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(71) Applicant *(for all designated States except US)*: **ILLINOIS TOOL WORKS INC.** [US/US]; 3600 West Lake Avenue, Glenview, IL 60026 (US).

(72) Inventor; and

(75) Inventor/Applicant *(for US only)*: **KOSMYNA, Michael, J.** [US/US]; 2442 Shoreland Avenue, Toledo, OH 43611 (US).

(74) Agents: **PILARSKI, John, H.** et al.; Illinois Tool Works Inc., 3600 West Lake Avenue, Glenview, IL 60026 (US).

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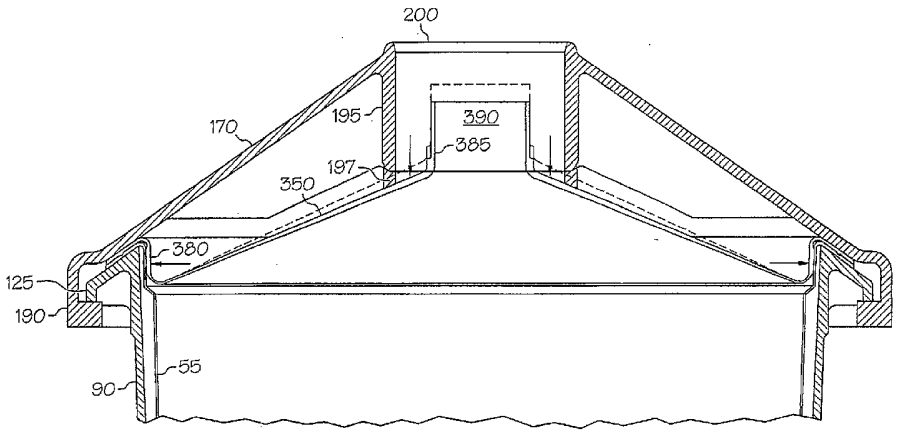
(54) Title: FLUID SUPPLY ASSEMBLY



(57) **Abstract:** A fluid supply assembly. The fluid supply assembly includes a disposable cup and lid, and a reusable cup holder and outer lid. The seal between the disposable cup and lid is enhanced by the outer lid comprising means to deflect the disposable lid down ward. A method of preparing a fluid supply assembly for use with a fluid supply applicator is also described.

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LINER WITH IMPROVED SEAL FOR THE PAINT SUPPLY CUP OF A SPRAY GUN

BACKGROUND OF THE INVENTION

The present invention is directed generally to a fluid supply assembly for a fluid applicator, and more particularly to a fluid supply assembly having an improved seal between a disposable cup and a disposable lid.

Some fluid applicators, such as gravity feed paint spray guns, have a fluid supply cup mounted on top of the fluid applicator. The fluid supply cup is typically reusable. Fluid, such as paint, is generally measured and mixed in a separate container, and then poured into the fluid supply cup for use. The container for measuring and mixing must be either cleaned or disposed of. During fluid application, the user must be careful not to tip the fluid applicator too much, or fluid will leak out a vent in the fluid supply cup. In addition, the user cannot use all of the fluid because it moves around in the fluid supply cup and air can be drawn into the drain hole.

Attempts have been made to provide fluid supply assemblies which do not leak during use. For example, U.S. Patent No. 5,582,350 describes a hand held spray gun with a top mounted paint cup which extends from the rear of the gun body at an angle of 30°±10°. The paint can be sealed in a collapsible closed bag in the paint cup, eliminating the need for a vent. Using the closed bag, the gun can be operated at all angles without the paint leaking out of the vent in the paint cup. The use of the closed bag also allows more of the paint to be used. In addition, it reduces cleanup time and cost because the bag keeps the paint cup clean. Thus, U.S. Patent No. 5,582,350 represented a significant advance in the art.

U.S. Patent No. 6,588,681 describes a paint cup with an outer container and an inner liner. There is an indicating sheet with indicia for measuring the paint components which must be positioned carefully between the inner liner and the outer container so that the indicia for measuring are aligned accurately. The paint cup includes a lid which is sealed to the outer container with an external sealing ring. An additional support ring is required so that the paint

cup can be used on a paint shaker machine. Moreover, the paint cup is unnecessarily complicated.

SUMMARY OF THE INVENTION

Therefore, there remains a need for a fluid supply assembly which provides an improved seal to prevent fluid leakage.

The present invention meets this need by providing a fluid supply assembly. The fluid supply assembly includes a disposable cup, a reusable cup holder, a disposable lid, a reusable outer lid, and optionally a conduit.

Another aspect of the present invention is a method of preparing a fluid supply assembly for use with a fluid supply applicator. The method includes providing a fluid supply assembly; placing the disposable cup in the reusable cup holder; filling the disposable cup with fluid; placing the disposable lid on the disposable cup; attaching the reusable outer lid to the reusable cup holder; attaching the conduit to the fitting of the reusable outer lid; and deflecting the disposable lid downward.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is side elevation view of a gravity-feed paint sprayer with a fluid supply assembly.

Fig. 2 is an exploded side sectional view of one embodiment of a fluid supply assembly.

Fig. 3 is partial side sectional view of the assembled connection between the reusable cup holder and reusable outer lid.

Fig. 4 is a partial side sectional view of an alternate embodiment of the reusable outer lid showing stacking of the fluid supply assemblies.

Fig. 5 is a side sectional view of an alternate embodiment of the disposable lid.

Fig. 6 is an assembled side sectional view of the alternate embodiment of the disposable lid of Fig. 5 and the disposable cup.

Fig. 7 is a side sectional view of an alternate embodiment of the disposable cup.

Fig. 8 is a top view of an alternate embodiment of the disposable cup.

Fig. 9 is a side sectional view of the disposable cup of Fig. 8 in one axis.

Fig. 10 is a side sectional view of the disposable cup of Fig. 8 in another axis.

Fig. 11 is a side view of one embodiment of the adapter.

Fig. 12 is a side sectional view of one embodiment of the outer lid.

Fig. 13 is a top view of the outer lid of Fig. 12.

Fig. 14 is a partial assembled side sectional view of the connection between one embodiment of an adapter and reusable outer lid.

Fig. 15 is a side sectional view of another embodiment of the outer lid.

Fig. 16 is a perspective view of the embodiment of the reusable outer lid of Fig. 15.

Fig. 17 is a side view of another embodiment of the adapter to be used with the outer lid of Figs. 15 and 16.

Fig. 18 is a side sectional view of one embodiment of the present invention.

Fig. 19 is a side sectional view of another embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

A fluid supply assembly attached to a fluid applicator is shown in Fig. 1. In one embodiment, the fluid supply assembly is for feeding liquid, such as paint, to the fluid applicator, such as a paint sprayer. The present invention will be described for a paint sprayer, such as a gravity feed paint sprayer for use in applying paint to coat substrate surfaces. The paint sprayer can be used in the automotive refinishing market, such as automobile body shops, for repainting automobiles. Although the fluid supply assembly is described for a paint sprayer, it is not limited to such use. It can be used for supplying other flowable liquids, including, but not limited to, beverages, foods, condiments (such as ketchup), gasoline, petrochemicals and hydrocarbons, water, water-based solutions, solvent-based solutions, emulsions, adhesives, and the like.

Referring to Fig. 1, a paint sprayer 10 is shown. It includes a body 15, a nozzle assembly 20 secured to a front end 25 of body 15, and a handle 30 depending from a rear end 35 of body 15. A trigger 40 is pivotally secured to body 15 for the manual actuation of sprayer 10. A top-mounted paint supply assembly 45 is mounted to body 15 near front end 25 for feeding paint to nozzle assembly 20. An air connector 50 is connected to an air hose (not shown) for the delivery of pressurized air to nozzle assembly 20, wherein the delivery of pressurized air is controlled by trigger 40.

Compressed air from air connector 50 is delivered through an internal passage (not shown) to nozzle assembly 20 and the compressed air acts to atomize paint and deliver it through nozzle assembly 20 to spray paint about paint axis 55. Paint is delivered to nozzle assembly 20 from paint supply assembly 45.

Figs. 1-3 show a first embodiment of paint supply assembly 45. The paint supply assembly includes disposable cup 55. Disposable cup 55 has a side wall 60 which is generally cylindrical. The outlet end 65 at the top of the cup is open, and the bottom 70 is closed. The side wall 60, outlet end 65, and bottom 70 define an interior 75. The outlet end 65 defines an axis 80. There is a flange 85 extending outward and downward from the edge of the outlet end 65. The flange 85 extends downward at an angle α in a range of from about 10° to about 70° from the axis 80 of the outlet end 65. Alternatively, the flange can extend straight outward, with a lesser angle, or there could be no flange.

The disposable cup can have flexible side walls which allow the disposable cup to collapse as paint is dispensed. The side walls can be thin, for example in the range of about 0.003 in. to about 0.008 in. In one arrangement, the disposable cup can have flexible side walls which are designed to allow the disposable cup to collapse with a minimum of folds using almost all of the paint. The side walls adjacent to the outlet end and the bottom can be thicker than the middle portion of the sidewall. With this arrangement, the cup appears almost to roll inside out as it collapses. The sidewall adjacent to the outlet end and the bottom can be about two to about three times thicker than the middle of the sidewall. For example, the sidewalls adjacent to the outlet end and the bottom can be about 0.006 in. to about 0.015 in., while the middle portion is about 0.003 in. to about 0.005 in. The thicker portions adjacent to the outlet end and the bottom can cover about ¼ of the sidewall, if desired. One of skill in the art will understand that other thickness can be used, as well as other ratios of the thicker end portions to the thinner middle portion.

The bottom can be in the range of about 0.003 to about 0.02 in., so that the bottom will remain substantially flat as the side walls collapse, if desired. No air vent is needed in the disposable cup because the side walls collapse. This allows the user to discharge the paint sprayer at any angle without leaks and to use more of the paint in the cup than is possible with conventional gravity feed paint cups.

The disposable cup 55 can be made of transparent or translucent plastic if desired. Suitable plastics include, but are not limited to, low density polyethylene, and polypropylene.

If desired, the disposable cup can be made of an antistatic material, which dissipates the static charge which can develop during manufacture, storage, and use. The term "antistatic material" is intended to include conventional antistatic materials, as well as static dissipative materials, i.e., materials which have the ability to discharge static charges at a rate higher than typical antistatic additives, and conductive materials, which have the ability to discharge electrostatic charges rapidly. Generally, the antistatic material comprises a polymeric material containing an antistatic additive. Suitable polymeric materials include, but are limited to, polyethylene, polypropylene, or other soft, flexible polymers. Suitable antistatic additives include, but are not limited to, long-chain aliphatic amines and amides, phosphates, quaternary ammonium compounds, polyethylene glycols, glycol esters, ethoxylated long-chain aliphatic amines, polymeric antistatic additives composed of hydrophilic copolymers, intrinsic conductive polymers, such as polyaniline and polythiophene, and conductive fillers, such as carbon black, metal powder and fibers, and graphite fibers.

Reusable cup holder 90 is generally cylindrical. It has a side wall 95, an open upper end 100, and a lower end 105. The lower end 105 has an opening 110 in it. The opening 110 can cover all or almost all of the lower end 105, if desired. Alternatively, the lower end 105 could have one or more smaller openings. The opening 110 in the lower end 105 allows ambient air pressure to help the disposable cup collapse during use. Optionally, the reusable cup holder 90 can include one or more legs 112 extending downward from the lower end 105. The legs can extend all of the way around the opening 110 (i.e., a circular rib) or only a part of the way around the opening 110. The legs 112 can assist in stacking the fluid supply assemblies as described below.

The upper end 100 defines an axis 115. A flange 120 extends outward and downward from an edge of the upper end 100. The flange 120 extends downward at an angle β in a range of from about 10° to about 70° from the axis 115 of the upper end 100. The angle β is substantially the same as the angle α of the flange 85 of disposable cup 55. When the disposable cup 55 is placed in the reusable cup holder 90, the flange 120 of reusable cup

holder 90 supports the flange 85 of the disposable cup 55. Alternatively, the flange can extend straight outward or with a lesser angle.

There is a connecting surface 125 at the upper end 100 of the reusable cup holder 90. The connecting surface 125 can be on the sidewall, extend out from the side wall, or it can extend outward from the end of the flange 120, if desired.

The reusable cup holder 90 can be made of a rigid plastic, including, but not limited to, polypropylene or high density polyethylene. Desirably, the plastic selected is strong enough that the reusable cup holder can withstand the clamping force of a paint shaker machine. The plastic is desirably transparent or translucent, although it could be opaque. If an opaque plastic is used, the side wall should have elongated openings in it so that the disposable cup and its contents can be seen. Typically, the walls can be in the range of from about 0.02 in. to about 0.08 in. thick.

The disposable lid 130 can have a generally frustoconical portion 135. The outer edge 140 of the generally frustoconical portion 135 defines an axis 145. The angle γ of the outer edge 140 of the generally frustoconical portion 135 is in a range of from about 10° to about 70° from the axis 145. The angle γ is substantially the same as the angle α of the flange 85 of disposable cup 55. The disposable lid 130 fits over the disposable cup 55, and the edge 140 of the disposable lid 130 mates with the flange 85 of the disposable cup 55. Alternatively, the edge can extend straight outward or with a lesser angle.

The inside of the disposable lid 130 can have a downward extending rib 150, if desired. The downward extending rib 150 extends into the interior 75 of the disposable cup and mates with the inside of the side wall 60 of the disposable cup 55, forming a seal. Additionally, there can be a downwardly projecting sealing bead 155 on the inside of the disposable lid 130. The downwardly projecting sealing bead 155 mates with the flange 85 of the disposable cup 55 to aid in forming a seal.

There is a fitting 160 integrally connected to the generally frustoconical portion 135. The fitting 160 has an opening 165 extending through it.

The disposable lid 130 can be made of a transparent, translucent, or opaque plastic. Suitable plastics include, but are not limited to, polypropylene or high density polyethylene.

The reusable outer lid 170 has a generally frustoconical portion 175. The outer edge 180 of the generally frustoconical portion 175 defines an axis 185. The angle δ of the outer edge 180 of the generally frustoconical portion 175 is in a range of from about 10° to about 70° from the axis 185. The angle δ is substantially the same as the angle β of the flange 120 of reusable cup holder 90. The outer edge 180 of the reusable outer lid 170 mates with the flange 120 of the reusable cup holder 90. Alternatively, the edge can extend straight outward or with a lesser angle.

There is a complementary connecting surface 190 at the outer edge 180 of the reusable outer lid 170. In this embodiment, the complementary connecting surface 190 extends downward from the outer edge 180, although other arrangements are possible. The complementary connecting surface 190 mates with the connecting surface 125 of the reusable cup holder 90 to seal the reusable cup holder 90 and reusable outer lid 170 together.

The reusable outer lid has a fitting 195 integrally connected to the generally frustoconical portion 175. The fitting 195 has an opening 200 extending through it. The fitting 160 of the disposable lid 130 fits into the fitting 195 of the reusable outer lid 170. The fitting can extend upward from the surface of the reusable outer lid, or downward as shown in Fig. 12, for example.

The reusable outer lid 170 can be made of a strong, tough plastic. Desirably, the plastic selected is strong enough that the reusable outer lid can withstand the clamping force of a paint shaker machine. Examples of suitable plastic include, but are not limited to, acetal. Acetal is not typically transparent. The reusable outer lid 170 can include one or more sight holes so that the paint level is visible to the user, if desired. The sight hole can also allow the

user to write the name of the name of the paint type on the disposable lid, and it permits easy removal of the disposable lid from the reusable outer lid.

A conduit 210 connects the fluid supply assembly to the paint sprayer 10. The conduit 210 mates with the fitting 195 of the reusable outer lid 170 and the fitting 160 of the disposable lid 130. The conduit 210 has an opening 215 through it. There is a path for fluid to flow from the interior 75 of the disposable cup 55 through the opening 165 in the disposable lid 130 through the opening 215 in conduit 210 to the paint sprayer 10. An optional filter 220 can be placed into the opening 215 in the conduit 210, the opening 200 in the reusable outer lid 170, or the opening 165 in the disposable lid 130 to filter out impurities.

In order to use the fluid supply assembly, the disposable cup 55 is placed into the reusable cup holder 90. The flange 85 of the disposable cup 55 mates with the flange 120 of the reusable cup holder 90. The flange 85 centers the disposable cup 55 in the reusable cup holder 90.

Optionally, there can be indicia 230 on either the disposable cup 55 or the reusable cup holder 90 or both. The indicia 230 can be molded in the side, printed on the side, a label can be attached to the side, or the indicia can be supplied in some other fashion. The indicia 230 can be used to measure paint components. Alternatively, the disposable cup and reusable cup holder can be used on a scale, or with a measuring stick to measure the paint components.

The indicia can include mixing scales with one or more mixing ratios, e.g., 4:1 mixing ratio, 2:1 mixing ratio; 3:2:1 mixing ratio, etc. Each mixing ratio might include one or more different sized divisions so that different amounts of fluid could be measured using each mixing ratio. The indicia can also include one or more universal scales, i.e., scales with equal sized divisions. One universal scale might have 20 equal divisions, another 10 equal divisions, a third 5 equal divisions. There can be as many universal scales as needed. The multiple universal scales allow the user to measure different amounts of fluid without using the mixing ratio scales, which would not have to be included. The user could select the appropriate universal scale based on the amount of fluid needed.

Alternatively, the measuring guide could have indicia printed on a clear, thin, flat, plastic sheet. The plastic sheet has connecting parts on opposite sides of the sheet, including, but not limited to, tabs and slots. The plastic sheet is formed into a cylinder, and the tabs are inserted into the slots. The measuring guide can be placed on the table, and the disposable cup, or the reusable cup holder with the disposable cup in it, can be placed inside the cylinder. After the paint components are measured, the disposable cup (and the reusable cup holder if present) is removed from the cylinder. This can be done by lifting the disposable cup by the flange, or by disconnecting the tabs and slots on the sheet. Optional removal tabs on the flange 180 degrees apart can assist in removing the disposable cup. The disposable cup can then be placed in the reusable cup holder (if not already there). This measuring guide improves visibility and accuracy in measuring the paint components. The rectangular shape is easy to manufacture. It eliminates the necessity for accurate placement of a label on the disposable cup or reusable cup holder. It also allows more direct viewing of the indicia than with the label (i.e., through the label, the reusable cup holder, and the disposable cup). It is particularly advantageous when a smaller diameter disposable cup is used because the indicia can be placed right next to the disposable cup. Finally, if the disposable cup is used alone, the reusable cup holder stays cleaner because it is not used when pouring and measuring paint.

The sheets may be formed in different sizes so that the measuring guides can be used with different sizes of disposable cups. A larger sheet could be used with the reusable cup holder and/or the larger disposable cup. The cylinder formed by the larger sheet is big enough so that the reusable cup holder and/or the larger disposable cup fit inside. The larger sheet could include a marking, such as a dotted line near the bottom, to allow proper alignment of the indicia depending whether the larger disposable cup is used with the reusable cup holder or not. The entire sheet might be used when the larger disposable cup is used with a reusable cup holder having legs. When the larger disposable cup is used alone (or the reusable cup does not affect the alignment, e.g. because it does not have legs), the sheet could be cut at the marking. This allows proper alignment in either situation. A smaller sheet could be used when a smaller disposable cup is used. The reusable cup holder would not generally be used

with the smaller disposable cup when measuring fluid in order to provide proper alignment of the indicia and the smaller disposable cup.

After the disposable cup 55 is filled with paint, the disposable lid 130 is placed on top of the disposable cup 55. The angle γ of the edge 140 of disposable lid 130 is substantially the same as the angle α of the flange 85 of disposable cup 55 so that the edge 140 of disposable lid 130 mates with the flange 85 of the disposable cup 55. The angle γ centers the disposable lid 130 on the disposable cup 55. The angle γ of the disposable lid 130 also allows for additional sealing area without an increase in the overall outside diameter of the fluid supply assembly.

The downward extending rib 150 on the inside of the disposable lid 130 fits inside the disposable cup 55. There can be one or more downward extending ribs 150 around the disposable lid 130 which extend part way around the inside of the disposable lid 55, or the rib can extend all the way around. The downward extending rib 150 keeps the disposable lid 55 in place, and it can also act as a seal. The disposable lid 55 can also have a downwardly extending sealing bead 155 which contacts the flange 85 of the disposable cup 55 to improve sealing.

An alternative embodiment of the disposable lid is shown in Figs. 5-6. The disposable lid 350 has an inner portion 355 and an outer portion 360. The outer portion 360 is generally frustoconical. The outer edge 365 of the outer portion 360 defines an axis 370. The angle γa of the outer edge 365 of the outer portion 360 is in a range of from about 10° to about 70° from the axis 370. As in the first embodiment, the angle γa is substantially the same as the angle α of the flange 85 of disposable cup 55.

The inner portion 355 has a generally frustoconical part 375 and an upwardly extending sealing portion 380 at the outer end. The upwardly extending sealing portion 380 is connected to the outer portion 360. There is a fitting 385 integrally connected to the inner portion 355. The fitting 385 has an opening 390 extending through it.

The outer portion 360 mates with the flange 85 of the disposable cup 55. The upwardly extending sealing portion 380 fits inside the outlet end 65 the disposable cup 55 forming an additional seal.

The reusable outer lid 170 is placed on top of the disposable lid 130. It is tightened to the reusable cup holder 90 using the connecting surface 125 of the reusable cup holder 90 and the complementary connecting surface 190 of the reusable outer lid 170. Suitable connecting surfaces and complementary connecting surfaces include, but are not limited to, threaded connections, lugs and grooves, and pins and slots.

Fig. 18 shows one embodiment of the present invention. The disposable lid 350 fits into the disposable cup 55. The sealing portion 380 of the disposable lid 350 is in contact with the upper end of the disposable cup 55, forming a seal. A projection 197 extends downward from the fitting 195. As the reusable outer lid 170 is connected to the reusable cup holder 90 using connecting surface 125 and complementary connecting surface 190, the projection 197 contacts the disposable lid 350, forcing it downward. This downward movement forces the sealing portion 380 outward against the disposable cup 55, increasing the area of the seal. Alternatively, the projection can extend downward from anywhere on the underside of the reusable outer lid, typically close to the fitting to provide the greatest amount of force.

The outer edge 180 of the reusable outer lid 170 has an angle δ which is substantially the same as the angle β of the flange 120 of reusable cup holder 90. The tightening of the reusable outer lid 170 to the reusable cup holder 90 clamps the edge 140 of disposable lid 130 and flange 85 of disposable cup 55 together between edge 180 of reusable outer lid 170 and flange 120 of reusable cup holder 90. The angle increases the clamping force without an increase in torque.

The angles α of the flange 85 of disposable cup 55, γ of the edge 140 of disposable lid 130, β of flange 120 of reusable cup holder 90, and δ of edge 180 of reusable outer lid 170 are

generally in the range of about 10° to about 70° from the respective axis, typically about 20° to about 60°, more typically about 30° to about 50°, more typically about 35° to about 45°.

When the angles α and γ of the flange 85 of disposable cup 55 and the edge 140 of disposable lid 130 match the angle at which the fluid supply assembly is attached to the paint sprayer so that in use the disposable lid is substantially parallel to the paint axis of the paint sprayer, almost all of the paint in the disposable cup is used. Because the cost for a typical mixed paint is over $1.00 per fluid ounce, reducing paint waste is an important consideration.

A plug 235 can be used to cover the fitting 160 on the disposable lid 130. The plug 235 can fit inside or outside of the fitting 160. The plug 230 seals the opening 165 in the fitting 160 for shaking or storage.

In one embodiment, the fluid supply assembly of the present invention is strong enough to be placed in a paint shaker machine without any additional support.

The conduit 210 is placed into the fitting 195 in the reusable outer lid 170. An optional filter 220 is inserted in the opening 215 of the conduit 210. Alternatively, the filter 220 could be placed in the fitting 160 of the disposable lid 130 or the fitting 195 of the reusable outer lid 170. The filter 220 can have a projection 225, if desired, which prevents the collapsing disposable cup 55 from blocking the opening 165 through to the conduit 210. Projection 225 can also be used to remove the filter 220 for cleaning or disposal. The conduit 210 can be filled with solvent and plugged for storage, if desired. If an inside fitting plug 235 is used for the fitting 160 on the disposable cup 130, the same size plug may also fit in the conduit.

The fluid supply assembly is attached to the conduit 210. The conduit 210 connects to the reusable outer lid 170 and the paint sprayer 10 and provides a flow path from the interior 75 of the disposable cup 55 to the paint sprayer 10.

Various types of conduits could be used, as are well known to those of skill in the art. For example, U.S. Patent No. 6,698,670, entitled "Friction Fit Paint Cup Connection," issued March 2, 2004, and U.S. Serial No. 10/760079, filed January 16, 2004, entitled Adapter Assembly for a Fluid Supply Assembly, describe suitable conduits.

Another suitable conduit is shown in Figs. 11-17. The adapter assembly 500 includes adapter 505 for connecting between paint sprayer 10 and outer lid 508. Adapter 505 includes a first end 510 engagable with paint sprayer 10, shown in Fig. 1, a second end 515 engagable with outer lid 508, and a hollow bore 520 between first end 510 and second end 515.

In one embodiment, first end 510 has a diameter smaller than second end 515. First end 510 is generally cylindrical in shape. First end 510 has a connecting surface 525 for engaging with a complementary connecting surface 530 on the paint sprayer 10. Suitable connecting surface 525 and complementary connecting surface 530 include, but are not limited to, threading helical surfaces, lugs and grooves, tapered connections, bayonet connections, snap connections, or first end 510 can be integral with paint sprayer 10 so that the adapter 505 is a feed conduit into sprayer 10. Desirably, the connecting surface 525 and complementary connecting surface 530 are threads of a typical size and pitch for paint sprayers so that the fluid assembly can be used with any of several sprayers.

There can be one or more grooves 535 on the outside of the second end 515 extending from the bottom 540 toward the top 545. The grooves 535 form an angle a with respect to the plane of the bottom 540 of the second end 515. A portion of the grooves 535 can form a helix around the outside of the second end 515. The grooves 535 can optionally include a portion 550 which can form an angle b with respect to the plane of the groove 535. The portion 550 can be parallel to the plane of the bottom 540 of the second end 515, or it can form an angle with respect to the bottom 540 of the second end 515, if desired. In order to form a secure connection, more than one groove can be used; two, three, or four grooves are suitable for most applications, although more can be used if desired.

The outer lid 508 has an integral generally cylindrical fitting 555 with an opening 560 therethrough. The opening 560 is generally circular. The opening 560 in the outer lid 508 has projections 565 extending inward at the upper end of the opening 560. The projections 565 can be positioned at the edge of the upper end of the fitting 555 or below the edge, if desired. The projections 565 are typically rod-shaped, but they can be any desired shape. The number of projections will correspond to the number of grooves.

When the second end 515 is positioned in fitting 555, the bottom 540 of the second end 515 will enter the fitting 555 until it reaches projections 565. This centers the adapter 505 in the opening 560 of the fitting 555. The adapter 505 can be rotated until the grooves 535 in the second end align with projections 565. Alternatively, the outer lid 508 could be rotated onto the adapter 505.

The second end 515 can then be rotated further so that the projections 565 follow the grooves 535 which moves the second end 515 into the fitting 555 and onto the fitting 570 of the disposable lid 575. When the projections 565 reach portion 550, the second end 515 is engaged with the fitting 555. If the portion 550 is parallel to the bottom 540 of the second end 515, further rotation of the second end 515 causes the projections 565 to follow portion 550, locking the second end 515 in the fitting 555 without the second end 515 moving further into the fitting 555. The adapter's rotation will stop when it reaches the end of the portion 550. This arrangement allows the adapter to be "unscrewed" slightly without it raising off the disposable lid 575. Thus, accidental bumping of the adapter will not cause it to start disengaging the connection immediately. When the adapter is "unscrewed" to remove the cup, the presence of a portion 550 which is parallel to the bottom 540 of the second end 515 allows the adapter to be removed slowly and gradually, which reduces the likelihood of residual paint be spattered during removal.

If the portion 550 is not parallel to the bottom 540 of the second end 515, rotating the second end 515 will move the second end 515 further into the fitting 555.

Optionally, when the adapter is almost inserted completely, the adapter can have an interference fit with the fitting 555. The fitting 555 can be slightly smaller near the bottom to give the feel of a snug fit as the second end 515 nears the locking point between the adapter and the outer lid. The fitting 555 can have a smaller diameter all of the way around, or it can have only some portions which are smaller.

The fitting can extend downward from the top of the outer lid (as shown in Fig. 12), or it can extend upward from the top (as shown in Fig. 15), as desired.

Alternatively, as shown in Figs. 15-17, the second end 515 can include projections 565, and the fitting 555 can include grooves 535. In this arrangement, the projections 565 could be at the bottom of the second end 515 or slightly above the bottom. The grooves 535 would extend downward from the top of the fitting 555 toward the bottom. The portion 550 of the groove 535 would be near the bottom of the fitting 555. The operation would be similar to that described above.

Fig. 19 shows another embodiment of the present invention. The disposable lid 350 fits into the disposable cup 55. The sealing portion 380 of the disposable lid 350 is in contact with the upper end of the disposable cup 55, forming a seal. The bore 520 in the adapter 505 has a first portion 211 ending in a ridge 212. The first portion 211 is shorter than the fitting 385 of the disposable lid 350. As the adapter 505 is connected to the fitting 195 of the reusable outer lid 170 using projections 565 and grooves (not shown), the ridge 212 engages the top of the fitting 385 before the adapter 505 is fully engaged. Further engagement of the adapter 505 causes the ridge 212 to force the fitting 385 of the disposable lid 350 downward. This downward movement forces the sealing portion 380 outward against the disposable cup 55, increasing the area of the seal.

Although one embodiment of the invention has been described for one type of conduit, other conduits could also be used, as those skilled in the art would readily understand.

An alternate embodiment for the reusable outer lid is shown in Fig. 4. In this embodiment, the reusable outer lid 300 has an inner portion 305 and an outer portion 310. The outer portion 310 is generally frustoconical. The outer edge 315 defines an axis 320. The angle δa of the outer edge 315 is in a range of from about 10° to about 70° from the axis 320. As in the first embodiment, the angle δa is substantially the same as the angle β of the flange 120 of reusable cup holder 90.

The inner portion 305 is substantially flat. Alternatively, it could be at an angle different from the angle δa of the outer edge 315. It can optionally include one or more upward extending prongs 325. The prongs 325 can extend all or part of the way around the reusable outer lid 300. They can be positioned to mate with the legs 112 of an adjacent reusable cup holder 90a, allowing the fluid supply assemblies to be stacked on top of one another.

If the distance across the legs 112 of the reusable cup holder is smaller than the diameter of the lower end of the reusable cup and the reusable cup holder is to be used in a paint shaker, it may be desirable to include a second ring on the bottom of the reusable cup holder. The second ring should be the same (or substantially the same) diameter as the lower end of the reusable cup holder in order to transfer the paint shaker's clamping force to the side wall of the reusable cup holder, reducing deflection of the bottom of the reusable cup holder.

The reusable outer lid has a fitting 330 integrally connected to the inner portion 305. The fitting 330 has an opening 335 extending through it.

The outer edge 315 of the reusable outer lid 300 mates with the flange 120 of the reusable cup holder 90. There is a complementary connecting surface 340 at the outer edge 315 of the reusable outer lid 300. The complementary connecting surface 340 mates with the connecting surface 125 of the reusable cup holder 90 to seal the reusable cup holder 90 and reusable outer lid 300 together.

Alternate embodiments of the disposable cup are shown in Figs. 7-10. In Fig. 7, the disposable cup 400 has a generally cylindrical lower side wall portion 405, a generally frustoconical intermediate side wall portion 415, and a generally cylindrical upper side wall portion 420.

The outlet end 425 at the top of the disposable cup 400 is open, and the bottom 430 is closed. The lower side wall portion 405, intermediate side wall portion 415, and upper side wall portion 420, outlet end 425, and bottom 430 define an interior 435. The interior 435 is smaller than the interior 75. The smaller diameter of the lower side wall portion allows accurate measuring of the paint ratios when less paint is to be used.

The outlet end 425 defines an axis 440. There is a flange 445 extending outward and downward from the edge of the outlet end 425. The flange 445 extends downward at an angle αa in a range of from about 10° to about 70° from the axis 440 of the outlet end 425. The outlet end 425 is adapted to be placed into the reusable cup holder, so it sized to fit in the reusable cup holder.

Alternatively, the generally cylindrical lower side wall portion could be off centered, i.e., not concentric with the upper side wall portion. This would bring the lower side wall portion close to the side wall of the reusable cup holder, allowing easy reading of any measuring indicia.

In Figs. 8-10, the disposable cup 450 has a generally elliptical lower side wall portion 455, and intermediate side wall portion 460 extending from the lower side wall portion to the generally cylindrical upper side wall portion 465.

The outlet end 470 at the top of the disposable cup 450 is open, and the bottom 475 is closed. The lower side wall portion 455, intermediate side wall portion 460, and upper side wall portion 465, outlet end 470, and bottom 475 define an interior 480. The interior 480 is smaller than the interior 75. The elliptical shape makes it easier to read the indicia for measuring paint because the disposable cup extends close to the reusable cup holder. The

longer axis of the ellipse can extend all or substantially all the way across the diameter of the reusable cup holder, or something less than all or substantially all the way across the diameter.

The outlet end 470 defines an axis 485. There is a flange 490 extending outward and downward from the edge of the outlet end 470. The flange 490 extends downward at an angle αa in a range of from about 10° to about 70° from the axis 485 of the outlet end 470. The outlet end 470 is adapted to be placed into the reusable cup holder, so it sized to fit in the reusable cup holder.

In these embodiments, the distance across the outlet end of the disposable cup is greater than the distance across the bottom in at least one direction. The smaller portion of the disposable cup can extend the entire height of the side wall or less than the entire height of the side wall. If the side wall is cylindrical, and the smaller diameter portion extends the entire height of the sidewall, it can be connected to the flange by a flat annular portion. If it does not extend the entire height of the side wall, it can be can be connected by a generally frustoconical upper side wall portion. Other side wall arrangements are possible, as are well known to those of skill in the art.

This embodiment of the disposable cup can be used with the reusable cup holder and outer lid and disposable lid without any modification to the assembly, allowing different sizes of disposable cups to be used in the fluid supply assembly.

The fluid supply assembly has been shown and described with the disposable cup and reusable cup holder being generally cylindrical, which is a typical shape because of ease of manufacture and use. However, it could be made in other shapes, including, but not limited to, square, triangular, pentagonal, elliptical, etc.

While certain representative embodiments and details have been shown for purposes of illustrating the invention, it will be apparent to those skilled in the art that various changes in the compositions and methods disclosed herein may be made without departing from the scope of the invention, which is defined in the appended claims.

What is claimed is:

1. A method of preparing a fluid supply assembly for use with a fluid supply applicator comprising:

providing a fluid supply assembly comprising:

a flexible, disposable cup having a side wall, an open outlet end, and a closed bottom defining an interior;

a disposable lid having an integrally connected fitting, the fitting having an opening therethrough, the disposable lid having a sealing portion at an outside thereof adapted to fit into the open outlet end of the disposable cup, the sealing portion contacting the sidewall forming a seal with the sidewall, the seal having an area, wherein the sealing portion extends upward from the outside or downward from the outside;

a reusable cup holder having a side wall, an open upper end, and a lower end, the reusable cup holder being adapted to receive the disposable cup, the reusable cup having a connecting surface at the upper end;

a reusable outer lid having an integrally connected fitting, the fitting of the reusable outer lid having an opening therethrough, the fitting of the disposable lid adapted to fit into the fitting of the reusable outer lid, the reusable lid holder having a complementary connecting surface adapted to mate with the connecting surface on the reusable cup holder to seal the reusable cup holder and reusable outer lid together; and

a conduit having an opening therethrough, the conduit adapted to mate with the fitting of the reusable outer lid and the fitting of the disposable lid to provide a fluid connection from the interior of the disposable cup through the conduit;

placing the disposable cup in the reusable cup holder;

filling the disposable cup with fluid;

placing the disposable lid on the disposable cup, the sealing portion of the disposable lid fitting into the open outlet end of the disposable cup, the sealing portion contacting the sidewall forming the seal with the sidewall, the seal having the area;

attaching the reusable outer lid to the reusable cup holder;

attaching the conduit to the fitting of the reusable outer lid; and

deflecting the disposable lid downward, forcing the sealing portion outward against the sidewall thereby increasing the area of the seal.

2. The method of claim 1 wherein the opening in the conduit has a first portion ending in a ridge, the first portion having a length less than a length of the fitting of the disposable lid, the ridge engaging the fitting of the disposable lid and deflecting the disposable lid downward when the conduit is attached to the fitting of the reusable outer lid.

3. The method of claim 1 wherein the reusable outer lid has a projection extending downward, the projection engaging the disposable lid and deflecting the disposable lid downward when the reusable outer lid is attached to the reusable cup holder.

4. The method of claim 3 wherein the projection extends from the fitting.

5. A fluid supply assembly comprising:

a flexible, disposable cup having a side wall, an open outlet end, and a closed bottom defining an interior;

a disposable lid having an integrally connected fitting, the fitting having an opening therethrough, the disposable lid having a sealing portion at an outside thereof, the sealing portion adapted to fit into the open outlet end of the disposable cup, the sealing portion contacting the sidewall forming a seal with the sidewall, the seal having an area, wherein the sealing portion extends upward from the outside or downward from the outside;

a reusable cup holder having a side wall, an open upper end, and a lower end, the reusable cup holder being adapted to receive the disposable cup, the reusable cup having a connecting surface at the upper end; and

a reusable outer lid having an integrally connected fitting, the fitting of the reusable outer lid having an opening therethrough, the fitting of the disposable lid adapted to fit into the fitting of the reusable outer lid, the reusable lid holder having a complementary connecting surface adapted to mate with the connecting surface on the reusable cup holder to seal the reusable cup holder and reusable outer lid together, the reusable outer lid having a projection extending downward from an underside, the projection adapted to deflect the disposable lid downward, forcing the sealing portion outward against the sidewall thereby increasing the area of the seal.

6. The fluid supply assembly of claim 5 wherein the projection extends from the fitting.

7. The fluid supply assembly of claim 5 wherein the disposable cup further comprises a flange extending outward from the sealing portion.

8. The fluid supply assembly of claim 5 wherein the reusable cup holder has a flange extending outward from the upper end.

9. The fluid supply assembly of claim 5 wherein the disposable cup, the disposable lid, the reusable outer lid, and the reusable cup holder are made of a polymeric material.

10. The fluid supply assembly of claim 5 wherein the disposable cup is made of an antistatic material.

11. The fluid supply assembly of claim 5 wherein the disposable cup has indicia for measuring fluids on the side wall.

12. The fluid supply assembly of claim 5 wherein the reusable cup holder has indicia for measuring fluids on the side wall.

13. The fluid supply assembly of claim 5 wherein the sidewall of the disposable cup has a first portion adjacent to the outlet end, a second portion adjacent to the bottom, and a third

portion between the outlet end and the bottom, the first and second portions having a thickness greater than a thickness of the third portion.

14. The fluid supply assembly of claim 13 wherein the thickness of the first and second portions is in a range of about 2 to about 3 times the thickness of the third portion.

15. A fluid supply assembly comprising:

a flexible, disposable cup having a side wall, an open outlet end, and a closed bottom defining an interior;

a disposable lid having an integrally connected fitting, the fitting having an opening therethrough, the disposable lid having a sealing portion at an outer edge thereof, the sealing portion adapted to fit into the open outlet end of the disposable cup, the sealing portion contacting the sidewall forming a seal with the sidewall, the seal having an area;

a reusable cup holder having a side wall, an open upper end, and a lower end, the reusable cup holder being adapted to receive the disposable cup, the reusable cup having a connecting surface at the upper end;

a reusable outer lid having an integrally connected fitting, the fitting of the reusable outer lid having an opening therethrough, the fitting of the disposable lid adapted to fit into the fitting of the reusable outer lid, the reusable lid holder having a complementary connecting surface adapted to mate with the connecting surface on the reusable cup holder to seal the reusable cup holder and reusable outer lid together; and

a conduit having an opening therethrough, the conduit adapted to mate with the fitting of the reusable outer lid and the fitting of the disposable lid to provide a fluid connection from the interior of the disposable cup through the conduit, the opening in the conduit having a first portion ending in a ridge, the first portion having a length less than a length of the fitting of the disposable lid, the ridge adapted to engage the fitting of the disposable lid to deflect the disposable lid downward, forcing the sealing portion outward against the sidewall thereby increasing the area of the seal.

16. The fluid supply assembly of claim 15 wherein the disposable cup further comprises a flange extending outward from the sealing portion.

17. The fluid supply assembly of claim 15 wherein the reusable cup holder has a flange extending outward from the upper end.

18. The fluid supply assembly of claim 15 wherein the disposable cup, the disposable lid, the reusable outer lid, and the reusable cup holder are made of a polymeric material.

19. The fluid supply assembly of claim 15 wherein the disposable cup is made of an antistatic material.

20. The fluid supply assembly of claim 15 wherein the disposable cup has indicia for measuring fluids on the side wall.

21. The fluid supply assembly of claim 15 wherein the reusable cup holder has indicia for measuring fluids on the side wall.

22. The fluid supply assembly of claim 15 wherein the sidewall of the disposable cup has a first portion adjacent to the outlet end, a second portion adjacent to the bottom, and a third portion between the outlet end and the bottom, the first and second portions having a thickness greater than a thickness of the third portion.

23. The fluid supply assembly of claim 22 wherein the thickness of the first and second portions is in a range of about 2 to about 3 times the thickness of the third portion.

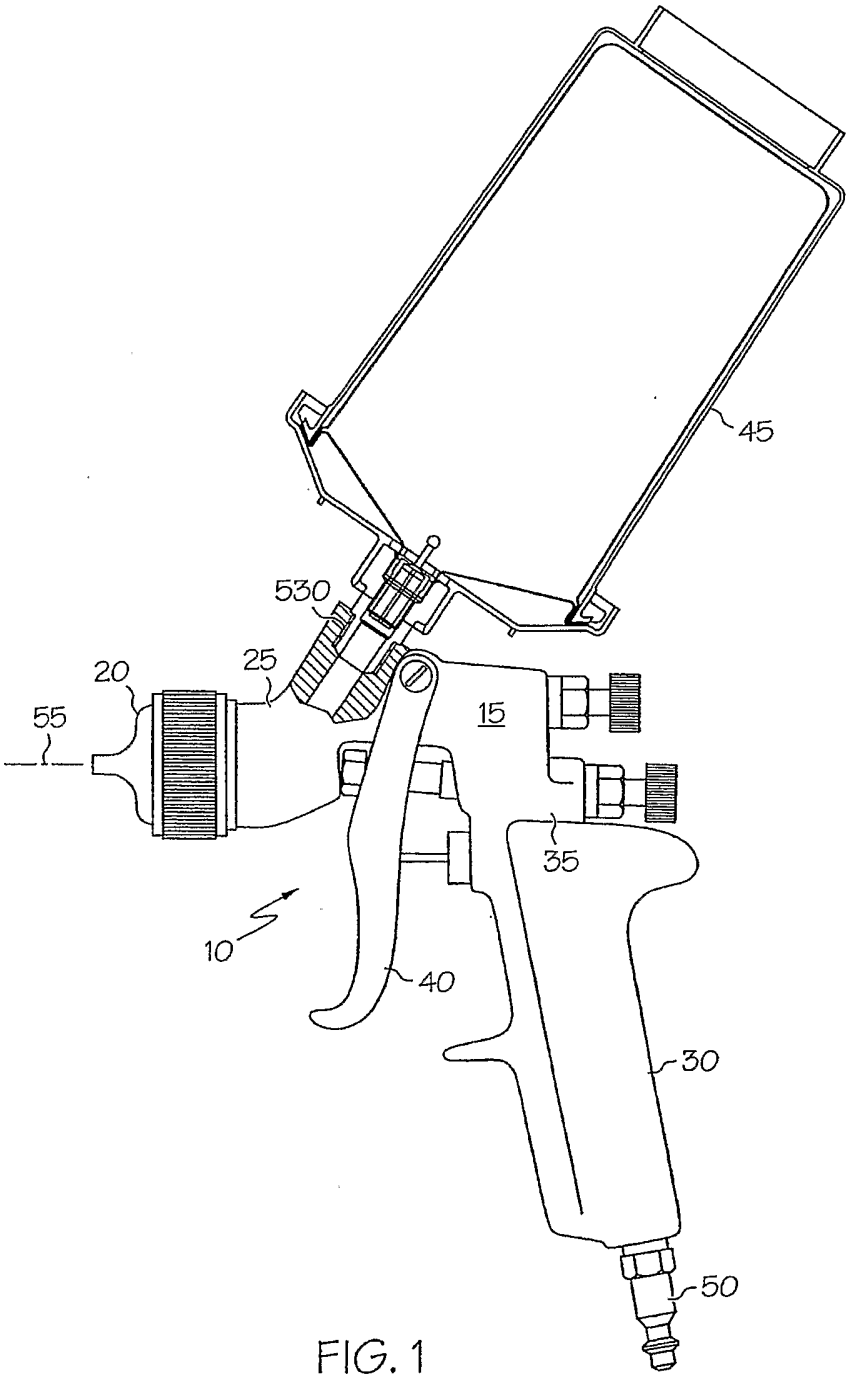

FIG. 1

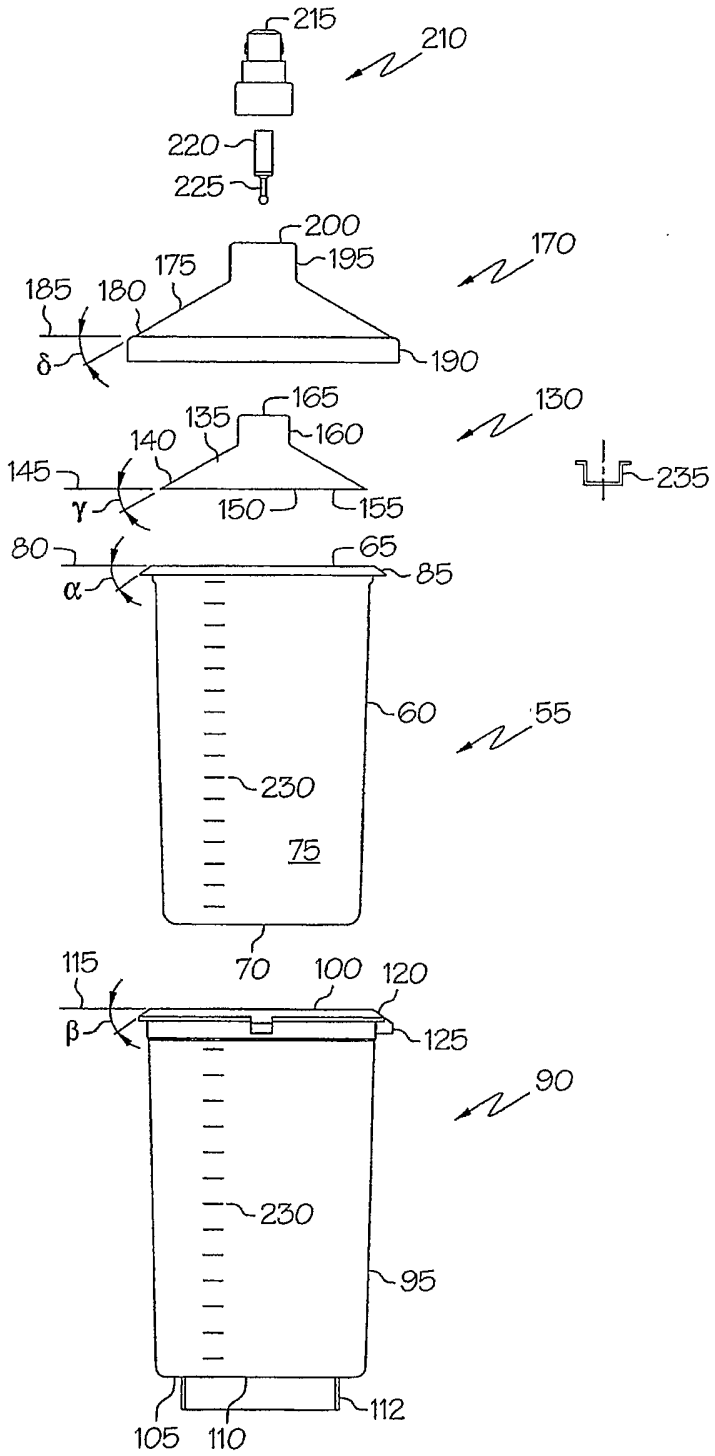
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FIG. 2

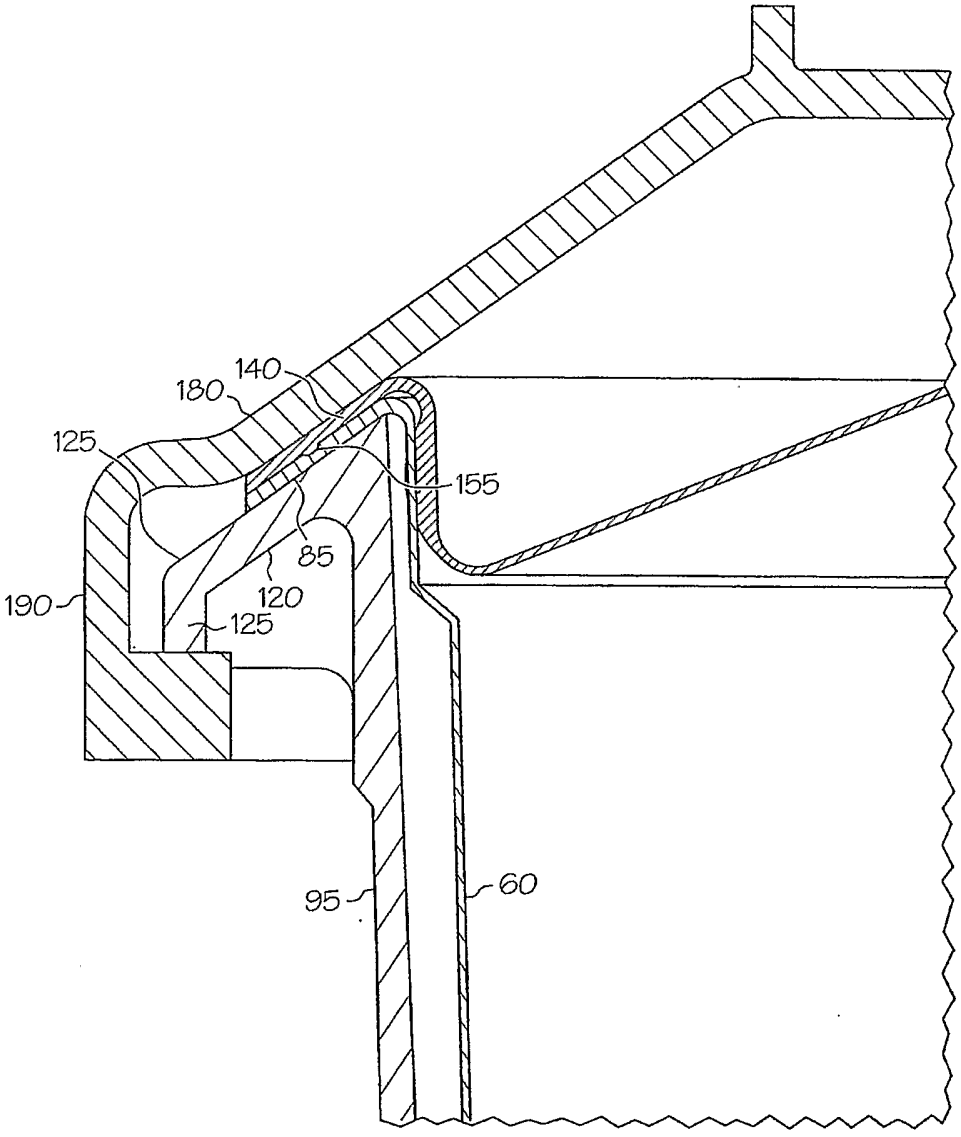
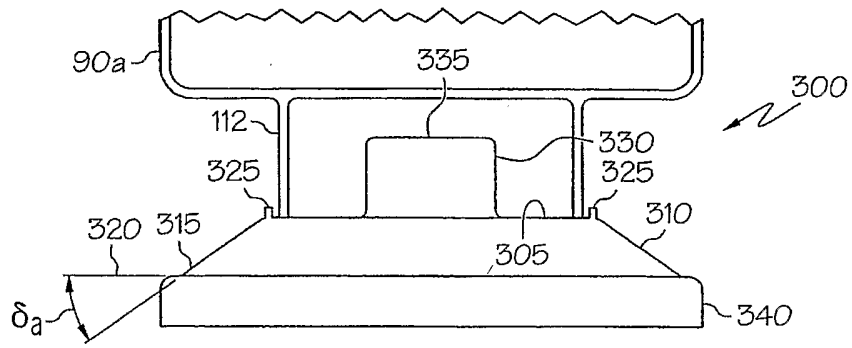


FIG. 3


90a
335
300
112
330
325
325
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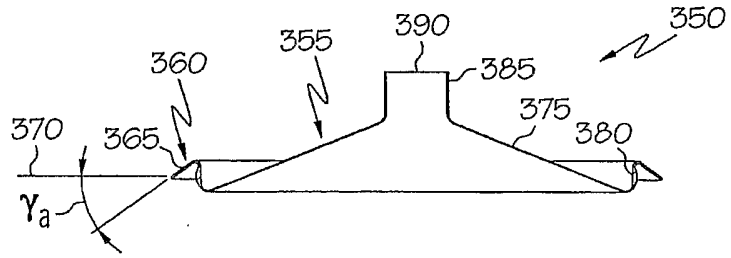
310
305
δ_a
340

FIG. 4


350
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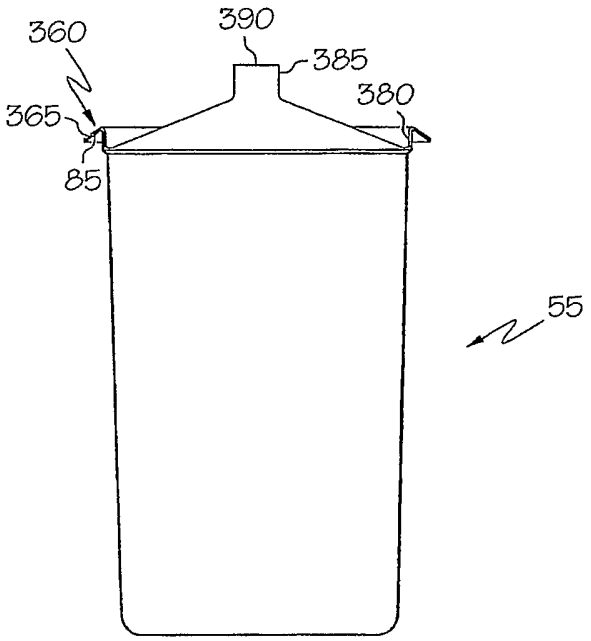
365
380
γ_a

FIG. 5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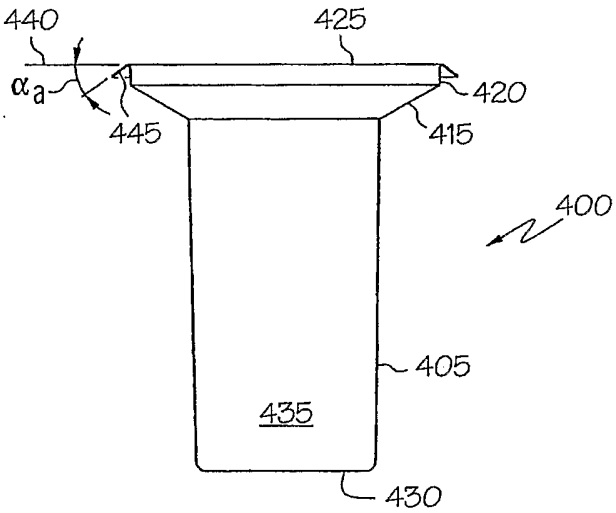
85
55

FIG. 6


440
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α_a
420
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415
400
405
435
430

FIG. 7

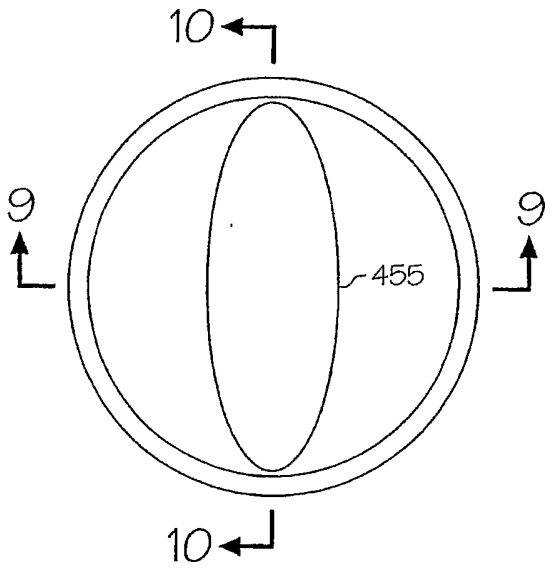

FIG. 8

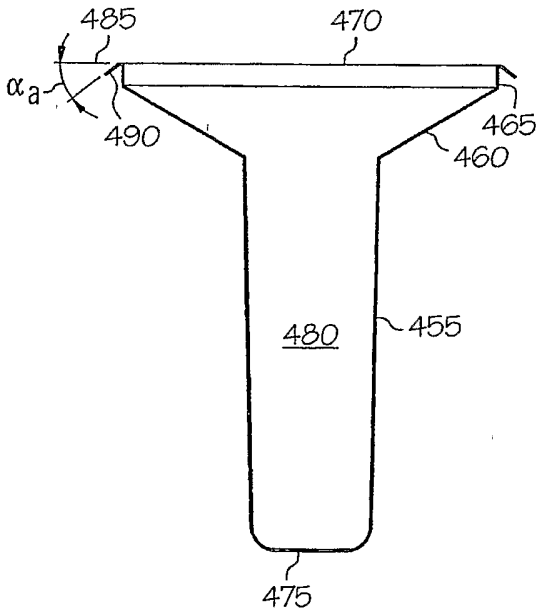

FIG. 9

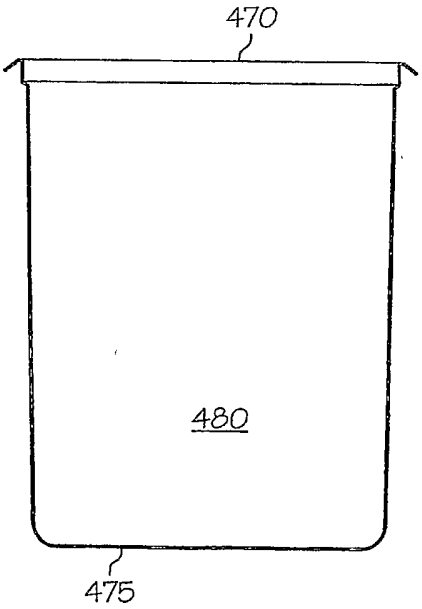

FIG. 10

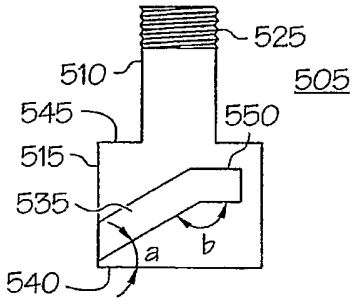

FIG. 11

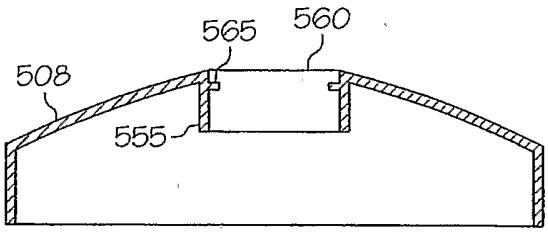

FIG. 12

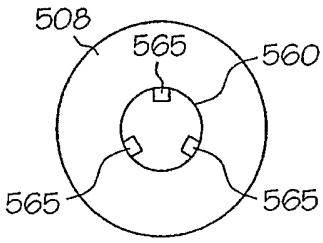

FIG. 13

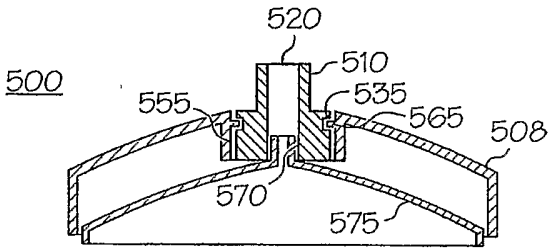

FIG. 14

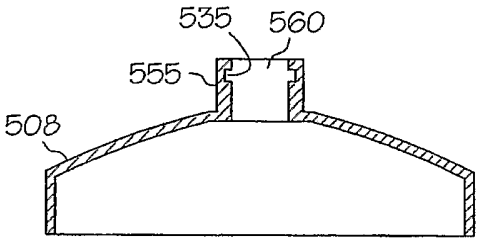

FIG. 15

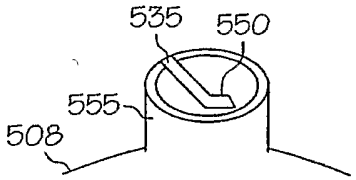

FIG. 16

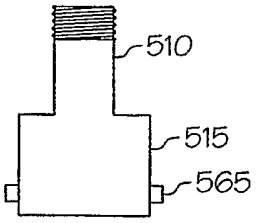

FIG. 17

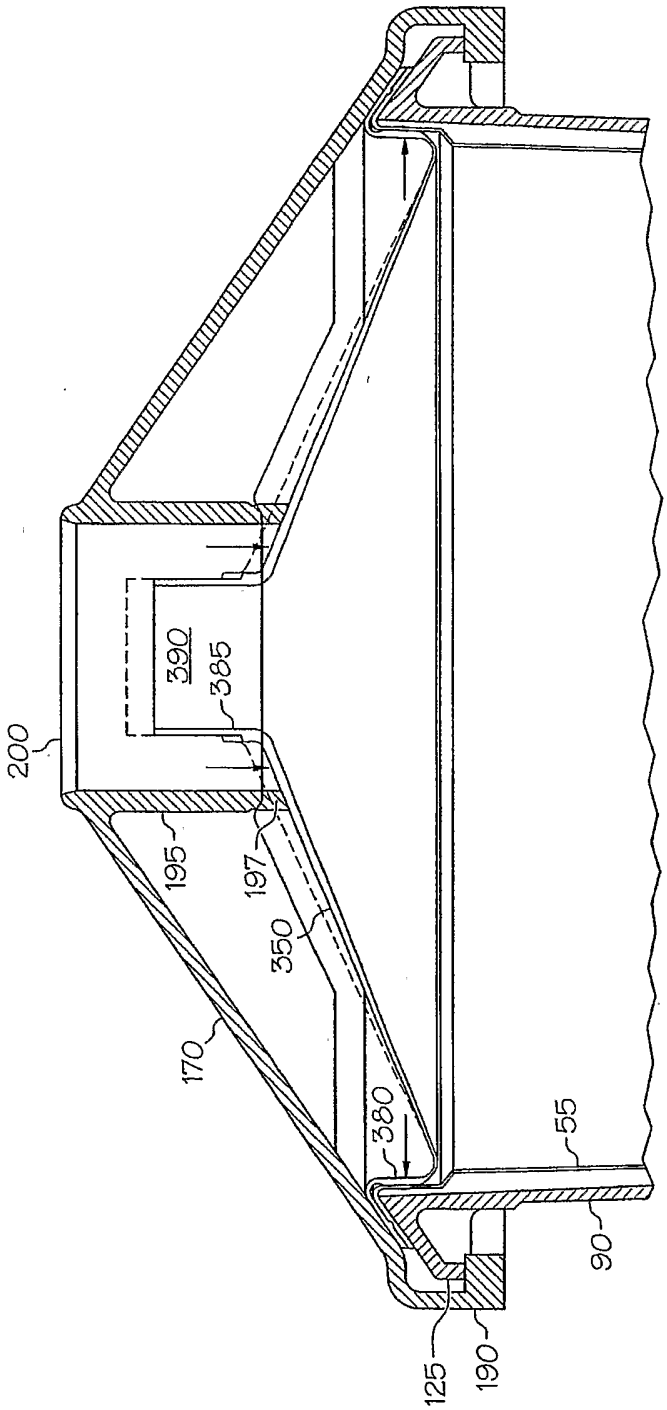

FIG. 18

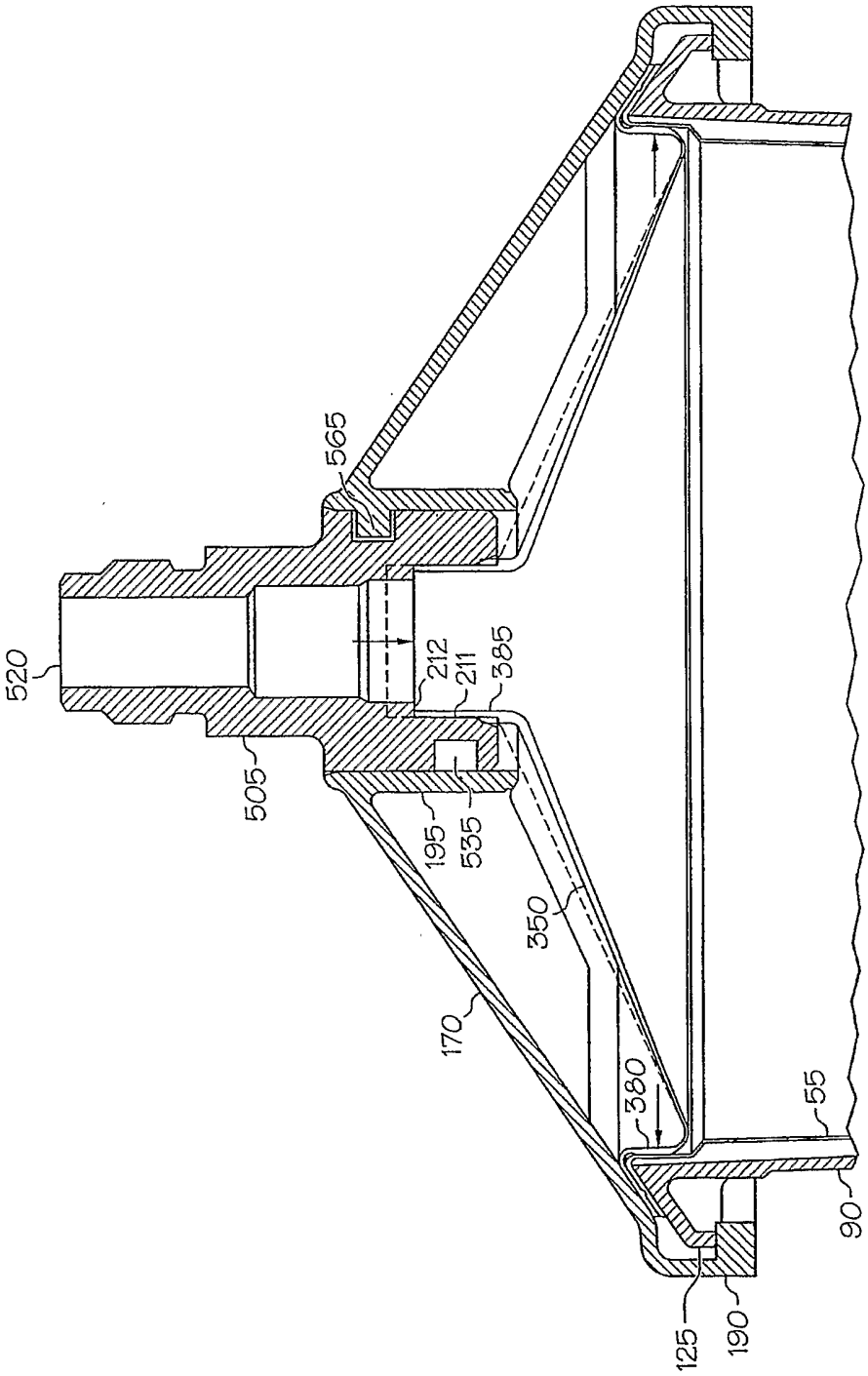

FIG. 19

INTERNATIONAL SEARCH REPORT

Inter al Application No
PCT/US2005/019098

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B05B7/24

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)
IPC 7 B05B

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 practical, search terms used)
EPO-Internal, PAJ, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FR 2 798 868 A (INJELEC) 30 March 2001 (2001-03-30) page 4, line 21 - page 8, line 23; figures -----	1
A	WO 03/045575 A (RUDA, MARTIN) 5 June 2003 (2003-06-05) page 12, line 12 - page 13, line 28; figures 3,4 -----	1,5,15
A	FR 2 774 928 A (INJELEC) 20 August 1999 (1999-08-20) page 5, line 27 - page 9, line 2; figures 2,6 -----	1,5,15
A	EP 1 424 135 A (ANEST IWATA EUROPE SRL) 2 June 2004 (2004-06-02) paragraphs '0017! - '0027!; figures 2,3 ----- -/--	1,5,15

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"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)

"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

"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

"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

"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.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
26 September 2005	04/10/2005

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Innecken, A

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INTERNATIONAL SEARCH REPORT

Inte nal Application No
PCT/US2005/019098

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	PATENT ABSTRACTS OF JAPAN vol. 1995, no. 03, 28 April 1995 (1995-04-28) -& JP 06 335643 A (HORIE KINZOKU KOGYO KK), 6 December 1994 (1994-12-06) abstract; figure 3	1,5,15
A	US 3 401 842 A (MORRISON, LESTER G.) 17 September 1968 (1968-09-17) column 2, line 1 - column 4, line 17; figures 1-3	1,5,15

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/US2005/019098

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
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			AU	2002342550 A1	10-06-2003
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FR 2774928	A	20-08-1999	NONE		
EP 1424135	A	02-06-2004	NONE		
JP 06335643	A	06-12-1994	NONE		
US 3401842	A	17-09-1968	NONE		