a ventilation port which allows said interior cavity, during operation of said poppet, to operate at ambient pressure; and

a passageway communicating with said compression chamber, said passageway having an inlet and a one-way valve which allows the product to flow along said passageway toward said compression chamber.

2. The finger pump assembly according to claim 1, wherein said poppet has an annular sealing and guide surface to facilitate sliding sealing engagement of the poppet along an inwardly facing surface of said inner housing.

3. The finger pump assembly according to claim 1, wherein said poppet is provided with a poppet shoulder for engaging with said poppet valve seat which defines the piston outlet, and said poppet has an appendage which extends

through said piston outlet to facilitate alignment of said poppet with said piston outlet.

4. The finger pump assembly according to claim 1, wherein an end of said poppet, received within said inner housing, supports an extension which engages with a first end of said spring to facilitate orientation of said poppet along a longitudinal axis of said finger pump assembly.

5. The finger pump assembly according to claim 1, wherein said pump body is coupled to a turret and said turret is connected to said closure, and a remote free end of said closure supports an annular skirt which extends away from a base portion of said closure.

6. The finger pump assembly according to claim 5, wherein said turret has an annular sidewall and a free end portion of said annular sidewall is provided with an annular retaining edge for securely connecting said pump body to said turret.

7. The finger pump assembly according to claim 5, wherein said actuator is provided with an annular sidewall which engages with said annular skirt of said closure to facilitate actuation of said actuator along a longitudinal axis of said pump assembly.

8. The finger pump assembly according to claim 5, wherein said closure is provided with an annular flange, and said turret is provided with a mating annular flange, and said annular flange of said closure and a gasket sandwich said annular flange of said turret therebetween to facilitate a sealing engagement of said finger pump assembly with a desired container.

9. The finger pump assembly according to claim 1, wherein said actuator has a central bore which communicates with said discharge orifice, and said piston has an annular housing side wall which frictionally engages with said central bore of said actuator to couple said piston to said actuator and facilitate the supply of the product to be dispensed from said piston to said discharge orifice.

10. The finger pump assembly according to claim 1, wherein an inwardly facing surface of said inner housing is provided with at least one nub to facilitate

relieving the pressure generated within the compression chamber once the poppet has been substantially completely displaced along an inwardly facing surface of said inner housing, and the relieved pressure is vented through the interior cavity and out through the ventilation port provided in the base of the pump body.

11. The finger pump assembly according to claim 5, wherein at least one groove is provided between an exterior surface of said pump body and an inwardly facing surface of said turret to allow an equalization in pressure, once the finger pump assembly is connected to a container and operated, to prevent the container attached to the finger pump assembly from becoming at least partially evacuated.

12. The finger pump assembly according to claim 1, wherein the passageway, communicating with said compression chamber, extends substantially parallel to a longitudinal axis of the pump assembly but is radially spaced from the longitudinal axis of the pump assembly.

13. The finger pump assembly according to claim 12, wherein a valve is located along said passageway communicating with said compression chamber, and said valve comprises a ball captively retained within a cage with said ball normally resting upon a ball valve seat to prevent flow of product along said passageway and, during a siphoning action of said pump assembly, said ball is displaced from said valve seat to allow the flow of product therethrough.

14. The finger pump assembly according to claim 12, wherein a dip tube is coupled the inlet of the passageway to facilitate siphoning of the product to be dispensed from a base portion of a container.

15. A finger pump assembly comprising:

a pump body comprising an outer housing and an inner housing, and said outer housing and said inner housing at least partially defining a compression chamber therebetween;

a closure supporting said pump body, and said closure having a mechanism for facilitating engagement with a spout of a container;

a piston being at least partially received within said pump body and being slidable relative to said pump body along said outer housing, said piston

having an annular lip for providing a sealing engagement with the pump body, and said piston being provided with a poppet valve seat defining a piston outlet;

an actuator being coupled to said piston outlet, and said actuator having a discharge outlet communicating with said piston outlet for facilitating dispensing of a product;

a poppet being accommodated by said inner housing, said poppet being biased by a spring into engagement with said poppet valve seat to normally close said piston outlet and prevent flow of product therethrough, and said poppet and said inner housing defining an interior cavity, and a ventilation port being formed the pump body facilitate, during operation of said poppet, communication between said interior cavity and an interior of the container so that the interior cavity operates at ambient pressure; and

a passageway communicating with said compression chamber, said passageway having an inlet and a one-way valve which allows the product to flow along said passageway toward said compression chamber.

16. The finger pump assembly according to claim 15, wherein said poppet has an annular sealing and guide surface to facilitate sliding sealing engagement of the poppet along an inwardly facing surface of said inner housing;

said poppet is provided with a poppet shoulder for engaging with said poppet valve seat which defines the piston outlet, and said poppet has an appendage which extends through said piston outlet to facilitate alignment of said poppet with said piston outlet;

an end of said poppet, received within said inner housing, supports an extension which engages with a first end of said spring to facilitate orientation of said poppet along a longitudinal axis of said finger pump assembly.

17. The finger pump assembly according to claim 15, wherein said pump body is coupled to a turret and said turret is connected to said closure, and a remote free end of said closure supports an annular skirt which extends away from a base portion of said closure;

said turret has an annular sidewall and a free end portion of said annular sidewall is provided with an annular retaining edge for securely connecting said pump body to said turret; and

said actuator is provided with an annular sidewall which engages with said annular skirt of said closure to facilitate actuation of said actuator along a longitudinal axis of said pump assembly.

18. The finger pump assembly according to claim 17, wherein said closure is provided with an annular flange, and said turret is provided with a mating annular flange, and said annular flange of said closure and a gasket sandwich said annular flange of said turret therebetween to facilitate a sealing engagement of said finger pump assembly with a desired container.

19. The finger pump assembly according to claim 15, wherein said actuator has a central bore which communicates with said discharge orifice, and said piston has an annular housing side wall which frictionally engages with said central bore of said actuator to couple said piston to said actuator and facilitate the supply of the product to be dispensed from said piston to said discharge orifice.

20. The finger pump assembly according to claim 15, wherein an inwardly facing surface of said inner housing is provided with at least one nub to facilitate relieving the pressure generated within the compression chamber once the poppet has been substantially completely displaced along an inwardly facing surface of said inner housing, and the relieved pressure is vented through the interior cavity and out through the ventilation port provided in the base of the pump body.

21. The finger pump assembly according to claim 17, wherein at least one groove is provided between an exterior surface of said pump body and an inwardly facing surface of said turret to allow an equalization in pressure, once the finger pump assembly is connected to a container and operated, to prevent the container attached to the finger pump assembly from becoming at least partially evacuated.

22. The finger pump assembly according to claim 15, wherein the passageway, communicating with said compression chamber, extends

substantially parallel to a longitudinal axis of the pump assembly but is radially spaced from the longitudinal axis of the pump assembly.

23. The finger pump assembly according to claim 22, wherein a valve is located along said passageway communicating with said compression chamber, and said valve comprises a ball captively retained within a cage with said ball normally resting upon a ball valve seat to prevent flow of product along said passageway and, during a siphoning action of said pump assembly, said ball is displaced from said valve seat to allow the flow of product therethrough.

24. The finger pump assembly according to claim 22, wherein a dip tube is coupled the inlet of the passageway to facilitate siphoning of the product to be dispensed from a base portion of a container.

25. A finger pump apparatus comprising:

a container for housing a desired product to be dispensed, said container being closed at one end and having a spout, at an opposite end to facilitate dispensing of the product to be dispensed;

a pump body comprising a base supporting an outer housing and an inner housing, and said outer housing and said inner housing at least partially defining a compression chamber therebetween;

a closure supporting said pump body, and said closure sealingly engaging with the spout of the container;

a piston being at least partially received within said pump body and being slidable relative to said pump body along said outer housing, said piston having an annular lip for providing a sealing engagement with the pump body, and said piston being provided with a poppet valve seat defining a piston outlet;

an actuator being coupled to said piston outlet, and said actuator having a discharge outlet communicating with piston outlet for facilitating dispensing of a product;

a poppet being accommodated by said inner housing, said poppet being biased by a spring into engagement with said poppet valve seat to normally close said piston outlet and prevent flow of product therethrough, and said poppet and said inner housing defining an interior cavity, and a ventilation port being

formed the pump body facilitate, during operation of said poppet, communication between said interior cavity and an interior of the container so that the interior cavity operates at ambient pressure;

a passageway communicating with said compression chamber, said passageway having an inlet and a one-way valve which allows the product to flow along said passageway toward said compression chamber; and

a dip tube coupling the inlet of the passageway to a base portion of said container to facilitate siphoning of the product to be dispensed by the pump assembly.

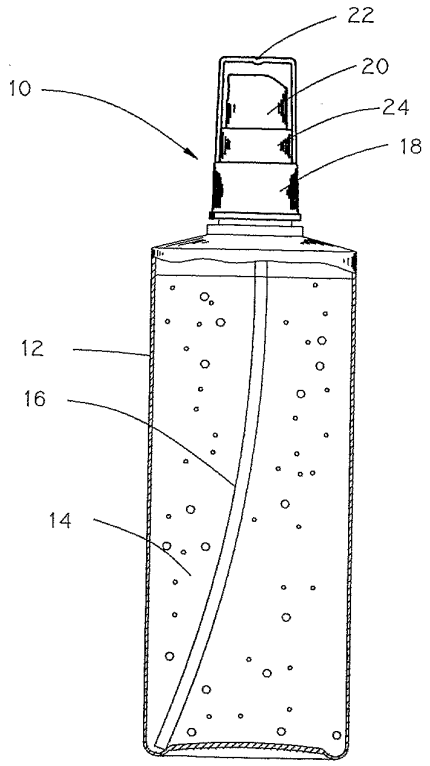

FIG. 1

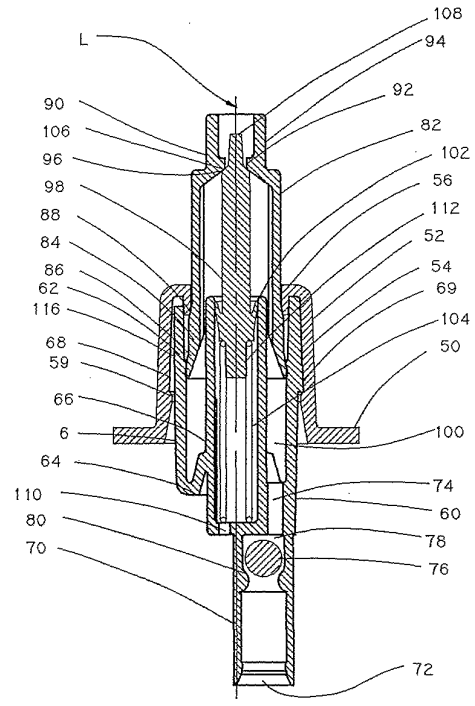
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FIG. 2

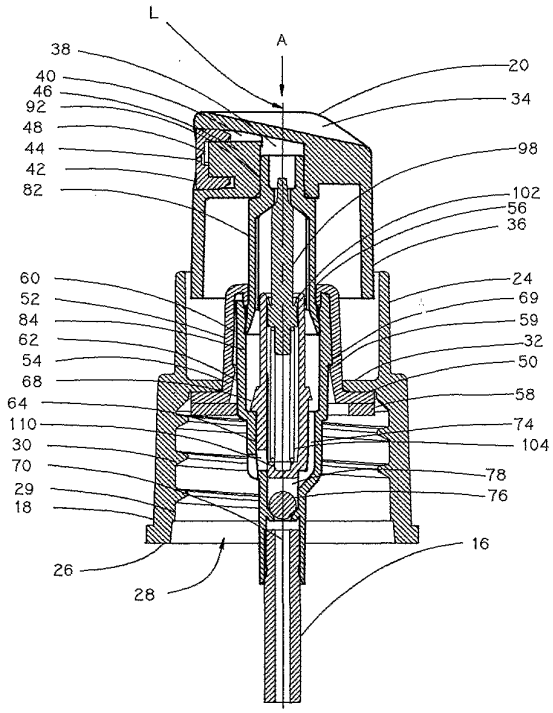
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FIG. 3

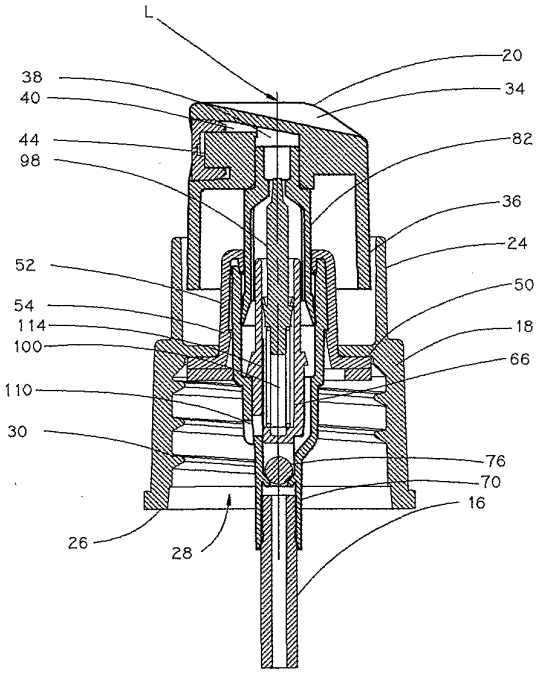
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FIG. 4

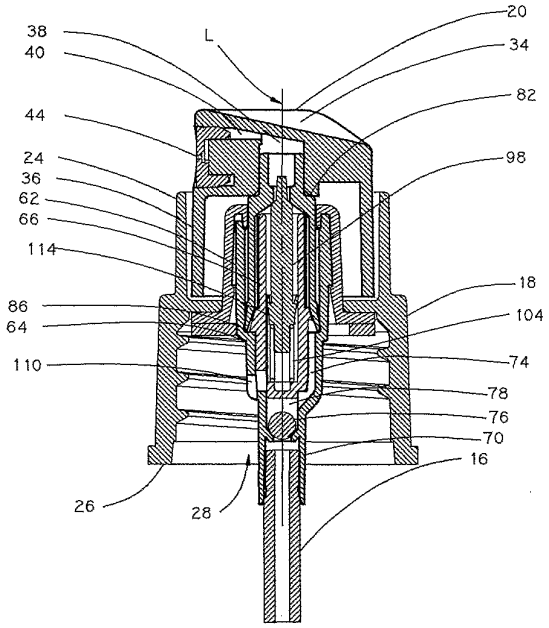
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FIG. 5

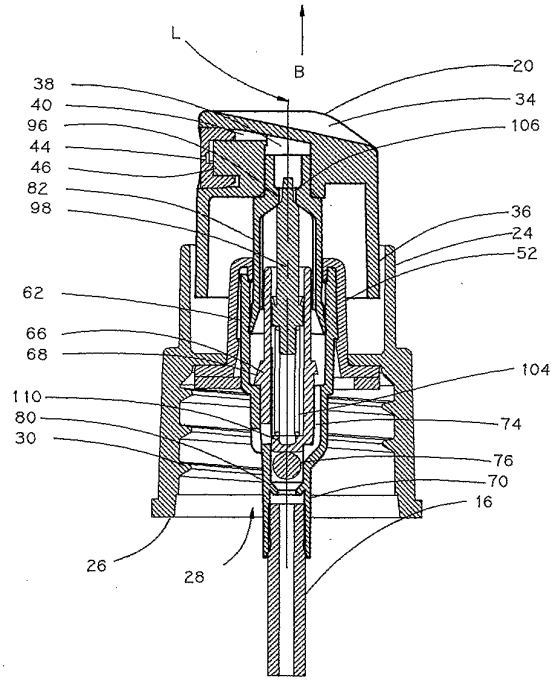
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FIG. 6

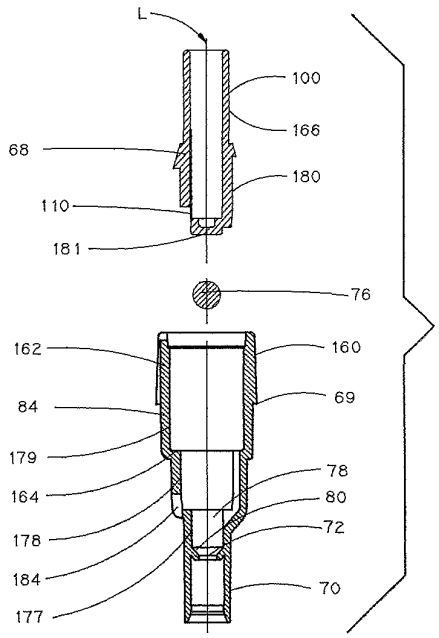
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FIG. 7

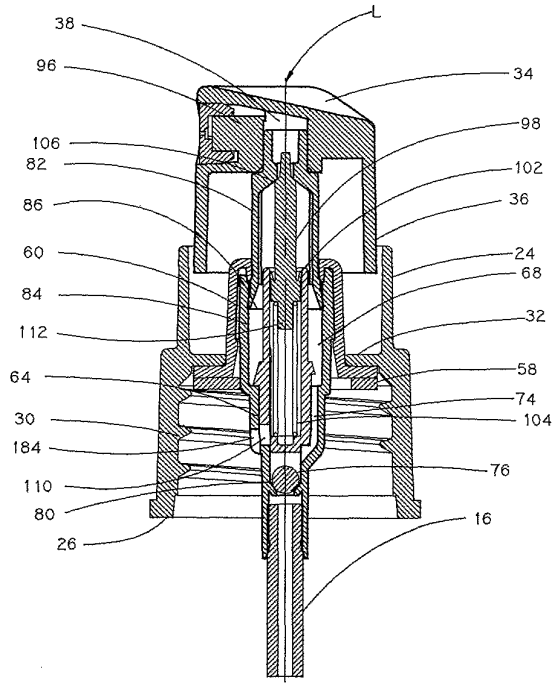
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FIG. 8

【国際公開パンフレット（コレクトバージョン）】

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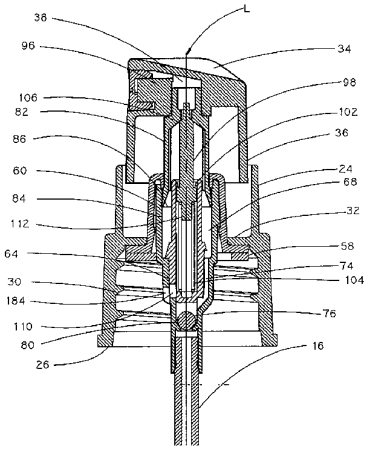
(54) Title: MANUALLY ACTUATED PUMP ASSEMBLY



(57) Abstract: A finger operated pump assembly comprising a pump body (60, 160) having a base (64, 164) supporting an outer housing (62, 162) and an inner housing (66, 166) and defining a first portion of a compression chamber (68) therebetween. A piston (82) has an annular lip and has a piston outlet defined by a poppet valve seat. A poppet (98) is accommodated by the inner housing (66, 166) and biased away from the base into engagement with the poppet valve seat by a spring (104). The poppet (98) and inner housing (66, 166) define an interior cavity (100). A peripheral passageway (74) communicates with the compression chamber (68) and includes a one-way valve (76). A ventilation port (110) is provided in the interior cavity (100) so that during operation of the poppet (98), it may operate at ambient pressure.

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IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

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MANUALLY ACTUATED PUMP ASSEMBLY

Field of the Invention

The invention relates to an improved manually operated pump assembly categorized as an accumulative pump, for dispensing a product under high pressure. The pump assembly comprises a compression chamber for pressurization of the product to be dispensed and a relief valve operating, substantially at ambient atmosphere, for controlling the release of product through a piston outlet of the pump.

Background of the Invention

A variety of prior art manually operated hand-held pump assemblies are well known and used for dispensing a variety of products such as liquids for personal care and pharmaceutical uses, fragrance products and the like. Pumps of this type comprise a housing body and a slidable piston which together define a compression chamber for receiving and dispensing of the product. The body, as well as the internal components contained within the body, are retained by a turret. An inlet in the base of the body communicates, via a dip tube, with the product to be dispensed. A conventional spray actuator communicates with an outlet of the piston to facilitate operation of the pump and provides a mechanical mechanism for dispensing the product, as desired, by an operator.

Directional flow of product to be dispensed, from the interoir of the container into the compression chamber of the body, is controlled by a first one-way valve, typically located at or adjacent to the coupling of the body inlet to the dip tube. A second one-way valve enables the product to be dispensed from the compression chamber through the piston outlet and into a supply passage of the actuator. Finally, the product is dispensed out through a discharge orifice of the actuator.

It is desirable for the pump to reach a specified pressure, prior to releasing the product to be dispensed from the compression chamber, to ensure that the product dispensed out the discharge orifice exhibits consistent and uniform spray characteristics. For example, some sprays need to consist of particles of uniform size, e.g. particles lying within a narrow particle size range, in order for proper dispensing of the product. It is also desirable to dispense a specific dosage of

product during a single actuation of the actuator. To accomplish both the desired dosage and particle size requirements, the construction and function of the pump assembly require accurately designed internal components which must be precisely controlled during operation of the pump assembly. Because the body, the piston, the spring, the valve, etc., determine the configuration and operating pressure of the compression chamber, these components are very important in controlling the function of the pump assembly.

Product dispensing requirements are increasingly more demanding. With an increase in the use of low volatile solvents, as the main carrier component for the product to be dispensed, and as well as using more viscous gel-type liquids, the design requirements for dispensing such products are more critical. In particular, the low volatile solvents and the viscous gel-type liquids require higher discharge pressures, to facilitate proper dispensing thereof, versus products that include solvents which are readily converted into vapor upon discharge. In an attempt to overcome this problem and facilitate control of the resulting spray configuration, many prior art pump assemblies use a single spring to both actuate the piston and also bias a second one-way valve. This single spring forces the piston back into its initial static position, once the actuator has actuated the piston, and holds the second one-way valve closed until a desired operating pressure is reached.

Other prior art designs use a first spring for returning the piston and a second spring for biasing the second one-way valve independently of the piston. The intended advantage of the two spring arrangement is that the second one-way valve spring can be independently adjusted to facilitate opening of the piston valve at a desired operating pressure. In either case, the second one-way valve and the spring(s) are all contained within the compression chamber of the body and are subjected to the generated operating pressure within the compression chamber. The spring(s) (or other known conventional biasing members) are typically located to bias the second one-way valve against a piston valve seat. The amount of pressure required to compress the spring, and thus move the second one-way valve away from its associated valve seat, determines the

operating pressure of the pump assembly. The construction of the spring thus determines the pressure at which the product is displaced from the body out through the discharge orifice. The spring pressure translates into a high reaction force upon the product as it is released by the second one-way valve and overcomes the spring bias.

It is to be appreciated that in order for the pump assembly to dispense liquid properly, the pump section of the assembly must be initially purged of any air contained within the compression chamber-this initial purging step is commonly referred to as "priming" of the pump. When the actuator is initially depressed by an operator, any air contained within the compression chamber of the body must be displaced in order for product to be siphoned into the compression chamber of the body via the dip tube. By depressing the actuator, the piston is moved toward a base of the body thereby compressing the spring as well as any air contained within the compression chamber. The compressed air assists with maintaining the first one-way valve in a closed position. The compressed air also induces an opening force on the second one-way valve but, in most cases, the induced force of the compressed air may never reach a high enough pressure to overcome the spring closing force of the second one-way valve. For this reason, prior art pumps use a small rib(s), or some other mechanical device located near the end of the compression stroke, to disrupt the seal between an inner part of the body and the piston and allow the compressed air to escape from the compression chamber. Two methods are used for allowing the compressed air to escape from the compression chamber. The first method is to allow the air to escape around the piston which can result in residual product drying along the escape path and seizing the piston. The second method is to allow air to escape down the dip tube which results in the air and the product to be dispensed reciprocating back and forth within the tube, which is also undesirable.

Because both the second one-way valve and the spring occupy space inside the body, these components effect the compression of the air during the priming operation of the pump, and thus effect the operation of the second one-

way valve. This also means that the product, siphoned via the dip tube into the body, is then pushed back through the system in the reverse direction as the piston reciprocates. This to and fro movement of the air and the product reduces the efficiency of the pump and increases the force needed to operate the system. In addition, the number of strokes required in order to remove the air contained within the compression chamber is increased.

Summary of the Invention

Wherefore, it is an object of the present invention to overcome the aforementioned problems and drawbacks associated with the prior art pump assembly designs.

Another object of the present invention to design a pump assembly, utilizing a smaller number of components, which is efficiently primed and operated while still ensuring a high dispensing efficiency for the pump assembly.

A further object of the invention is to provide a movable poppet which operates at ambient pressure so that the function of the poppet is essentially unaffected by the flow or circulation of the product to be dispensed within the compression chamber.

Still another object of the invention is to increase the compression efficiency of the pump assembly and also minimize the number of strokes required to "prime" the pump assembly by providing a spring which is not located along or in communication with the product dispensing flow path so that the spring is not hindered by and does not hinder or interfere with the flow of the product to be dispensed.

Yet another object of the invention is to provide a simpler, lower cost, higher quality and efficient spray pump assembly that provides the same spray characteristics for low volatile solvents, water based products, alcohol base and/or other formulas.

A still further object of the invention is provide a pump assembly having a dispensing dosage of between about 120-250 ml of product, or so, an actuation force of between about 5.5-7.5 lbs., or so, and an internal operating pressure of the compression chamber of between about 100 to 170 psi, or so.

The manually actuated pump assembly, according to the present invention, is capable of dispensing a wide range of products. The highly efficient internal volume and priming system, according to the present invention, renders the manually actuated pump assembly ideal for use with personal care products, pharmaceuticals, fragrances, etc. A majority of the structural components of the manually actuated pump, according to the present invention, are located outside of the compression chamber thereby allowing minimal clearance between the inwardly facing surfaces defining the compression chamber when those surfaces are moved into the fully actuated position. Such design of the pump assembly aids in both priming and normal operation of the pump assembly.

Priming is accomplished by venting the trapped air either out through the discharge orifice or past a seal formed between the poppet and an inner cylindrical housing, rather than down the dip tube or around the compression piston. The prior art dispensing systems, that prime through the dip tube, experience difficulties when dispensing gels or high water content products or when utilizing a long length dip tube. As note above, the pump assemblies that prime around the compression piston have a tendency to become clogged or seized due to drying of the product residue.

During normal operation, according to the present invention, the pump assembly has a high operating pressure due to the ratio of the compression chamber diameter to the piston stroke length. With an operation pressure of approximately 130 psi or so, the manually actuated pump according to the present invention operates about 30% higher than conventional pumps currently available on the market today. Another advantage of the high compression design, of the present invention, is the uniform spray consistently achieved during each dispensing stroke. In addition, less variation in the internal volume results by locating the spring and valving components external of the compression chamber. Lastly, the improved profile of the components provides substantially unrestricted flow of the product from the compression chamber to the discharge orifice.

Finally, the present invention relates to a finger pump apparatus comprising a container for housing a desired product to be dispensed, said container being

closed at one end and having a spout to facilitate dispensing of the product to be dispensed; a pump body having a base supporting an outer housing and an inner housing, and said outer housing and said inner housing at least partially defining a compression chamber therebetween; a closure supporting said pump body, and said closure sealingly engaging with the spout of the container; a piston being at least partially received within said pump body and being slidable relative to said pump body along said outer housing, said piston having an annular lip for providing a sealing engagement with the pump body, and said piston being provided with a poppet valve seat defining a piston outlet; an actuator being coupled to said piston outlet, and said actuator having a discharge outlet communicating with piston outlet for facilitating dispensing of a product; a poppet being accommodated by said inner housing, said poppet being biased away from said base of said pump body by a spring into engagement with said poppet valve seat to normally close said piston outlet and prevent flow of product therethrough, and said poppet, said base and said inner housing defining an interior cavity, and said interior cavity being provided with a ventilation port which allows said interior cavity, during operation of said poppet, to communicate with an interior of the container so that the interior cavity operates at ambient pressure; a passageway communicating with said compression chamber, said passageway including an inlet with a one-way valve which allows the product to flow along said passageway toward said compression chamber; and a dip tube coupling the inlet of the passageway to a base portion of said container to facilitate pumping of the product to be dispensed by the pump assembly.

Brief Description of the Drawings

Fig. 1 is a diagrammatic front perspective view of a container supporting the improved pump assembly according to the present invention;

Fig. 2 is a diagrammatic cross-sectional view of a first embodiment of the improved pump assembly, according to the present invention, shown in a static position without an overcap, an actuator, a closure, a liner, or a dip tube affixed thereto;

Fig. 3 is a diagrammatic cross-sectional view of the first embodiment of the improved pump assembly, according to the present invention, shown in the static position with an actuator, a closure, a liner and a dip tube attached thereto;

Fig. 4 is a diagrammatic cross-sectional view, of the first embodiment of the improved pump assembly of Fig. 3, shown in a partially depressed position in which the poppet has been sufficiently displaced from the poppet annular seat to commence dispensing of product;

Fig. 5 is a diagrammatic cross-sectional view of the first embodiment of the improved pump assembly of Fig. 3 showing the fully depressed position of the pump assembly;

Fig. 6 is a diagrammatic cross-sectional view, of the first embodiment of the improved pump assembly of Fig. 3, shown in its partially returned position in which the poppet is biased against the poppet annular seat to facilitate suction of the product into the compression chamber during the return stroke of the improved pump assembly;

Fig. 7 is a diagrammatic cross-sectional exploded view of a second embodiment of the pump body for the improved pump assembly, according to the present invention; and

Fig. 8 is a diagrammatic cross-sectional view of the second embodiment of the improved pump assembly, according to the present invention, shown in the static position with an actuator, a closure, a liner and a dip tube attached thereto.

Description of the Preferred Embodiment

While this invention is susceptible to various embodiments, the specification and the accompanying drawings disclose two specific forms as examples of the present invention. For ease of description, the pump assembly embodying this invention is described in the normal operating position, in terms such as: upper, lower, horizontal, etc., are used with reference to this position. It will be understood, however, that the pumps and components embodying this invention may be manufactured, stored, transported, used, and sold in an orientation other than the position described.

Turning first to Fig. 1, a brief description concerning the improved pump assembly 10, according to the present invention, used in combination with a prior art container 12 will now be provided. As can be seen in this Figure, the container 12 is a generally closed plastic container which has a spout (not shown in detail) formed on the top surface of the container. The spout is provided with an external thread (not shown) and has an aperture or opening formed therein to provide communication with an interior of the container 12. The container 12 accommodates a desired quantity of liquid, fluid or some other product to be dispensed 14. The product to be dispensed 14 is typically supplied from an interior space or area of the container 12, via a dip tube 16, to an inlet of the pump assembly 10. As is well known in the art, the bottom end of the dip tube 16 is normally submerged in the liquid or product when the container is in a generally in an upright orientation, as illustrated in Fig. 1. A further detailed description concerning the function of the dip tube 16 will be provided below.

The pump assembly 10 is provided with removable cap or closure 18 which accommodates a depressible actuator 20 that is movable relative to the closure 18 to facilitate actuation of the pump assembly 10, and a further detailed description concerning the purpose of such depression will follow below. If desired, a removable hood or overcap 22, can encase or enclose the actuator 20 to prevent inadvertent actuation thereof. The overcap 22 is hollow shell member and typically has a perimeter edge that has a friction fit with a hollow annular skirt 24 extending from a top surface of the closure 18. As such overcap feature in conventional and well known in the art, a further detailed description concerning the same is not provided.

With reference now to Figs. 2-6, a detailed description concerning a first embodiment of the improved pump assembly 10, according to the present invention, will now be provided. As can be seen in Figs. 3-6, for example, the base portion of the closure 18 is provided with an annular base flange 26 which is located to abut against a mating flange surface (not shown in detail) of the container 12. In addition, the closure 18 is provided with a central through bore 28 extending through the closure 18 along a longitudinal axis L of the

improved pump assembly 10. An inwardly facing surface 29 of the base of the closure 18 is provided with an internal thread 30 (or some other conventional retaining recess, lip or mechanism) for engagement with a mating external thread (or some other mating conventional retaining recess, lip or mechanism) provided on the spout of the container 12. The closure 18 is also provided with a substantially centrally located, radially inwardly extending horizontal closure annular flange 32 which separates a base portion of the closure 18 from the annular skirt 24. The closure annular flange 32 facilitates retention of the various components of the improved pump assembly 10 as will be discussed below in further detail.

A top surface of the actuator 20 is provided with a finger recess 34 which is preferably shaped or contoured to facilitate engagement with an index finger of an operator. As such shaping or contouring feature is well known in the art, a further description concerning the same is not provided. The actuator 20 is further provided with a downwardly extending annular side wall 36 which has a diameter that is slightly less than an inside diameter of the annular skirt 24 of the closure 18 to allow the annular side wall 36 of the actuator 20 to move relative to the annular skirt 24, e.g. to move in and out of the space encompassed by the annular skirt 24 of the closure 18 without excess friction or contact occurring between those two components. According to a preferred embodiment of the invention, there is a relative sliding motion between an outwardly facing surface of the annular side wall 36 and an inwardly facing surface of the annular skirt 24 to facilitate guiding the actuator 20 as it is actuated or depressed toward the closure 18. Such sliding motion facilitates maintaining the actuator 20 in its correct upright dispensing orientation.

An internal longitudinal central bore 38 is formed within the interior of the actuator 20 and the central bore 38, in turn, communicates with a transverse radial bore 40. The transverse radial bore 40 terminates at an opening formed in an exterior surface of the actuator which is sealed or closed by insert member 42. The insert member 42 has a discharged orifice 44 formed therein. The discharged orifice 44 facilitates dispensing of the product to the dispensed 14 out

of the actuator into the external environment. The insert member 42 is received within the transverse radial bore 40 and an outer periphery of the insert member 42 has a friction fit with an inner wall defining the transverse radial bore 40 to permanently retain the insert member 42 therein. An inwardly facing surface, located on the base of the insert member 42, engages with an outwardly facing planar end surface of a central post 46 accommodated within the radial bore 40. The end surface of the post 46 has a plurality of conventional radially inwardly directed channels 48 which lead to a conventional mixing chamber (not separately numbered) centrally formed on the end surface of the post 46. It will be apparent to one skilled in the art that the plurality of radially inwardly directed channels 48 and the mixing chamber may also be located on and supported by the inwardly facing base surface of the insert member 42, instead of the post 46, for engagement with a substantially flat end surface of the post 46. The mixing chamber directly communicates with the discharge orifice 44 for dispensing the throughly mixed and/or swirled product to be dispensed 14 out through the discharge orifice 44. As this dispensing arrangement is conventional and well known in the art, a further detailed description concerning the same is not provided.

The closure annular flange 32 of the closure 18 mates with an annular flange 50 of a turret 52 (see Fig. 3 for example) and also supports a gasket or liner 58. The gasket or liner 58 is provided with a central aperture and is employed for biasing the annular flange 50 of the turret 52 against the closure annular flange 32 of the closure 18, when the closure 18 is secured to the container 12. The closure annular flange 32 of the closure 18 and the gasket or liner 58 sandwich the annular flange 50 of the turret 52 therebetween as the closure 18 is secured to the spout of the container. Such sandwiching arrangement is conventional and well known in the art.

An annular side wall 54 of the turret 52 extends through a central aperture, provided in the closure annular flange 32, and the annular side wall 54 extends substantially parallel to the annular skirt 24 of the closure 18 and is spaced therefrom a sufficient distance to allow the annular side wall 36 of the actuator 20

to be readily received therebetween without an undue interference from the side wall 54 during operation of the actuator 20. A top free end portion of the turret 52 is provided with an annular retaining edge 56 which first extends radially inwardly and then extends downwardly a short distance, along the longitudinal axis L, toward the base of the closure 18. A further detailed description concerning the purpose of the retaining edge 56 will be provided below. An annular lip 59 (see Fig. 2) is provided on an inwardly facing surface of the annular side wall 54 of the turret 52 to facilitate retention of a pump body 60 and a further description concerning the purpose of the same will follow.

The pump body 60, as can be seen in further detail with reference to Fig. 2, comprises an outer cylindrical housing 62 which is connected to a base 64 of the pump body 60 to form a single unitary component or structure. An inner cylindrical housing 66 is integrally connected to the base 64, of the pump body 60, and the inner cylindrical housing 66 is located concentric with the outer cylindrical housing 62 but spaced therefrom. A exterior surface of the pump body 60 supports an annular nub 69 which is located to engage with the annular lip 59 of the turret 52 and secure the pump body 60 to the turret 52. A lower portion of the pump body 60 is provided with a cylindrical extension 70 having an inlet aperture 72 formed in a base end surface thereof. A first end of the dip tube 16 is frictionally received and retained within the inlet aperture 72, as is conventionally done in this art.

The inlet aperture 72 communicates with a first portion of a compression chamber 68, formed between an exterior surface of the inner cylindrical housing 66 and an inwardly facing surface of the outer cylindrical housing 62, via a longitudinal passageway 74. The longitudinal passageway 74 extends parallel to but is spaced radially from the longitudinal axis L of the pump assembly. A one way valve is located along the longitudinal passageway 74 and the one-way valve comprises a metal ball 76 that is captively retained within a cage 78. The cage 78 allows limited to and fro movement of the ball 76 to facilitate opening and closing of the one-way valve. This one-way valve allows the product to flow along the longitudinal passageway 74 when the ball 76 is spaced from an annular ball

seat 80 (see Fig. 6). The ball 76 normally rests, as can be seen in Figs. 3-5, against the annular ball seat 80 to shut off product flow through the longitudinal passageway 74. Prior to inserting the dip tube 16 within the inlet aperture 72, the metal ball 76 is forced into the inlet aperture 72, and urged past the annular ball seat 80 into the cage 78 where the ball 76 is thereafter permanently retained and utilized to operate the one-way valve.

It is to be appreciated that the ball 76 is normally held by gravity in a sealing position over the opening defined by the annular ball seat 80 so as to prevent the compressed liquid from being forced back down into the dip tube 16. During actuation of the actuator, i.e. either during priming of the pump or dispensing of product, the generated pressure within the compression chamber additional serves to hold the ball 76 in its sealing engagement against the annular ball seat 80. A further detailed description concerning the purposed of the same will follow below.

A piston 82 is at least partially accommodated within the body 60 and the piston 82 is slidably movable relative to the body 60. A first lower end 84 of the piston 82 is provided with an annular sealing lip 86, having an outer circumference slightly larger than the inner dimension of the outer housing 62 to provide a tight sealing engagement between the annular sealing lip 86 and the inner surface of the outer housing 62. During operation of the piston 82, as will be described below in further detail, the pressure generated within the compression chamber 86 assists with forcing the annular sealing lip 86 of the piston 82 into sealing engagement with the inwardly facing surface of the outer cylindrical housing 62. An exterior surface of the piston 82, adjacent the annular sealing lip 86, is provided with an annular shoulder 88 which abuts against the annular retaining edge 56 of the turret 52 to captively retain at least the first lower end 84 of the piston 82 within the pump body 60.

The piston 82 is a generally hollow member which has an exterior side wall that may taper slightly from the first lower end 84 to a second remote end 90. A piston outlet 92 is formed adjacent the second remote end 90 of the piston 82. The second remote end 90 of the piston 82, located adjacent the piston outlet 92,

is provided with a reduced diameter annular cylindrical side wall 94 which is sized to be frictionally received within the central bore 38 of the actuator 20 and provide a secure retaining engagement between the second remote end 90 of the piston 82 and the actuator 20. An annular surface of the piston 82, defining the piston outlet 92, forms the poppet valve seat 96. The piston outlet 92 is normally closed by a shoulder 106 of an elongate generally cylindrical poppet 98 which is biased against the poppet valve seat 96 via a spring 104. When the cylindrical poppet 98 becomes spaced from the poppet valve seat 96, during actuation of the pump assembly, the piston outlet 92 is opened and allows the product to be dispensed 14 to flow from the compression chamber 68 to the central bore 38 of the actuator 20, and a further detailed description concerning the same will be provided below.

As stated above, a first portion of the compression chamber 68 is formed between the inner cylindrical housing 66 and the outer cylindrical housing 62. A remaining second portion of the compression chamber 68 is formed between an inwardly facing surface of the piston 82 and an exterior surface of the poppet 98. The hollow interior dimension of the piston 82 is slightly larger than the outer diameter of the inner cylindrical housing 66 and either the piston 82 and/or the inner cylindrical housing 66 may have a channel(s) formed thereon so that the first portion of the compression chamber 68 is in constant communication with the remainder of the compression chamber 68 regardless of the position of the piston 82 relative to the inner cylindrical housing 66.

The cylindrical poppet 98 is accommodated within a central cavity 100 defined by the inner cylindrical housing 66. The poppet 98 is a solid elongate generally cylindrical member which supports an annular sealing and guide surface 102 adjacent a first lower end thereof. The annular sealing and guide surface 102 is sized to have an slight interference sliding fit with the inwardly facing surface of the inner cylindrical housing 66. The annular sealing and guide surface 102 slides along the inwardly facing surface of the inner cylindrical housing 66, in a sealed manner during operation of the pump assembly, and maintains the poppet 98 aligned with respect to the longitudinal axis L of the pump

assembly 10. The poppet 98 is biased into a normally closed position, via a spring 104 accommodated within a centrally located interior cavity 100, so that the shoulder 106 of the poppet 98 abuts against the poppet valve seat 96, formed on the piston 82, to shut off flow through the piston outlet 92. As can be seen in Fig. 2, for example, the poppet 98 has a tapered or smaller constant diameter appendage 108 that extends through the piston outlet 92 and facilitates maintaining proper alignment of the poppet 98 with respect to the outlet 92 during operation of the pump assembly.

A base of the centrally located interior cavity 100, accommodating the spring 104, is provided with a ventilation port 110 which provides communication between the centrally located interior cavity 100 and an interior space of the container 12 to ventilate the interior cavity so that the centrally located interior 100 is at ambient pressure. The ventilation port 110 prevents the creation of either excess pressure or vacuum in the centrally located interior 100 during operation of the pump assembly 10. A lower most portion of the poppet 98, opposite the appendage 108, is provided with a cylindrical extension 112 which receives one end of the spring 104 and further facilitates proper alignment and engagement between the poppet 98 and the spring 104.

In a preferred form of the invention, a lower inwardly facing surface of the inner cylindrical housing 66 is provided with at least one nub or some other protrusion 114 so that when the annular sealing guiding surface 102 of the poppet 98 engages with the nub or other protrusion 114, the remaining pressure in the compression chamber 68 is relieved and flows downward through the centrally located interior cavity 100 and out through the ventilation port 110, provided in the base 64, into the interior space of the container 12. It is to be appreciated that the nub or other protrusion 114 is formed on an inwardly facing surface of the inner cylindrical housing 66 at a location near the end of the stroke of the poppet 98, e.g. after the poppet has moved about 95% to 98% of is normal operating stroke within the inner cylindrical housing 66, so as not to compromise significantly the pumping efficiency of the compression chamber 68.

The use of the protrusion or nub 114 is very useful in "priming" the air normally contained within the compression chamber 68 of the pump assembly following the manufacturing process. Since air is a compressible fluid, the compressed air typically may not generate, even after the full compression stroke of the actuator 20, a sufficient pressure to bias the poppet shoulder 106 away from the poppet valve seat 96 and thereby allow discharge of the compressed air out of the compression chamber 68 into the central bore 38 of the actuator 20. According to the present invention, if the actuator 20 is substantially completely depressed and the poppet shoulder 106 still has not been biased away from the poppet valve seat 96 to thereby open the piston outlet 92, the air is immediately released by the breach in the seal formed between the annular sealing and guide surface 102 and the inwardly facing surface of the inner cylindrical housing 66, once the annular sealing and guide surface 102 engages with the nub or the protrusion 114. This released air is conveyed through the central cavity 100 and out the ventilation port 110. On the return stroke of the actuator 20, however, as soon as the annular sealing and guide surface 102 clears the nub or the protrusion 114 and again establishes a seal with the inner cylindrical housing 66, a siphoning action is created within the compression chamber 68 and a quantity of the product to be dispensed 14 is siphoned, via the dip tube 16 and passageway 74, toward the compression chamber 68. This siphoned product will eventually flow into the compression chamber 68 where the product, which is generally an incompressible fluid, will actuate the poppet 98 in its intended dispensing manner after a sufficient number, e.g. four (4), of priming strokes.

It is to be appreciated that if replacement air is not allowed to enter inside the container 12 and replace the volume of dispensed product 14, during normal operation of the pump, the container 12 will progressively become evacuated and eventually deform inwardly and/or collapse once a substantial portion of the product to be dispensed is sprayed. To alleviate this problem, at least one groove 116 is provided along either an exterior surface of the body 60 or an inwardly facing surface of the turret 52. This groove 116 is normally sealed off from the external environment by the piston shoulder 88 engaging with the annular

retaining edge 56 to provide a seal therebetween. Once the piston 82 is sufficiently depressed, the exterior surface of the piston 82 is slightly spaced from the annular retaining edge 56 to allow ambient air to flow along the exterior surface of the piston 82 and around the retaining edge 56 and down along the groove 116, located between the exterior surface of the body 60 and the inwardly facing surface of the turret 52, to replace the volume of the product which was just dispensed by the actuator 20. This ventilation groove 116 also maintains the pressure inside the container at substantially the same pressure as the external surrounding environment.

Now that a detailed description concerning the basic components of the pump assembly, according to the present invention, were provided, a detailed description concerning actuation of the pump assembly will now be described.

Initially the pump assembly 10 is first installed on a spout of a desired container 12, containing a product to be dispensed 14, by engaging the threads 30 of the closure 18 with a mating thread, or some other conventional retaining mechanism, provided on an exterior surface of the spout of the container 12. Once this has occurred, the dip tube 16 of the pump assembly is submerged within the product to be dispensed 14 such that an inlet of the dip tube is located adjacent a base of the container 12. The pump assembly 10 is now ready for actuation.

When actuation is desired, the operator places his or her index finger on the finger recess 34 and depresses the actuator 20, in the direction of arrow A of Fig. 3, so as to bias the actuator 20 downwardly along the longitudinal axis L toward the closure 18. Such depression of the actuator 20, in turn, causes a depression of the piston 82 which results in the annular sealing lip 86 sliding along the inwardly facing surface of the outer cylindrical housing 62 in an sealed manner toward the base 64 of the body 60. This action causes the product to be dispensed 14, contained within the compression chamber 68, to come under pressure, i.e. it is to be noted that a liquid is generally incompressible. As the pressure of the product to be dispensed increases, this increase in pressure serves to bias the ball 76 against the annular ball seat 80 and thereby prevent the

escape of any product downwardly back along the dip tube 16. As noted above, the inwardly facing surface of the piston 82 is spaced a sufficient distance away from the outwardly facing surface of the inner cylindrical housing 66 to allow the product to be dispensed 14 to continuously flow therebetween regardless of the position of the piston 82. Once the pressure within the compression chamber 68 increases to a sufficient pressure, e.g. an operating pressure of about 130 psi, the generated pressure of the product to be dispensed 14 overcomes the biasing force of the spring 104 and forces the poppet 98 downwardly toward the base 64 of the interior cavity 100 against the action of the spring 104. This movement results in a compression of the spring 104 which allows the poppet shoulder 106 to separate away from the poppet valve seat 96 and thereby establishes a product flow path through the piston outlet 92, as can be seen in Fig. 4.

Once the poppet shoulder 106 is sufficiently spaced from the poppet valve seat 96, the product to be dispensed 14 rushes through the piston outlet 92 and flows upwardly through the central bore 38, the radially bore 40, the inwardly directed channels 48 and is dispensed out through the discharge orifice 44 in a manner which generates a substantially uniform discharge spray configuration from the actuator 20. The piston 82 continues to force the product to be dispensed 14 out through the actuator 20, during further downward motion of the actuator in the direction of arrow A, until the annular lip 86 of the piston 82 abuts against the base 64 of the body 60, as seen in Fig. 5. Once the pump assembly is in its fully depressed position, an inwardly facing surface of the base 64 of pump body 60 is contoured to closely accommodate and substantially mirror the inwardly facing surface or profile of the annular sealing lip 86 of the piston 82 and thereby minimize the amount of the product to be dispensed 14 still remaining in the compression chamber 68, e.g. the volume of the compression chamber is minimized by this arrangement. As is apparent from Fig. 5, the volume of the compression chamber 68 has been significantly reduced so that a substantial portion of the product to be dispensed 14, that was previously stored within the compression chamber 68, has been dispensed by the actuation stroke of the actuator 20.

It is to be appreciated when the annular sealing and guide surface 102, seen in Fig. 5, engages with the nub or the protrusion 114, formed near a lower portion of the inner cylindrical housing 66, the seal therebetween is breached and most of the remaining product to be dispensed, or air during initial priming of the pump assembly, is conveyed through the interior cavity 100 and out the ventilation port 110 to quickly relieve the generated pressure of the compression chamber 68.

Once the actuation stroke is completed, the finger actuation pressure of the operator is relieved, e.g. the finger of the operator is removed from the finger recess 34. Thereafter, the spring 104 immediately biases the poppet 98, in the direction of arrow B of Fig. 6, toward and against the poppet valve seat 96 of the piston 82 to quickly close the piston outlet 92 and thereby prevent the further flow of the product to be dispensed 14 therethrough. The spring 104 also biases, due to biasing of the poppet 98 in the direction of arrow B, the piston 82 and the actuator 20 in an upward direction away from the closure 18. During this return stroke of the pump assembly 10, additional product to be dispensed 14 is siphoned into the inlet formed in the second end of the dip tube 16. The siphoned product to be dispensed 14 flows along the dip tube 16 and moves or displaces the ball 76 away from the ball seat 80 to allow passage of the product to be dispensed 14 therepast along the longitudinal passageway 74.

It is to be appreciated that the cage 78 captively retains the ball 76, e.g. opens this one-way valve but retains the ball 76 so that the ball 76 may fall, due to the effects of gravity, back on the ball valve seat 80 following completion of the pump assembly return stroke to close this one-way valve. The product to be dispensed 14 continues to flow along longitudinal passageway 74 into the compression chamber 68 where the product to be dispensed 14 is accumulated and stored, as can be seen in Fig. 3. Once the spring 104 has biased the poppet 98, in the direction of arrow B, a sufficient distance such that the shoulder 88 of the piston 82 abuts against the annular retaining edge 56, the ball 76 is again allowed to settle on ball valve seat 80 to thereby prevent further flow and allow

pressurization of the compression chamber 68 when the actuator 20 is again depressed.

With reference to Figs. 7 and 8, a second embodiment of the present invention will now be discussed. As this second embodiment is very similar to the first embodiment in many aspects, only the differences between the second and the first embodiments will be discussed in detail. In fact, the closure 18, the actuator 20, the ball 76, the piston 82, the poppet 98 and the spring 104 are identical in both embodiments and thus a further detail discussion concerning the same in not generally provided.

The major difference between the two embodiments can be readily seen in Fig. 7. A first difference is that the pump body 60 is formed as two separate components, i.e. the first component comprises the outer cylindrical housing 162 integral formed with the base 164 of the pump body 160 to form a unitary component or structure while the inner cylindrical housing 166 is a completely separate component. The interior of the pump body 160 has three distinct sections each having a different diameter, i.e. a first smaller diameter section 177 located adjacent a base of the pump body 160, a third larger diameter section 179 located adjacent an open end of the pump body 160, and a second intermediate diameter section 178 located between the smaller diameter section 177 and the larger diameter section 179. A lower cylindrical portion 180 of the inner cylindrical housing 166 is sized to have an interference fit, e.g. a few thousands of an inch or so, with the second intermediate section 178 of the pump body 160 so that the inner cylindrical housing 166 can be located concentric with respect to the outer cylindrical housing 162 and be captively retained thereby once engaged with the pump body 160.

A second difference is that a lower side wall section of the pump body 160 is provided with an aperture 184 and this aperture 184 is located to coincide with the ventilation port 110 formed in a side wall of the inner cylindrical housing 166, once the inner cylindrical housing 166 is received within the internal diameter of the base 164 of the pump body 160. As with the first embodiment, the ventilation port 110 provides communication between the centrally located interior cavity 100

and an interior space of the container 12 to ventilate the interior cavity so that the centrally located interior 100 is at ambient pressure and prevents the creation of either excess pressure or vacuum in the centrally located interior 100 during operation of the pump assembly 10.

A third difference relates to the retention of the metal ball 76. According to this embodiment, during assembly, the metal ball 76 is first placed within the pump body 160 and received by the first smaller diameter bore 177, prior to placing the inner cylindrical housing 166 within the internal diameter of the base 164 of the pump body 160. Thereafter, once the inner cylindrical housing 166 is received within the internal diameter of the base 164 of the pump body 160, a base 181 of inner cylindrical housing 166 functions as a stop to prevent the metal ball 76 from being dislodged from the first smaller diameter bore 177 thereby eliminating the need for the cage 78, as with the previous embodiment.

A fourth difference relates to the arrangement of the centrally located interior cavity 100 with respect to the inlet aperture 72 and the first smaller diameter bore 177. In the first embodiment, the centrally located interior cavity 100 has a longitudinal axis which coincides with the longitudinal axis L of the pump assembly while the inlet aperture 72 and the bore accommodating the metal ball 76 each have a longitudinal axis which extends parallel to by is offset with respect to the longitudinal axis L of the pump assembly. According to the second embodiment, the centrally located interior cavity 100 as well as both the inlet aperture 72 and the first smaller diameter bore 177 are all have longitudinal axes which coincide with the longitudinal axis L of the pump assembly.

An exterior surface of the pump body 160 supports an annular nub 69 which is located to engage with the annular lip 59 of the turret 52 and secure the pump body 160 to the turret 52. A lower portion of the pump body 160 is provided with a cylindrical extension 70 having an inlet aperture 72 formed in a base end surface thereof. A first end of the dip tube 16 is frictionally received and retained within the inlet aperture 72, as is conventionally done in this art.

The inlet aperture 72 communicates with a first portion of a compression chamber 68, formed between an exterior surface of the inner cylindrical housing 166 and an inwardly facing surface of the outer cylindrical housing 162, via a longitudinal passageway 74. The longitudinal passageway 74 extends parallel to but is spaced radially from the longitudinal axis L of the pump assembly. The metal ball 76 moves to and fro within the first smaller diameter section of the pump body 160 and forms a one way valve. This one-way valve allows the product to flow along the longitudinal passageway 74 when the ball 76 is spaced from an annular ball seat 80. As with the pervious embodiment, the ball 76 normally rests against the annular ball seat 80 to shut off product flow through the longitudinal passageway 74.

A piston 82 is at least partially accommodated within the pump body 160 and the piston 82 is slidably movable relative to the pump body 160. A first lower end 84 of the piston 82 is provided with an annular sealing lip 86, having an outer circumference slightly larger than the inner dimension of the outer housing 62 to provide a tight sealing engagement between the annular sealing lip 86 and the inner surface of the outer housing 162. During operation of the piston 82, the pressure generated within the compression chamber 86 assists with forcing the annular sealing lip 86 of the piston 82 into sealing engagement with the inwardly facing surface of the outer cylindrical housing 162. An exterior surface of the piston 82, adjacent the annular sealing lip 86, is provided with an annular shoulder 88 which abuts against the annular retaining edge 56 of the turret 52 to captively retain at least the first lower end 84 of the piston 82 within the pump body 160.

As with the first embodiment, a first portion of the compression chamber 68 is formed between the inner cylindrical housing 166 and the outer cylindrical housing 162. A remaining second portion of the compression chamber 68 is formed between an inwardly facing surface of the piston 82 and an exterior surface of the poppet 98. The hollow interior dimension of the piston 82 is slightly larger than the outer diameter of the inner cylindrical housing 166 and either the piston 82 and/or the inner cylindrical housing 166 may have a channel(s) formed

thereon so that the first portion of the compression chamber 68 is in constant communication with the remainder of the compression chamber 68 regardless of the position of the piston 82 relative to the inner cylindrical housing 166.

The cylindrical poppet 98 is accommodated within a centrally located internal cavity 100 defined by the inner cylindrical housing 166. The poppet 98 is a solid elongate generally cylindrical member which supports an annular sealing and guide surface 102 adjacent a first lower end thereof. The annular sealing and guide surface 102 is sized to have an slight interference sliding fit with the inwardly facing surface of the inner cylindrical housing 166. The annular sealing and guide surface 102 slides along the inwardly facing surface of the inner cylindrical housing 166, in a sealed manner during operation of the pump assembly, and maintains the poppet 98 aligned with respect to the longitudinal axis L of the pump assembly 10. The poppet 98 is biased into a normally closed position, via a spring 104 accommodated within the centrally located interior cavity 100, so that the shoulder 106 of the poppet 98 abuts against the poppet valve seat 96, formed on the piston 82, to shut off flow through the piston outlet 92.

In a preferred form of the invention, a lower inwardly facing surface of the inner cylindrical housing 166 is provided with at least one nub or some other protrusion 114 so that when the annular sealing guiding surface 102 of the poppet 98 engages with the nub or some other protrusion, the remaining pressure in the compression chamber 68 is relieved and flows downward through the centrally located interior cavity 100 and out through the ventilation port 110 and aperture 184, provided in the base 164, into the interior space of the container 12.

According to a preferred form of the invention, the compression chamber which has a maximum transverse dimension or diameter of between 0.225 and 0.275 inches, and more preferably a diameter of about 0.250 inches and the piston has a stroke length of between 0.275 and about 0.325 inches, and more preferably a piston stroke length of about 0.300 inches. This results in a compression chamber diameter to piston stroke ratio of between about 4 to 5 and about 2 to 3 which facilitates achievement of an operating pressure of approximately 130 psi or so.

According to the design of the present invention, if, during depression of the actuator 20 toward the closure 18, the finger actuation pressure discontinues for any reason, once flow has been established through the piston outlet 92, the spring 104 will immediately bias the poppet 98 in the direction of arrow B of the Fig. 6, toward and against the poppet valve seat 96. This biasing action quickly closes the piston outlet 92 and thereby prevents the further flow of product to be dispensed 14 therethrough.

According to the present invention, passageway 74 leading to the compression chamber 68 extends along a second longitudinal axis LP which is off set with respect to the longitudinal axis L of the pump assembly but extends substantially parallel thereto. This arrangement facilitates venting of the base 64 of the central cavity 100 to the interior space of the container 12 so that the central cavity 100 operates at ambient pressure or to some other pressure other than the operating pressure of the compression chamber.

Since certain changes may be made in the above described finger operated pump assembly, without departing from the spirit and scope of the invention herein involved, it is intended that all of the subject matter of the above description or shown in the accompanying drawings shall be interpreted merely as examples illustrating the inventive concept herein and shall not be construed as limiting the invention.

I Claim:

1. A finger pump assembly comprising:

a pump body having a base supporting an outer housing and an inner housing, and said outer housing and said inner housing at least partially defining a compression chamber therebetween;

a closure supporting said pump body, and said closure having a mechanism for facilitating engagement with a spout of a container;

a piston being at least partially received within said pump body and being slidable relative to said pump body along said outer housing, said piston having an annular lip for providing a sealing engagement with the pump body, and said piston being provided with a poppet valve seat defining a piston outlet;

an actuator being coupled to said piston outlet, and said actuator having a discharge outlet communicating with said piston outlet for facilitating dispensing of a product;

a poppet being accommodated by said inner housing, said poppet being biased away from said base of said pump body by a spring into engagement with said poppet valve seat to normally close said piston outlet and prevent flow of product therethrough, and said poppet, said base and said inner housing defining an interior cavity, and said interior cavity being provided with a ventilation port which allows said interior cavity, during operation of said poppet, to operate at ambient pressure; and

a passageway communicating with said compression chamber, said passageway having an inlet and a one-way valve which allows the product to flow along said passageway toward said compression chamber.

2. The finger pump assembly according to claim 1, wherein said poppet has an annular sealing and guide surface to facilitate sliding sealing engagement of the poppet along an inwardly facing surface of said inner housing.

3. The finger pump assembly according to claim 1, wherein said poppet is provided with a poppet shoulder for engaging with said poppet valve seat which defines the piston outlet, and said poppet has an appendage which extends

through said piston outlet to facilitate alignment of said poppet with said piston outlet.

4. The finger pump assembly according to claim 1, wherein an end of said poppet, received within said inner housing, supports an extension which engages with a first end of said spring to facilitate orientation of said poppet along a longitudinal axis of said finger pump assembly.

5. The finger pump assembly according to claim 1, wherein said pump body is coupled to a turret and said turret is connected to said closure, and a remote free end of said closure supports an annular skirt which extends away from a base portion of said closure.

6. The finger pump assembly according to claim 5, wherein said turret has an annular sidewall and a free end portion of said annular sidewall is provided with an annular retaining edge for securely connecting said pump body to said turret.

7. The finger pump assembly according to claim 5, wherein said actuator is provided with an annular sidewall which engages with said annular skirt of said closure to facilitate actuation of said actuator along a longitudinal axis of said pump assembly.

8. The finger pump assembly according to claim 5, wherein said closure is provided with an annular flange, and said turret is provided with a mating annular flange, and said annular flange of said closure and a gasket sandwich said annular flange of said turret therebetween to facilitate a sealing engagement of said finger pump assembly with a desired container.

9. The finger pump assembly according to claim 1, wherein said actuator has a central bore which communicates with said discharge orifice, and said piston has an annular housing side wall which frictionally engages with said central bore of said actuator to couple said piston to said actuator and facilitate the supply of the product to be dispensed from said piston to said discharge orifice.

10. The finger pump assembly according to claim 1, wherein an inwardly facing surface of said inner housing is provided with at least one nub to facilitate

relieving the pressure generated within the compression chamber once the poppet has been substantially completely displaced along an inwardly facing surface of said inner housing, and the relieved pressure is vented through the interior cavity and out through the ventilation port provided in the base of the pump body.

11. The finger pump assembly according to claim 5, wherein at least one groove is provided between an exterior surface of said pump body and an inwardly facing surface of said turret to allow an equalization in pressure, once the finger pump assembly is connected to a container and operated, to prevent the container attached to the finger pump assembly from becoming at least partially evacuated.

12. The finger pump assembly according to claim 1, wherein the passageway, communicating with said compression chamber, extends substantially parallel to a longitudinal axis of the pump assembly but is radially spaced from the longitudinal axis of the pump assembly.

13. The finger pump assembly according to claim 12, wherein a valve is located along said passageway communicating with said compression chamber, and said valve comprises a ball captively retained within a cage with said ball normally resting upon a ball valve seat to prevent flow of product along said passageway and, during a siphoning action of said pump assembly, said ball is displaced from said valve seat to allow the flow of product therethrough.

14. The finger pump assembly according to claim 12, wherein a dip tube is coupled the inlet of the passageway to facilitate siphoning of the product to be dispensed from a base portion of a container.

15. A finger pump assembly comprising:

a pump body comprising an outer housing and an inner housing, and said outer housing and said inner housing at least partially defining a compression chamber therebetween;

a closure supporting said pump body, and said closure having a mechanism for facilitating engagement with a spout of a container;

a piston being at least partially received within said pump body and being slidable relative to said pump body along said outer housing, said piston

having an annular lip for providing a sealing engagement with the pump body, and said piston being provided with a poppet valve seat defining a piston outlet;

an actuator being coupled to said piston outlet, and said actuator having a discharge outlet communicating with said piston outlet for facilitating dispensing of a product;

a poppet being accommodated by said inner housing, said poppet being biased by a spring into engagement with said poppet valve seat to normally close said piston outlet and prevent flow of product therethrough, and said poppet and said inner housing defining an interior cavity, and a ventilation port being formed the pump body facilitate, during operation of said poppet, communication between said interior cavity and an interior of the container so that the interior cavity operates at ambient pressure; and

a passageway communicating with said compression chamber, said passageway having an inlet and a one-way valve which allows the product to flow along said passageway toward said compression chamber.

16. The finger pump assembly according to claim 15, wherein said poppet has an annular sealing and guide surface to facilitate sliding sealing engagement of the poppet along an inwardly facing surface of said inner housing;

said poppet is provided with a poppet shoulder for engaging with said poppet valve seat which defines the piston outlet, and said poppet has an appendage which extends through said piston outlet to facilitate alignment of said poppet with said piston outlet;

an end of said poppet, received within said inner housing, supports an extension which engages with a first end of said spring to facilitate orientation of said poppet along a longitudinal axis of said finger pump assembly.

17. The finger pump assembly according to claim 15, wherein said pump body is coupled to a turret and said turret is connected to said closure, and a remote free end of said closure supports an annular skirt which extends away from a base portion of said closure;

said turret has an annular sidewall and a free end portion of said annular sidewall is provided with an annular retaining edge for securely connecting said pump body to said turret; and

said actuator is provided with an annular sidewall which engages with said annular skirt of said closure to facilitate actuation of said actuator along a longitudinal axis of said pump assembly.

18. The finger pump assembly according to claim 17, wherein said closure is provided with an annular flange, and said turret is provided with a mating annular flange, and said annular flange of said closure and a gasket sandwich said annular flange of said turret therebetween to facilitate a sealing engagement of said finger pump assembly with a desired container.

19. The finger pump assembly according to claim 15, wherein said actuator has a central bore which communicates with said discharge orifice, and said piston has an annular housing side wall which frictionally engages with said central bore of said actuator to couple said piston to said actuator and facilitate the supply of the product to be dispensed from said piston to said discharge orifice.

20. The finger pump assembly according to claim 15, wherein an inwardly facing surface of said inner housing is provided with at least one nub to facilitate relieving the pressure generated within the compression chamber once the poppet has been substantially completely displaced along an inwardly facing surface of said inner housing, and the relieved pressure is vented through the interior cavity and out through the ventilation port provided in the base of the pump body.

21. The finger pump assembly according to claim 17, wherein at least one groove is provided between an exterior surface of said pump body and an inwardly facing surface of said turret to allow an equalization in pressure, once the finger pump assembly is connected to a container and operated, to prevent the container attached to the finger pump assembly from becoming at least partially evacuated.

22. The finger pump assembly according to claim 15, wherein the passageway, communicating with said compression chamber, extends

substantially parallel to a longitudinal axis of the pump assembly but is radially spaced from the longitudinal axis of the pump assembly.

23. The finger pump assembly according to claim 22, wherein a valve is located along said passageway communicating with said compression chamber, and said valve comprises a ball captively retained within a cage with said ball normally resting upon a ball valve seat to prevent flow of product along said passageway and, during a siphoning action of said pump assembly, said ball is displaced from said valve seat to allow the flow of product therethrough.

24. The finger pump assembly according to claim 22, wherein a dip tube is coupled the inlet of the passageway to facilitate siphoning of the product to be dispensed from a base portion of a container.

25. A finger pump apparatus comprising:

a container for housing a desired product to be dispensed, said container being closed at one end and having a spout, at an opposite end to facilitate dispensing of the product to be dispensed;

a pump body comprising a base supporting an outer housing and an inner housing, and said outer housing and said inner housing at least partially defining a compression chamber therebetween;

a closure supporting said pump body, and said closure sealingly engaging with the spout of the container;

a piston being at least partially received within said pump body and being slidable relative to said pump body along said outer housing, said piston having an annular lip for providing a sealing engagement with the pump body, and said piston being provided with a poppet valve seat defining a piston outlet;

an actuator being coupled to said piston outlet, and said actuator having a discharge outlet communicating with piston outlet for facilitating dispensing of a product;

a poppet being accommodated by said inner housing, said poppet being biased by a spring into engagement with said poppet valve seat to normally close said piston outlet and prevent flow of product therethrough, and said poppet and said inner housing defining an interior cavity, and a ventilation port being

formed the pump body facilitate, during operation of said poppet, communication between said interior cavity and an interior of the container so that the interior cavity operates at ambient pressure;

a passageway communicating with said compression chamber, said passageway having an inlet and a one-way valve which allows the product to flow along said passageway toward said compression chamber; and

a dip tube coupling the inlet of the passageway to a base portion of said container to facilitate siphoning of the product to be dispensed by the pump assembly.

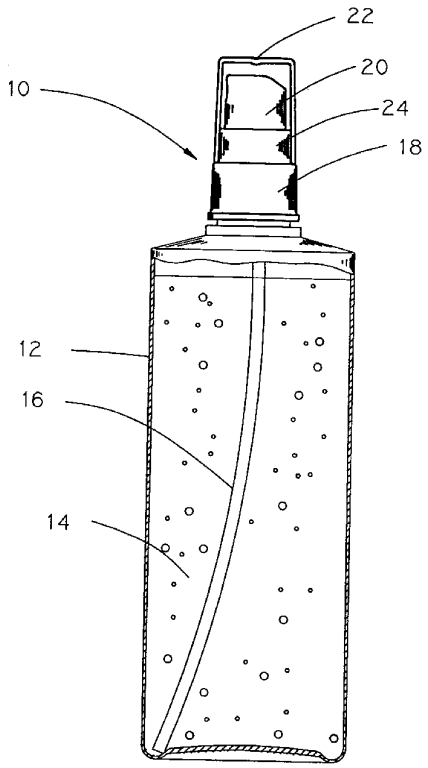

FIG. 1

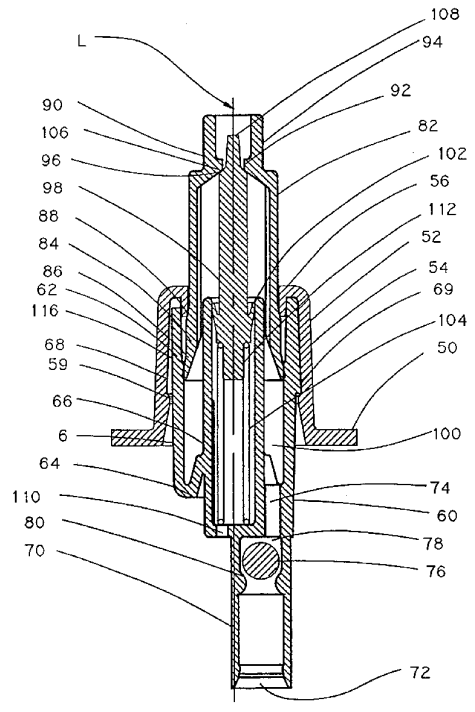
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FIG. 2

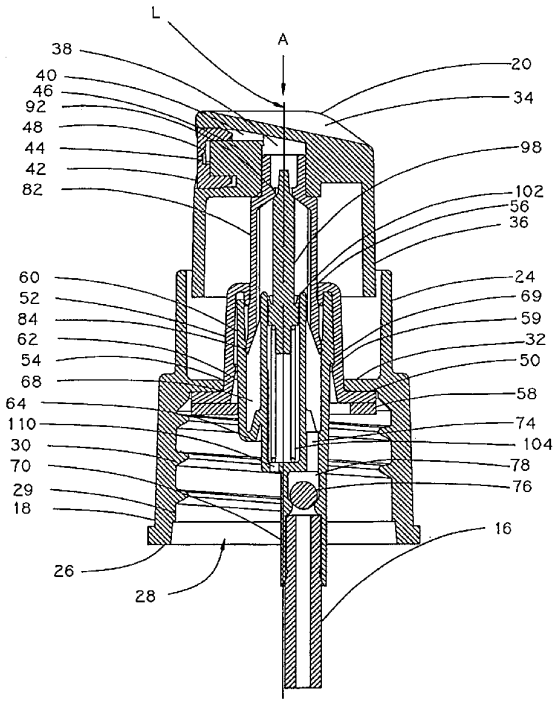
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FIG. 3

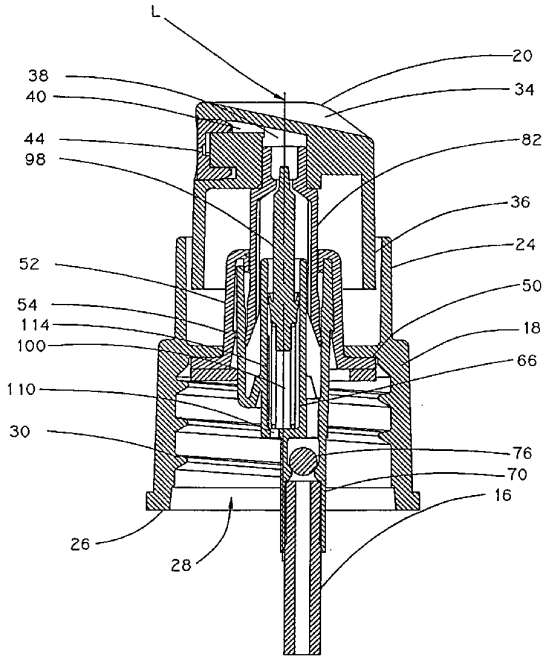
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FIG. 4

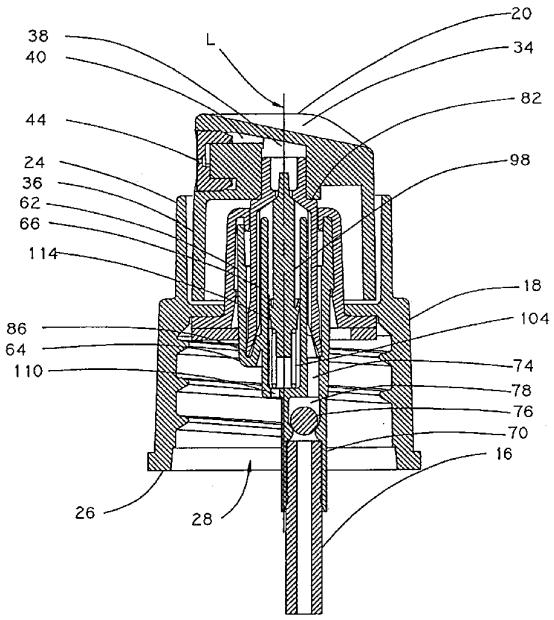
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FIG. 5

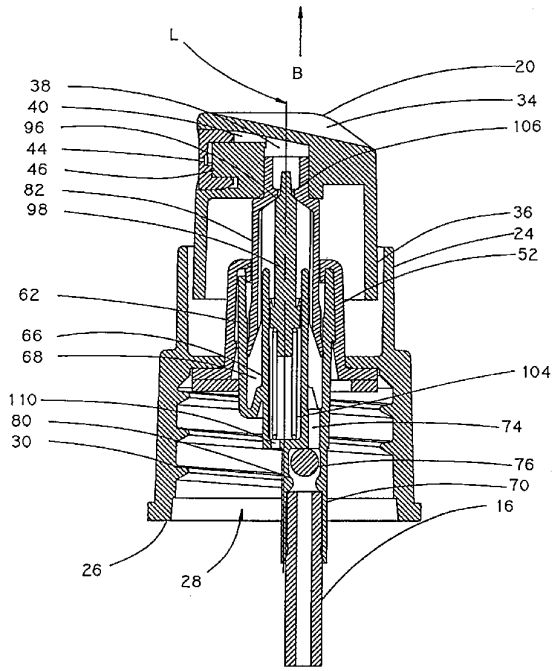

FIG. 6

RECTIFIED SHEET (RULE 91)

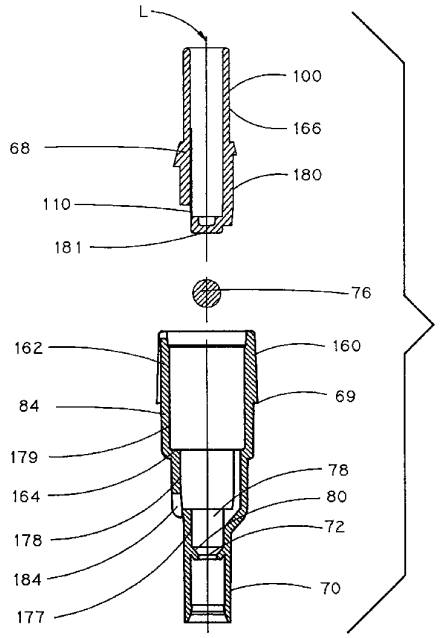
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FIG. 7

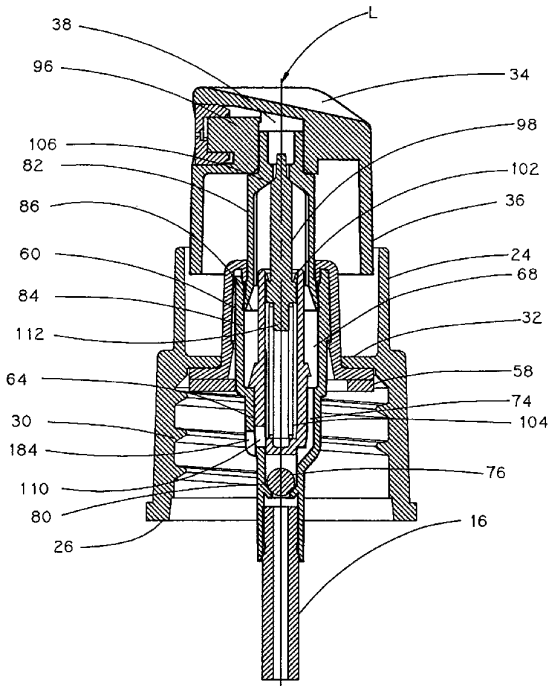
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FIG. 8

【手続補正書】
【提出日】平成13年12月18日(2001.12.18)
【手続補正１】
【補正対象書類名】明細書
【補正対象項目名】特許請求の範囲
【補正方法】変更
【補正の内容】
【特許請求の範囲】
【請求項１】
指で作動するポンプアセンブリであって、
外側のハウジング及び内側のハウジングを支持する基部を有するポンプ本体であって、前記外側のハウジング及び前記内側のハウジングは互いに同軸であり前記外側のハウジング及び前記内側のハウジングはそれらの間に少なくとも部分的に圧縮室を形成するポンプ本体と、
前記ポンプ本体を支持する閉鎖部であって、容器の注ぎ口との係合を容易にするための機構を備える閉鎖部と、
少なくとも部分的に前記ポンプ本体に受け入れられ、前記外側のハウジングに沿って前記ポンプ本体に対して同軸の外側及び内側のハウジングの間で摺動可能であるピストンであって、前記ピストンは前記ポンプ本体に密封係合を供給するための環状のリップを有し、前記ピストンにはピストン出口を形成する揚弁弁座が設けられたピストンと、
前記ピストン出口に連結されたアクチュエータであって、製品の噴霧を容易にするための前記ピストン出口に繋がる排出口を備えるアクチュエータと、
少なくとも部分的に内側のハウジングに収納された揚弁であって、前記ポンプ本体の前記基部からばねによって離れる方へ付勢され、前記揚弁弁座と係合し前記ピストン出口を通常閉じて製品の流れを防止し、前記揚弁、前記基部及び前記内側のハウジングは内部空洞を形成し、前記内部空洞には前記揚弁の作動中、前記内部空洞が周囲の圧力で作動するための通気ポートが設けられた揚弁と、
直接前記圧縮室に繋がる通路であって、製品を前記通路に沿って流し内部空洞を通過することなく直接前記圧縮室に流入させる入口及び逆止弁を有する通路と、を備えたことを特徴とする指で作動するポンプアセンブリ。
【請求項２】
前記揚弁が環状の密封及び誘導面を有し、前記内側のハウジングの内側に向いた面に沿って前記揚弁の摺動密封係合を容易にすることを特徴とする、請求項１記載の指で作動するポンプアセンブリ。
【請求項３】
前記揚弁に、ピストン出口を形成する前記揚弁弁座と係合するための揚弁肩部が設けられ、前記揚弁が前記ピストン出口から延出し前記揚弁を前記ピストン出口に揃えることを容易にするための付属体を有することを特徴とする、請求項１記載の指で作動するポンプアセンブリ。
【請求項４】
前記内側のハウジング内に受け入れられた前記揚弁の端部が、前記ばねの第１端部と係合する延長部を支持し、前記指で作動するポンプアセンブリの長さ方向の軸に沿って前記揚弁の誘導を容易に行わせることを特徴とする、請求項１記載の指で作動するポンプアセンブリ。
【請求項５】
前記ポンプ本体が小塔に連結され、前記小塔は前記閉鎖部に接続され、前記閉鎖部の遠隔自由端部が前記閉鎖部の基部から離れる方に延出する環状のスカートを支持することを特徴とする、請求項１記載の指で作動するポンプアセンブリ。
【請求項６】
前記小塔が環状の側壁を有し、前記側壁の自由端の部分には前記ポンプ本体を前記小塔に

堅固に接続するための環状の保持縁が設けられていることを特徴とする、請求項５記載の指で作動するポンプアセンブリ。
【請求項７】
前記アクチュエータに、前記閉鎖部の前記環状のスカートと係合する環状の側壁が設けられ、前記ポンプアセンブリの長さ方向の軸に沿って前記アクチュエータの作動を容易に行わせることを特徴とする、請求項５記載の指で作動するポンプアセンブリ。
【請求項８】
前記閉鎖部には環状のフランジが設けられ、前記小塔には対となる環状のフランジが設けられ、前記閉鎖部の前記環状のフランジとガスケットが前記小塔の前記環状のフランジをサンドイッチ状に挟み、前記指で作動するポンプアセンブリと所望の容器との密封係合を容易に行わせることを特徴とする、請求項５記載の指で作動するポンプアセンブリ。
【請求項９】
前記アクチュエータが前記排出口と繋がる中央の穴を有し、前記ピストンが前記ピストンを前記アクチュエータに接続するために前記アクチュエータの前記中央の穴と摩擦力で係合する環状のハウジング側壁を有し、前記ピストンから前記排出口へ噴霧すべき製品の供給を確実に行うことを特徴とする、請求項１記載の指で作動するポンプアセンブリ。
【請求項１０】
前記内側ハウジングの内側に向いた面には、少なくとも１つの突起が設けられ、前記揚弁が前記内側のハウジングの内側に向いた面に沿って実質的に完全に変位すると、圧縮室内に生成された圧力を解放し、解放された圧力は内部空洞を通りポンプ本体の基部に設けられた通気ポートから排出されることを特徴とする、請求項１記載の指で作動するポンプアセンブリ。
【請求項１１】
少なくとも１つの溝が、圧力同等化のために前記ポンプ本体の外側面と前記小塔の内側に向いた面との間に設けられ、指で作動するポンプアセンブリが容器に接続され作動すると、指で作動するポンプアセンブリに取り付けられた容器が少なくとも部分的に真空になるのを防止することを特徴とする、請求項５記載の指で作動するポンプアセンブリ。
【請求項１２】
前記圧縮室に繋がる前記通路が、ポンプアセンブリの長さ方向の軸に実質上平行に延びているが、ポンプアセンブリの前記長さ方向の軸から半径方向に離されていることをを特徴とする、請求項１記載の指で作動するポンプアセンブリ。
【請求項１３】
弁が前記圧縮室に繋がる前記通路に沿って配置され、前記弁は前記通路に沿った製品の流れを妨げるためにボール弁座に通常置かれているケージ内に拘束されたボールからなり、前記ポンプアセンブリの吸い上げ活動の間、前記ボールが製品を流すために前記弁座から変位することを特徴とする、請求項１２記載の指で作動するポンプアセンブリ。
【請求項１４】
汲み上げ管が通路の入口に接続され、容器の基部から噴霧すべき製品の吸い上げが確実に行われることを特徴とする、請求項１２記載の指で作動するポンプアセンブリ。
【請求項１５】
指で作動するポンプ装置であって、
所望の噴霧すべき製品を収納する容器であって、一端が閉じられ噴霧すべき製品を確実に噴霧するための注ぎ口を有する容器と、
外側のハウジング及び内側のハウジングを支持する基部を有するポンプ本体であって、前記外側のハウジング及び前記内側のハウジングは互いに同軸であり前記外側のハウジング及び前記内側のハウジングはそれらの間に少なくとも部分的に圧縮室を形成するポンプ本体と、
前記ポンプ本体を支持する閉鎖部であって、容器の注ぎ口と密封状に係合する閉鎖部と、少なくとも部分的に前記ポンプ本体に受け入れられ、前記外側のハウジングに沿って前記ポンプ本体に対して同軸の外側及び内側のハウジングの間で摺動可能であるピストンであ

って、前記ピストンは前記ポンプ本体に密封係合を供給するための環状のリップを有し、
前記ピストンにはピストン出口を形成する揚弁弁座が設けられたピストンと、
前記ピストン出口に連結されたアクチュエータであって、製品の噴霧を容易にするための前記ピストン出口に繋がる排出口を備えるアクチュエータと、
少なくとも部分的に前記内側のハウジングに収納された揚弁であって、前記ポンプ本体の前記基部から離れるようにばねによって付勢され、前記揚弁弁座と係合し前記ピストン出口を通常閉じて製品の流れを防止し、前記揚弁、前記基部及び前記内側のハウジングは内部空洞を形成し、前記内部空洞には前記揚弁の作動中、内部空洞が周囲の圧力で作動するように容器の内部と繋がる通気ポートが設けられた揚弁と、
直接前記圧縮室に繋がる通路であって、製品を前記通路に沿って流し内部空洞を通過することなく直接前記圧縮室に流入させる入口及び逆止弁を有する通路と、
通路の入口を前記容器の基部に接続しポンプアセンブリによって容器の内部から噴霧すべき製品の吸い上げを容易にする汲み上げ管と、を備えたことを特徴とする指で作動するポンプ装置。
【請求項１６】
前記揚弁が環状の密封及び誘導面を有し、前記内側のハウジングの内側に向いた面に沿って前記揚弁の摺動密封係合を容易にし、
前記揚弁に、ピストン出口を形成する前記揚弁弁座と係合するための揚弁肩部が設けられ、前記揚弁が前記ピストン出口から延出し前記揚弁を前記ピストン出口に揃えることを容易にするための付属体を有し、
前記内側のハウジング内に受け入れられた前記揚弁の端部が、前記ばねの第１端部と係合する延長部を支持し、前記指で作動するポンプアセンブリの長さ方向の軸に沿って前記揚弁の誘導を容易に行わせることを特徴とする、請求項１５記載の指で作動するポンプアセンブリ。
【請求項１７】
前記ポンプ本体が小塔に連結され、前記小塔は前記閉鎖部に接続され、前記閉鎖部の遠隔自由端が前記閉鎖部の基部から離れる方に延出する環状のスカートを支持し、
前記小塔が環状の側壁を有し、前記側壁の自由端の部分には前記ポンプ本体を前記小塔に堅固に接続するための環状の保持縁が設けられていることを特徴とする、請求項１５記載の指で作動するポンプアセンブリ。
【請求項１８】
前記閉鎖部には環状のフランジが設けられ、前記小塔には対となる環状のフランジが設けられ、前記閉鎖部の前記環状のフランジとガスケットが前記小塔の前記環状のフランジをサンドイッチ状に挟み、前記指作動ポンプアセンブリと所望の容器との密封係合を容易に行わせることを特徴とする、請求項１７記載の指で作動するポンプアセンブリ。
【請求項１９】
前記アクチュエータが前記排出口と繋がる中央の穴を有し、前記ピストンが前記ピストンを前記アクチュエータに接続するために前記アクチュエータの前記中央の穴と摩擦力で係合する環状のハウジング側壁を有し、前記ピストンから前記排出口へ噴霧すべき製品の供給を容易にすることを特徴とする、請求項１５記載の指で作動するポンプアセンブリ。
【請求項２０】
前記内側ハウジングの内側に向いた面には、少なくとも１つの突起が設けられ、前記揚弁が前記内側のハウジングの内側に向いた面に沿って実質的に完全に変位すると、圧縮室内に生成された圧力を解放し、解放された圧力は内部空洞を通りポンプ本体の基部に設けられた通気ポートから排出されることを特徴とする、請求項１５記載の指で作動するポンプアセンブリ。
【請求項２１】
単一ばねの指で作動するポンプアセンブリであって、
外側のハウジング及び内側のハウジングを支持する基部を有するポンプ本体であって、前記外側のハウジング及び前記内側のハウジングは互いに同軸であり前記外側のハウジング

及び前記内側のハウジングはそれらの間に少なくとも部分的に圧縮室を形成するポンプ本体と、
前記ポンプ本体を支持する閉鎖部であって、容器の注ぎ口との係合を容易にするための機構を備える閉鎖部と、
少なくとも部分的に前記ポンプ本体に受け入れられ、前記外側のハウジングに沿って前記ポンプ本体に対して同軸の外側及び内側のハウジングの間で摺動可能であるピストンであって、前記ピストンは前記ポンプ本体に密封係合を供給するための環状のリップを有し、前記ピストンにはピストン出口を形成する揚弁弁座が設けられたピストンと、
前記ピストン出口に連結されたアクチュエータであって、製品の噴霧を確実にするための前記ピストン出口に繋がる排出口を備えるアクチュエータと、
少なくとも部分的に内側のハウジングに収納された揚弁であって、前記ポンプ本体の前記基部からばねによって離れる方へ付勢され、前記揚弁弁座と係合し前記ピストン出口を通常閉じて製品の流れを防止し、前記揚弁、前記基部及び前記内側のハウジングは内部空洞を形成し、前記内部空洞には前記揚弁の作動中、前記内部空洞が周囲の圧力で作動するための通気ポートが設けられた揚弁と、
直接前記圧縮室に繋がる通路であって、製品を前記通路に沿って流し内部空洞を通過することなく直接前記圧縮室に流入させる入口及び逆止弁を有し、長さ方向の軸に平行に延びるが長さ方向の軸から偏心している通路と、を備えた単一ばねの指で作動するポンプアセンブリ。

【請求項２２】
前記圧縮室に繋がる前記通路が、ポンプアセンブリの長さ方向の軸に実質上平行に延びているが、ポンプアセンブリの前記長さ方向の軸から半径方向に離されていることをを特徴とする、請求項１５記載の指で作動するポンプアセンブリ。

【請求項２３】
弁が前記圧縮室に繋がる前記通路に沿って配置され、前記弁は前記通路に沿った製品の流れを妨げるためにボール弁座に通常置かれているケージ内に拘束されたボールからなり、前記ポンプアセンブリの吸い上げ活動の間、前記ボールが製品を流すために前記弁座から変位することを特徴とする、請求項２２記載の指で作動するポンプアセンブリ。

【請求項２４】
汲み上げ管が通路の入口に接続され、容器の基部から噴霧すべき製品の吸い上げが容易に行われることを特徴とする、請求項２２記載の指で作動するポンプアセンブリ。

【請求項２５】
指で作動するポンプ装置であって、
所望の噴霧すべき製品を収納する容器であって、一端が閉じられ、他端に噴霧すべき製品を容易に噴霧するための注ぎ口を有する容器と、
外側のハウジング及び内側のハウジングを支持する基部を有するポンプ本体であって、前記外側のハウジング及び前記内側のハウジングは互いに同軸であり、前記外側のハウジング及び前記内側のハウジングはそれらの間に少なくとも部分的に圧縮室を形成するポンプ本体と、
前記ポンプ本体を支持する閉鎖部であって、容器の注ぎ口との係合を容易にするための機構を備える閉鎖部と、
少なくとも部分的に前記ポンプ本体に受け入れられ、前記外側のハウジングに沿って前記ポンプ本体に対して同軸の外側及び内側のハウジングの間に摺動可能であるピストンであって、前記ピストンは前記ポンプ本体に密封係合を供給するための環状のリップを有し、前記ピストンにはピストン出口を形成する揚弁弁座が設けられたピストンと、
前記ピストン出口に連結されたアクチュエータであって、製品の噴霧を容易にするためのピストン出口に繋がる排出口を備えるアクチュエータと、
少なくとも部分的に前記内側のハウジングに収納された揚弁であって、ばねによって前記ポンプ本体の前記基部から離れるように付勢され、前記揚弁弁座と係合し前記ピストン出口を通常閉じて製品の流れを防止し、前記揚弁、前記基部及び前記内側のハウジングは内

部空洞を形成し、前記内部空洞には前記揚弁の作動中、前記内部空洞が周囲の圧力で作動する通気ポートが設けられた揚弁と、
直接前記圧縮室に繋がる通路であって、製品を前記通路に沿って前記圧縮室の方へ流れさせ内部空洞を通過することなく直接前記圧縮室に流入させる入口及び逆止弁を有する通路と、
前記通路の入口を前記容器に接続しポンプアセンブリによって噴霧される製品の吸い上げを容易にする汲み上げ管と、を備えたことを特徴とする指で作動するポンプ装置。

【国際調査報告】

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US00/14550

A. CLASSIFICATION OF SUBJECT MATTER
IPC(7) :B67D 5/42
US CL :222/321.7, 321.9, 321.2
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. : 222/321.7, 321.9, 321.2

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 5,626,264 A (FLOREZ et al) 06 May 1997, col. 2, line 39 - col. 4, line 32.	1-25
Y	US 5,641,097 A (RENAULT et al) 24 June 1997, col. 5, line 4 - col. 9, line 10.	1-25
Y	US 5,655,688 A (MOORE) 12 August 1997, col. 5, line 37 - col. 23, line 67.	1-25

☐ 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 16 AUGUST 2000	Date of mailing of the international search report 03 OCT 2000
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer KEVIN P. SHAVER Telephone No. (703) 308-2582

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