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Malin et al.

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(54) **LIQUID DISPENSER PINCH VALVE**

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B67D 7/80 (2010.01)

(52) **U.S. Cl.**
USPC **222/146.6**; 222/212; 222/517; 222/529; 222/532; 251/10; 62/396

(58) **Field of Classification Search**
USPC 251/7, 9–10; 62/389, 391, 393, 396; 222/146.6, 212–214, 391, 323–324, 222/469–474, 517, 527–532
See application file for complete search history.

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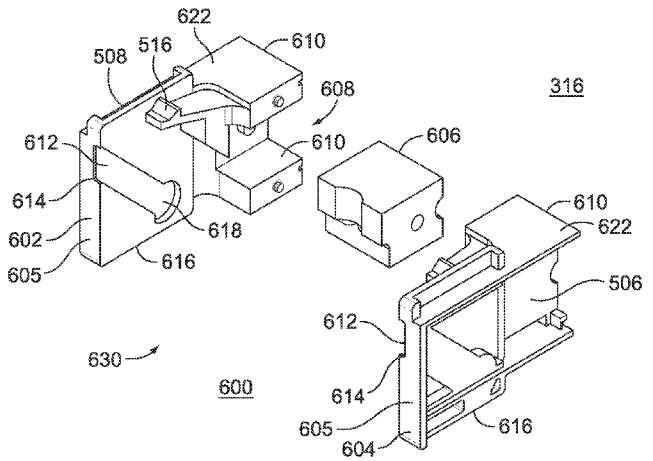
(57) **ABSTRACT**

A two-piece pinch valve is disclosed. A first piece or part of the valve is fixedly installed into a dispensing cabinet. A second piece or part having a movable pinch bar that pinches and un-pinches a tube is installable into and removable from the first piece by hand. Removal of the second piece from the first pieces allows a tube to be directly installed into the pinch valve. Installation of the second piece into the first piece configures the valve for operation. The second piece is installed into slots in the first piece. The slots and engaging protuberances on the second piece enable the second piece to be locked in place.

13 Claims, 12 Drawing Sheets



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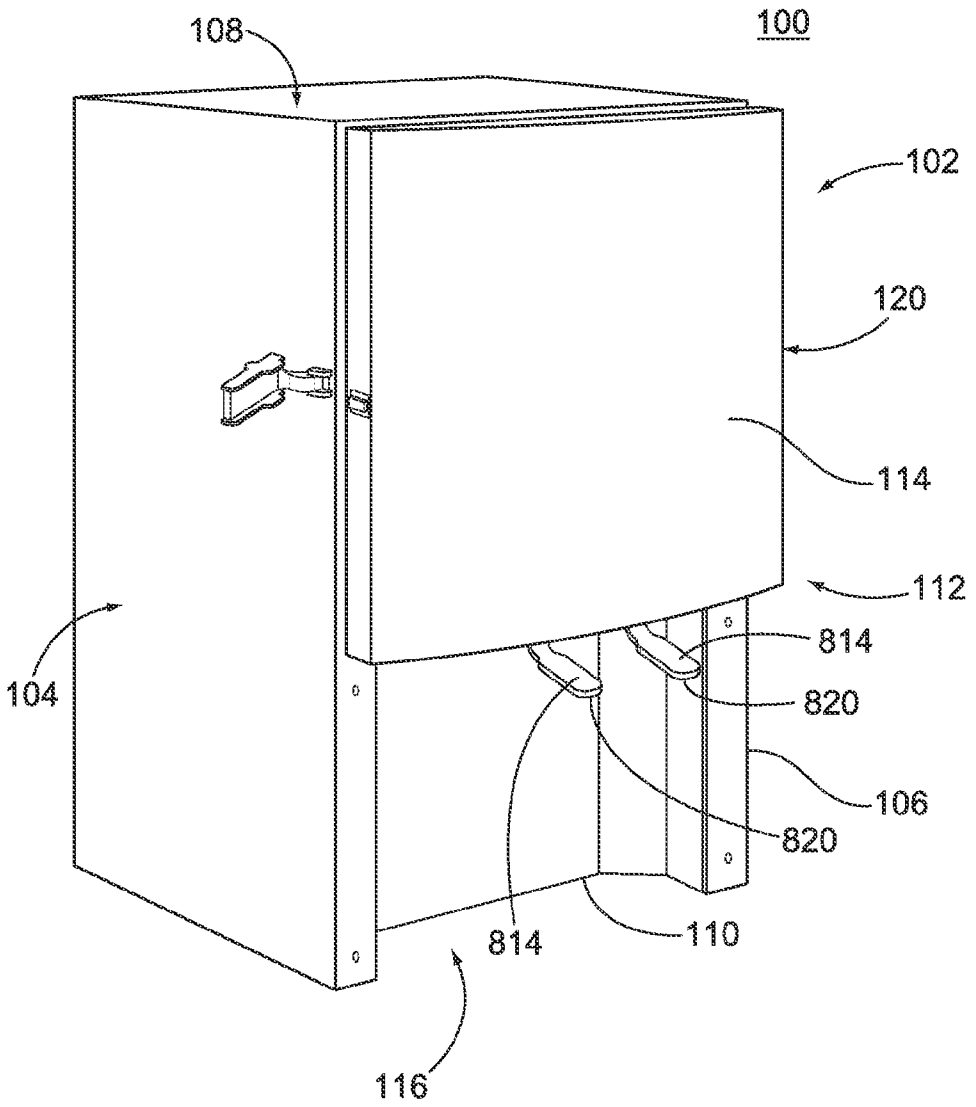

FIG. 1

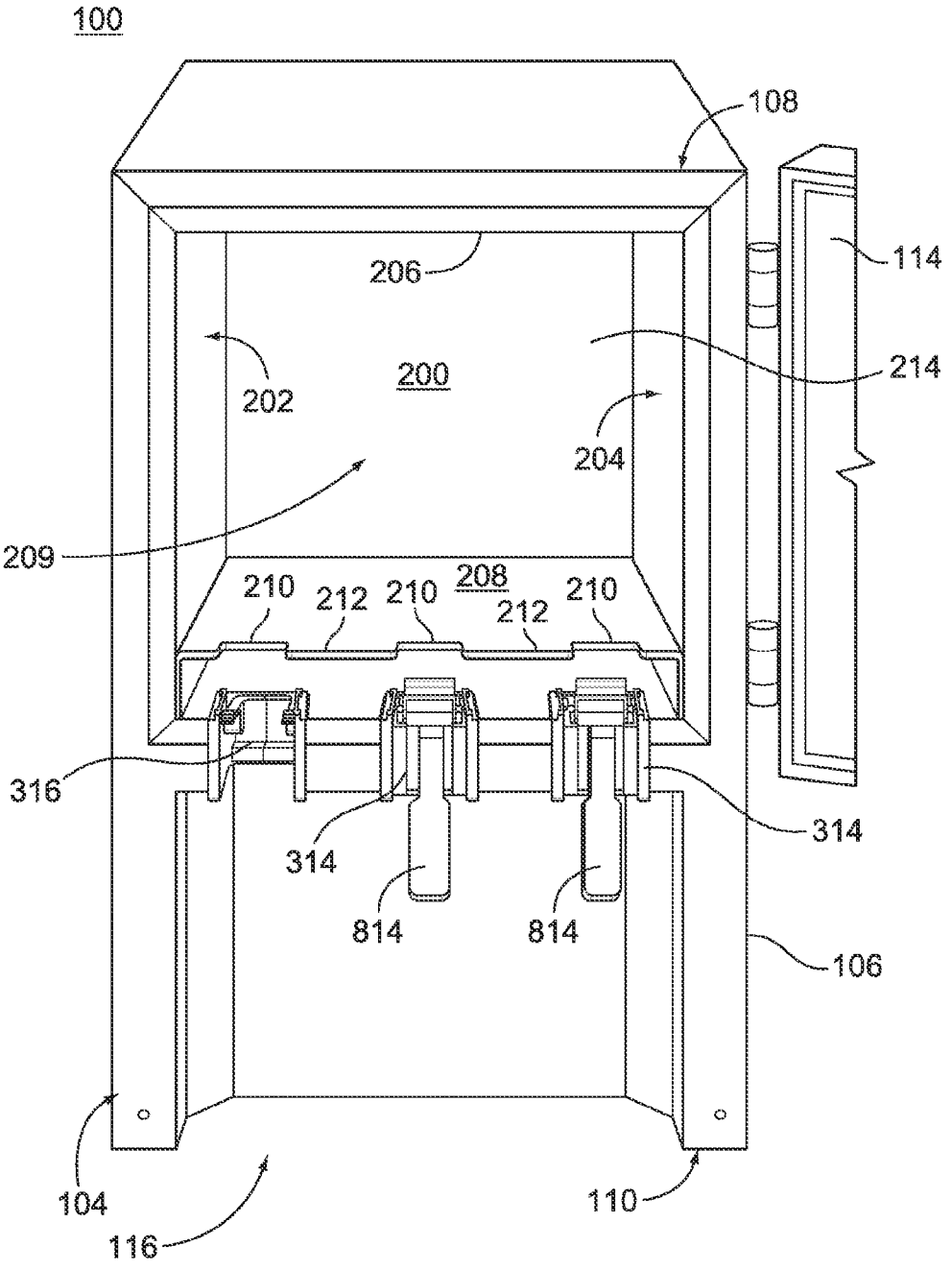
100
108
114
206
214
202
200
204
209
210
212
210
208
212
210
316
314
314
814
814
106
104
116
110

FIG. 2

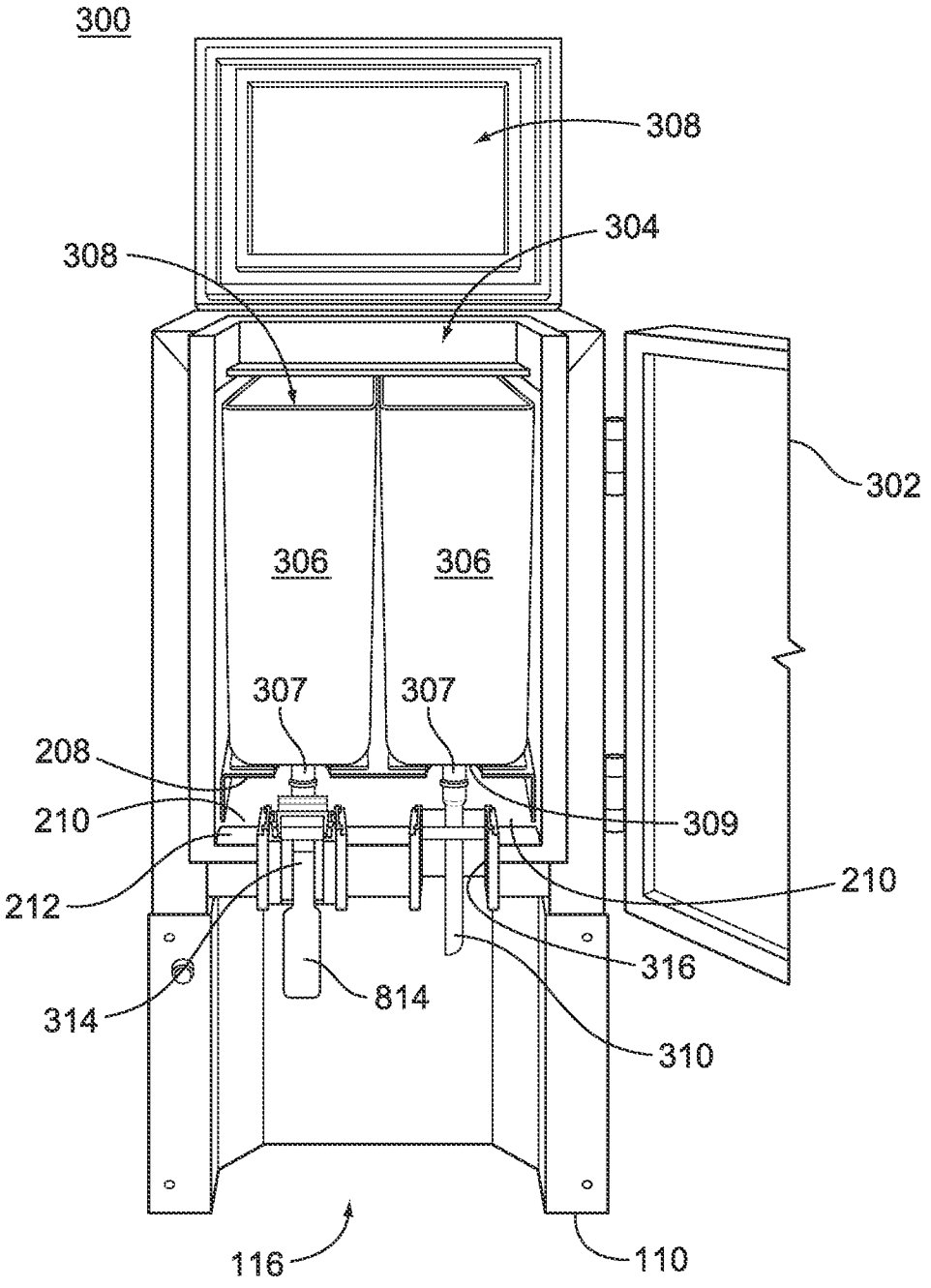
300
308
308
304
302
306
306
307
307
208
210
309
210
212
316
814
314
310
116
110

FIG. 3A

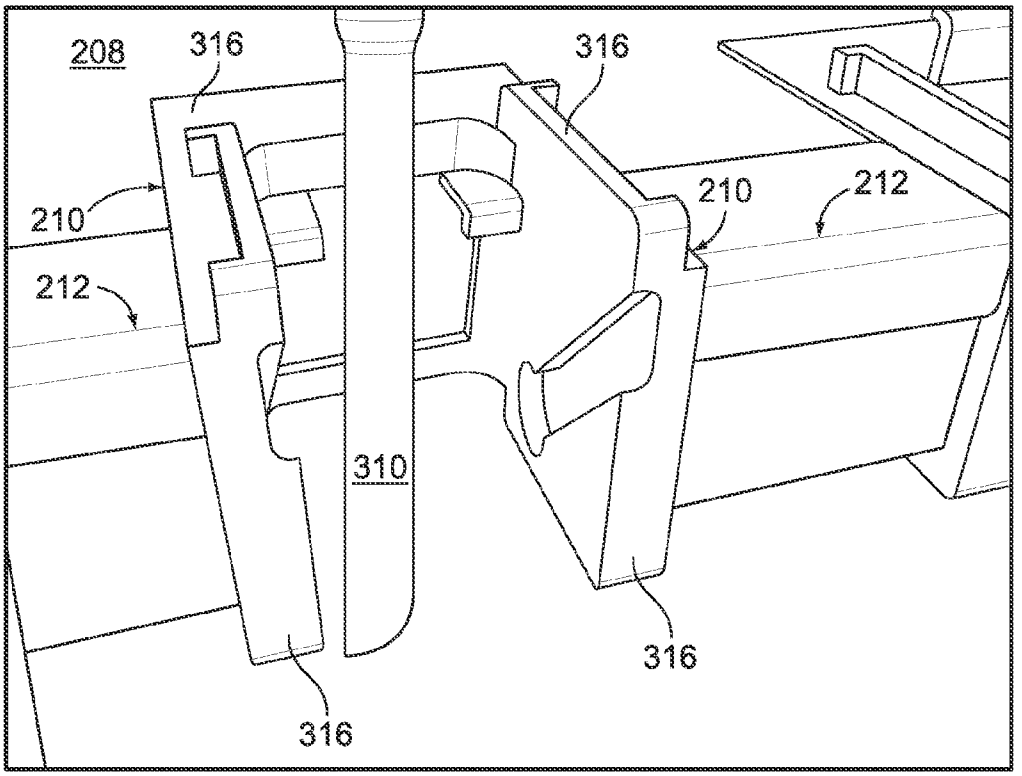

FIG. 3B

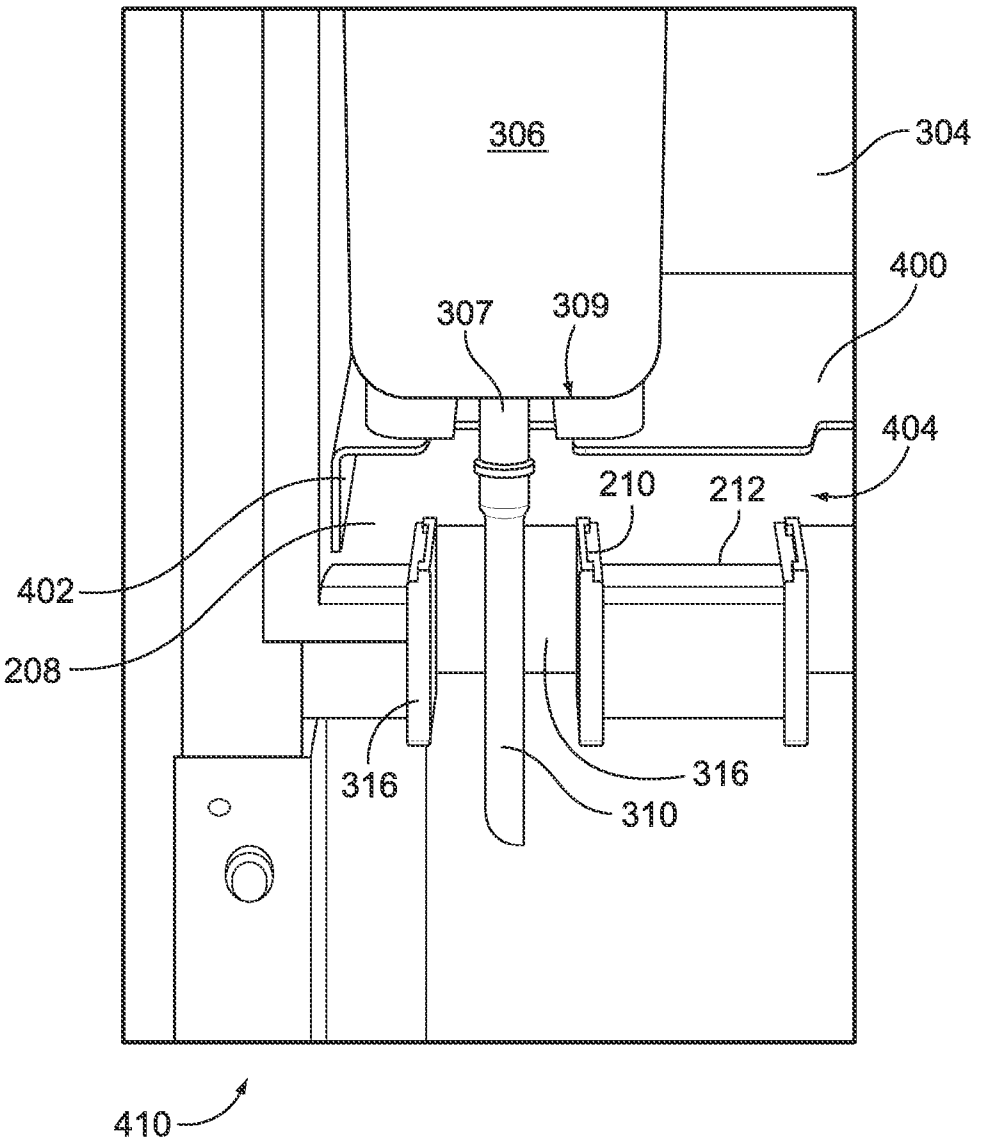

FIG. 4

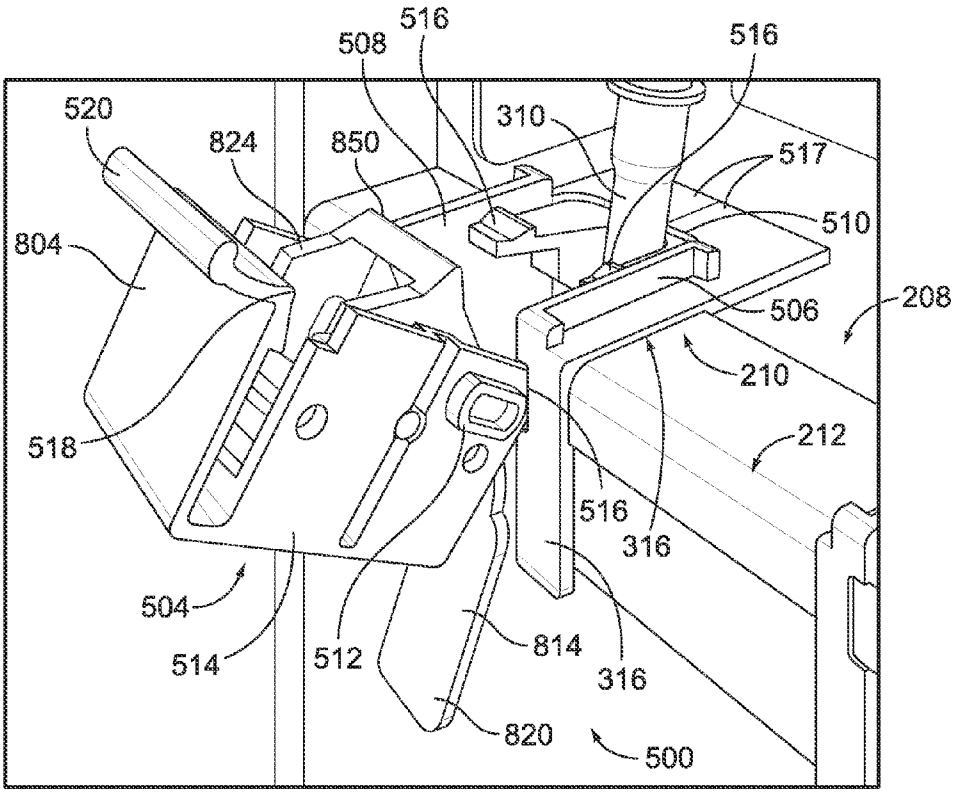
516
508
516
520
824
850
310
517
510
804
506
208
210
518
212
516
316
504
514
512
814
316
820
500

FIG. 5

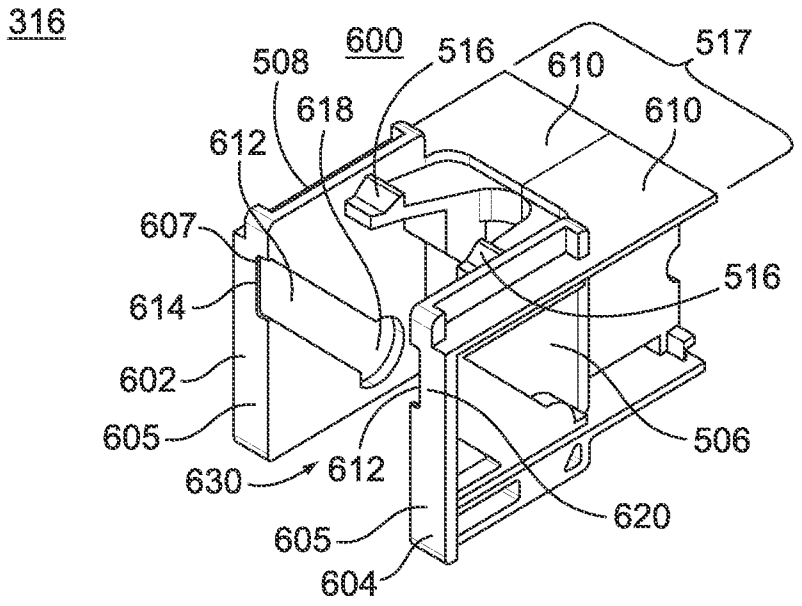
316
600
508
516
517
610
610
618
612
607
516
614
602
605
630
612
506
620
605
604

FIG. 6A

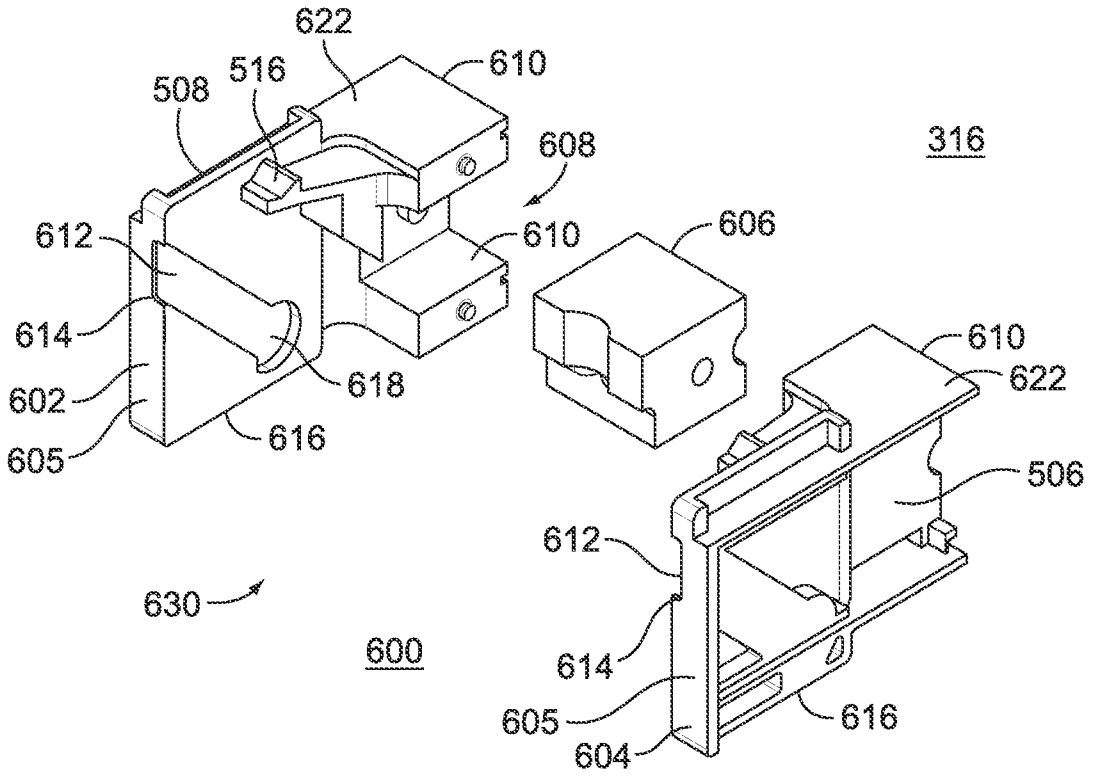
622
610
516
508
608
316
612
610
606
614
618
602
616
605
610
622
506
612
630
600
614
605
616
604

FIG. 6B

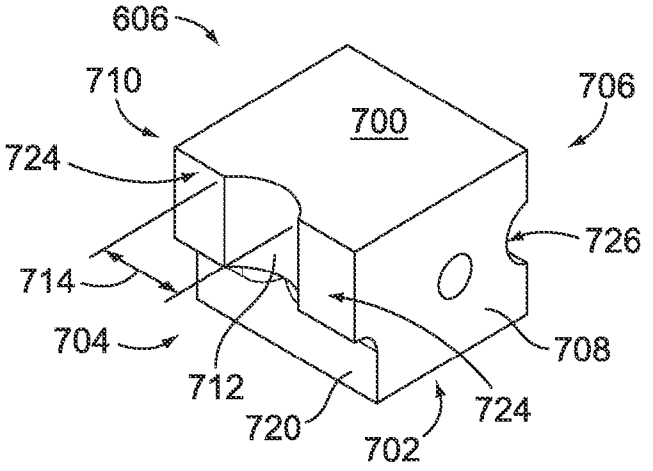

FIG. 7A

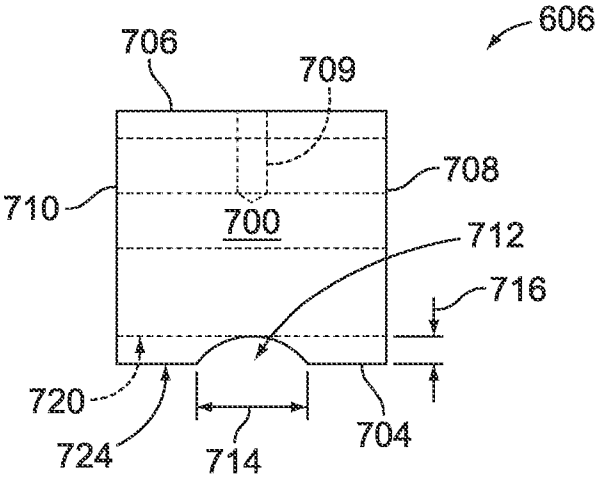

FIG. 7B

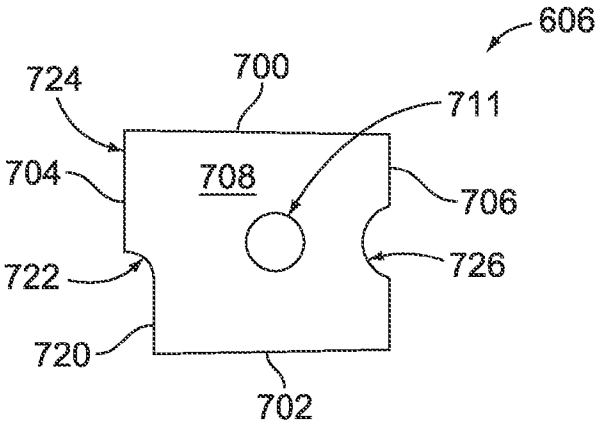

FIG. 7C

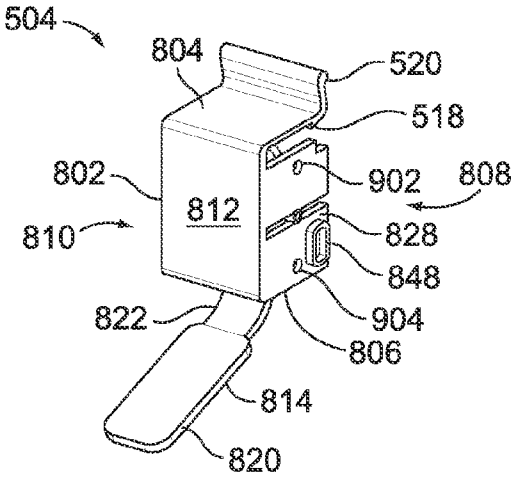
504
804
520
518
802
902
808
812
810
828
848
822
904
806
814
820

FIG. 8A

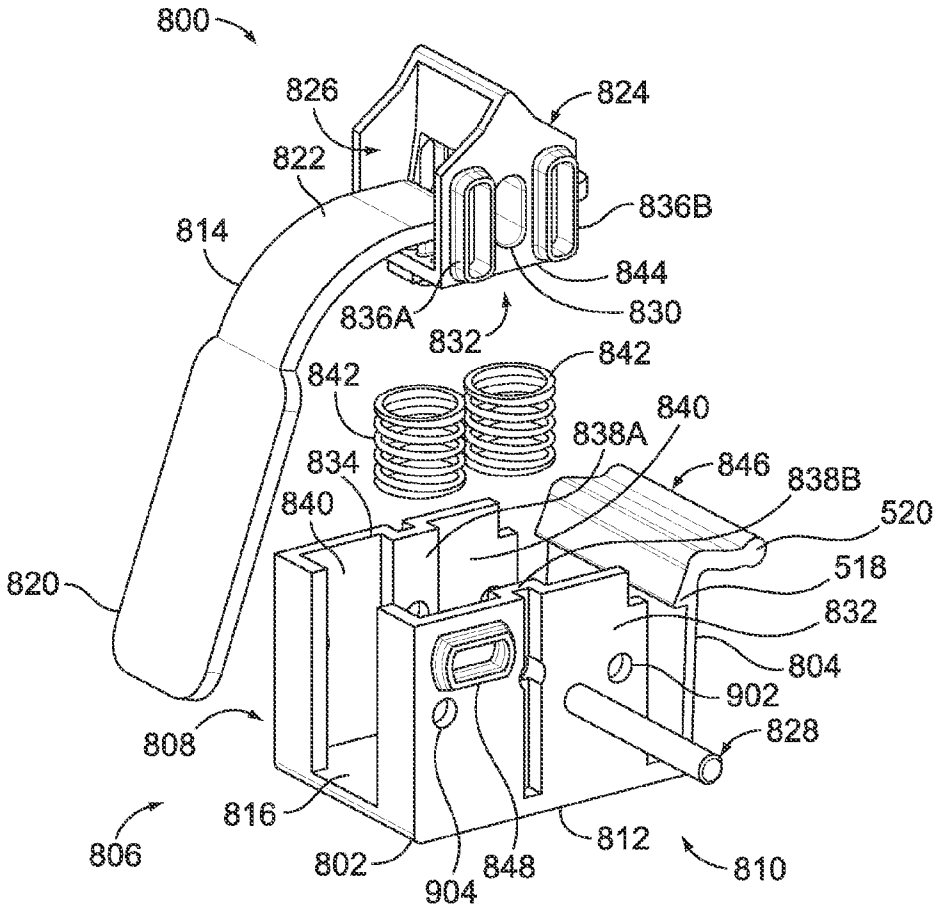
800
826
824
822
836B
814
844
836A
830
832
842
842
840
838A
834
846
838B
840
520
820
518
832
804
902
808
828
816
806
802
848
812
810
904

FIG. 8B

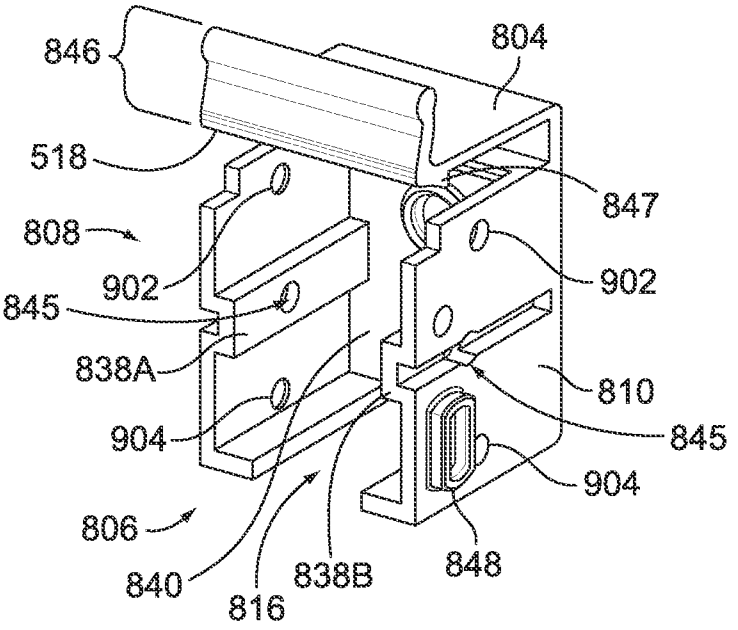
846
804
518
847
808
902
902
845
838A
810
845
904
904
806
840
816
838B
848

FIG. 8C

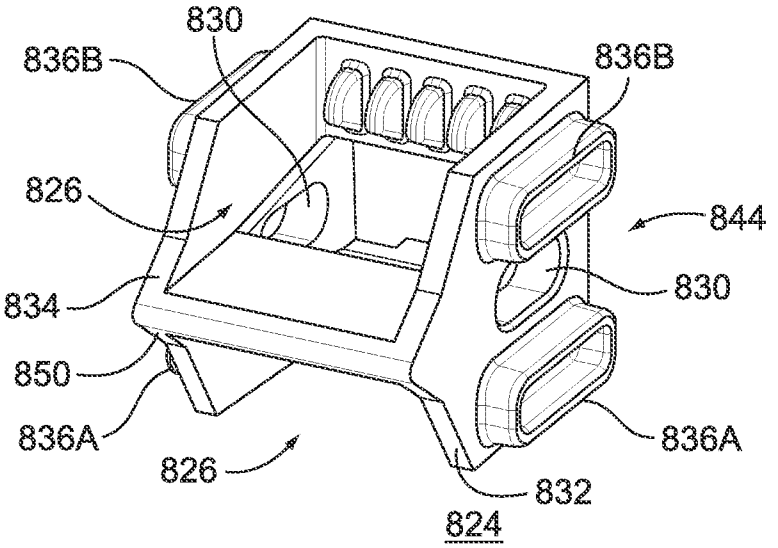
830
836B
836B
826
844
834
830
850
836A
836A
826
832
824

FIG. 8D

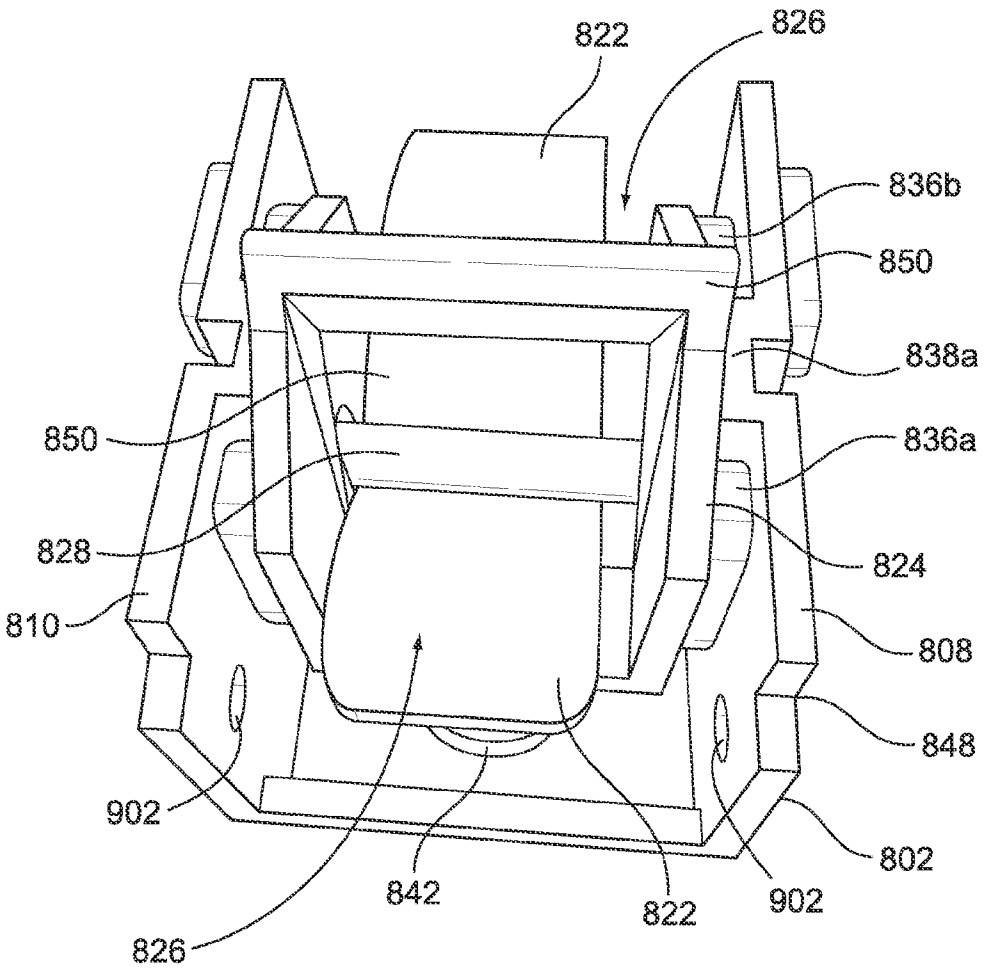
822
826
836b
850
838a
850
836a
828
824
810
808
848
902
802
842
822
902
826

FIG. 8E

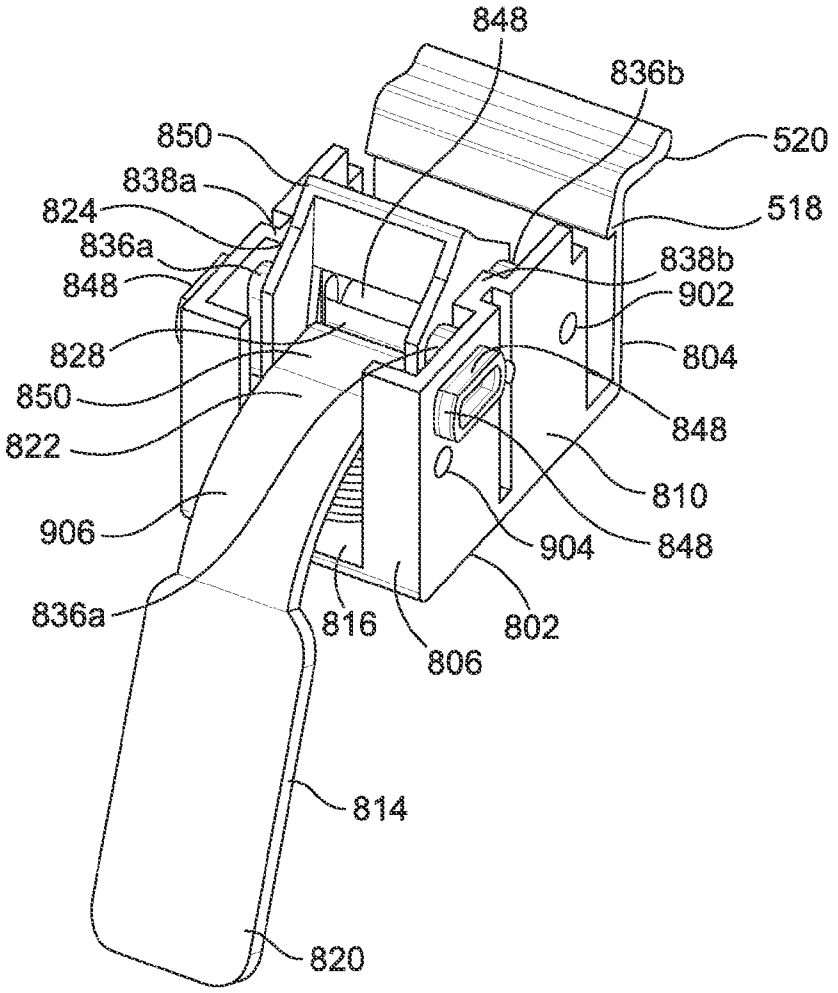
848
836b
850
520
838a
824
518
836a
838b
848
902
828
804
850
848
822
810
906
904
848
836a
816
802
806
814
820

FIG. 9

LIQUID DISPENSER PINCH VALVE

BACKGROUND

A pinch valve is a valve that is operable with a flexible tubing or hose and which is capable of pinching the tube or hose using a tube-pinching mechanism. Pinch valves are typically full bore, linear action valves that can be used in an off/on manner. However, some pinch valves can be used in a variable position or throttling service.

Pinch valves are used in many medical and pharmaceutical applications. They are also used in food dispensing applications because advantages of pinch valves include cleanliness, excellent drainage, and ease of cleaning. In addition to cleanliness, another advantage of pinch valves is their operation speed. Most pinch valves are simply on-off valves; they open and close a flexible tube using a pinch bar that moves between two positions. Moving a pinch bar through two, fixed locations can be done quickly.

A problem with prior art pinch valves, especially those used with a liquid dispenser is that they do not facilitate the installation and removal of the bulk containers from which liquids are dispensed. Stated another way, prior art pinch valves typically require disassembly to install and/or remove a tube passing through them and also for cleaning. Disassembling a prior art pinch valve is difficult and time consuming. A pinch valve that can be disassembled quickly and easily would be an improvement over the prior art.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of a dispenser for liquids;

FIG. **2** is a front elevation view of the liquid dispenser;

FIG. **3**A is a front elevation view of a liquid dispenser, the door of which is removed;

FIG. **3**B is a perspective view of a dispensing tube inserted into the first part of the pinch valve;

FIG. **4** is a close-up view of a refrigerated liquid dispenser compartment and depicting how the tank is placed directly into the compartment;

FIG. **5** is a perspective view of the clamp section of the pinch valve;

FIG. **6**A is a perspective view of the frame section of the pinch valve;

FIG. **6**B is an exploded view of the frame section of the pinch valve;

FIG. **7**A is a perspective view of the latch;

FIG. **7**B is a top view of a heat sink in the pinch valve frame section;

FIG. **7**C is a right-side view of a heat sink in the pinch valve frame section;

FIG. **8**A is a perspective view of a preferred embodiment of a removable clamp part of the pinch valve;

FIG. **8**B is a perspective view of the clamp body and pinch bar;

FIG. **8**C is a perspective view of the open interior of the clamp body;

FIG. **8**D is a perspective view of the pinch bar viewed from the apex ridge;

FIG. **8**E is a perspective view into the open sides of the pinch bar; and

FIG. **9** is a perspective view of the assembled clamp section.

DETAILED DESCRIPTION

FIG. **1** is a perspective view of a refrigerated liquid dispenser **100**. The dispenser **100** is comprised of a cabinet **102** having a left side **104**, a right side **106**, a top **108**, a bottom **110** and a front side **112**. The front side **112** is comprised of a door **114** attached by a hinge (not visible in FIG. **1**) to the right side **106** of the cabinet **102**. Refrigeration equipment comprised of a compressor, condenser and a fan are enclosed inside a refrigeration equipment compartment **116** located below a refrigerated storage compartment **120**, which is located behind the hinged door **114**.

FIG. **2** is a front elevation view of the liquid dispenser **100** with the door **114** open to reveal the inside of the refrigerated storage compartment **200**. The refrigerated storage compartment **200** has a left side **202**, a right side **204**, a top **206**, a bottom **208** and a rear panel **209**. The sides, top and bottom are thermally insulated. The insulation is not shown but well-known to those of ordinary skill in the art and further discussion of it is omitted for brevity.

The bottom **208** of the refrigerated storage compartment **200** has a front edge **212** into which slots **214** are formed. The slots **214** receive pinch valves described below. The pinch valves are comprised of two pieces. A first part is fixed in a slot **214**. The second part of the pinch valve is removable from the first part in order to allow a flexible tube extending downwardly from a liquid storage bin in the refrigerator storage compartment **200** to be received directly into the first part of the valve wherein the tube is pinched and un-pinched.

FIG. **3**A is a front elevation view of a liquid dispenser **100**, the door **114** of which is removed to reveal a refrigerated compartment **300** having two liquid storage tanks **302** side-by-side in the compartment **300**. The top **301** is hinged to a back side of the cabinet **102** to allow tanks **302** to be refilled without having to remove them from the compartment **200**.

The tanks **302** shown in FIG. **3**A are known in the art. They are plastic, substantially rectangular in shape and with an open top **304** into which liquid can be poured. The tanks have bottoms **309** with openings, not visible in FIG. **3**A but from which flexible plastic tubes **310** extend downwardly from short and relatively rigid cylinders. The tube from the left-side tank **302** is shown passing through an assembled pinch valve **314**. The tube from the right-side tank **302** is shown passing through the aforementioned first part **316** of the pinch valve, i.e., the second part of the valve is removed.

Controllably dispensing liquid from the tanks **302** requires the flexible plastic tubes **310** to be opened and closed. Opening and closing the flexible tubes **310** is accomplished using a pinch valve **314**, which is considered herein to be a full bore control valve that uses a pinching effect to obstruct fluid flow.

A problem with many prior art pinch valves is that they require a tube to be threaded through the valve. Threading a tube through a pinch valve means passing the flexible tube through a pinch valve in a manner akin to inserting a strand through a small opening. Threading a tube through a prior art pinch valve usually requires manipulating the tube through the valve from the top by bending folding. It is time consuming, tedious and usually requires supporting a relatively heavy, liquid-filled container.

The pinch valve **314** disclosed herein is comprised of two sections or portions that can be quickly and easily separated from each other without tools or special equipment in order to enable a dispensing tube **310** to be inserted directly into the "valve," i.e., without having to feed or thread a tube through the valve **314**. FIG. **3**B shows a dispensing tube **310** from a tank inserted into a substantially U-shaped first part of the valve **314**, which is preferably fixed into a slot **210** formed in the front edge **212** of the bottom **208** of the refrigerated compartment using an adhesive.

The first part of the valve **314** is referred to herein as a frame section **316**. When viewed from above or below, the

frame section has a shape reminiscent of the upper case Arabic letter "U." Its shape is also reminiscent of the Greek letter "Π" which is also known as "pi." When viewed from above or below, its shape is also reminiscent of the mathematical symbol for intersection (∩) and union. A second section that is removable from the frame section **316** is referred to as a removable clamp section. The clamp section is described below. For brevity, such shapes (∩, U, Π) and equivalents thereof are collectively referred to hereinafter as U-shaped or substantially U-shaped.

FIG. **4** depicts a tank **306** in the compartment **300** and its associated flexible tube **310** descending downward after being placed directly into the first part **410** of the pinch valve **314**. The tube **310** can be seen in its entirety, extending, downwardly from the bottom **309** of the tank **306** a distance of between about six and about ten inches. FIG. **4** also shows that there is no structure or mechanism through which the tube **310** needs to be placed or threaded. The tube is simply placed into a substantially U-shaped frame portion or section **316**. The frames section **316** is considered herein to be a first part of the pinch valve **314**.

The bottom **309** of the tank **306** rests on a support plate **400**. The support plate **400** has a side wall **402** that defines an air gap **404** below the support plate **400** and above the bottom **208** of the storage compartment **200**. The notch **210** formed at the front edge **212** of the bottom **208** is configured to receive the pinch valve assembly that is comprised of the aforementioned U-shaped frame section **316**, which receives a clamp section that is removable from the frame section **316**.

FIG. **5** is a perspective view of the clamp section **504**, shown removed from the frame section **316** and inclined at an angle relative to the horizontal bottom surface **208** of the refrigerated storage compartment **200**. The frame section **316** is considered herein to be comprised of two opposing and substantially parallel sides **506** and **508**, which are spaced-apart from each other by what is considered herein to be a third side **510** extending between the two opposing sides **506** and **508**.

When the clamp section **504** is held at an angle as shown, protuberances **512** that extend outwardly from sides **514** of the frame section **316** can be slid into two, opposing grooves **516** formed into the opposing sides **506** and **508** of the frame section **316**. The removable clamp section **504** is slid down the grooves **516** to a substantially circular cutout located near the bottom of the U-shaped frame section sides **506** and **508**. The cutout is identified by reference numeral **618** in FIG. **6**A. When the protuberances reach the cutout **618**, the frame section **504** can be rotated forwardly, i.e., toward the tube **310**.

Cantilevered arms **516** extend from the third side **510** of the frame section **316**. They are configured to engage an edge **518** of a clamp **520** located at the top **804** of the clamp section **504**. When the clamp section **504** is slid down the grooves **516** to the cut-out **618** and when the clamp section **504** is rotated forwardly, the arms **516** and clamp **520** lock the clamp section **504** in place in the frame section **316**.

In a preferred embodiment, the third side **510** of the frame section **316** is formed by wide, base section portions of the first side **506** and the second side **508**. As stated above, both of the sides of the frame section have a slot formed in them to receive the clamp section, which is also referred to herein as a second part of the pinch valve.

The slot **618** formed into each side of the frame section **316** that receives a protuberance extending from a side of the clamp section **504** is referred to herein as a clamp receiving slot **618**. The clamp-receiving slot **618** in the first side of the U-shaped frame section **316** faces or opposes a clamp-receiving slot in the opposite second side of the U-shaped frame section **316**. The clamp-receiving slots **618** in the sides of the frame section **316** enable the clamp section **504** to be slid upwardly and removed from the frame section **316** and thereafter slid downwardly for re-installation into the frame section **316**. The ability to quickly and easily remove the clamp section **504** from the frame section **316**, without tools, enables a dispensing tube **310** to be placed into and removed from the pinch valve frame section **316** directly, i.e., without having to thread or feed a tube **310** through a pinch bar mechanism as prior art pinch valves require.

A dispensing tube **310** is removed from the pinch valve by de-latching the clamping arms **516** from the edge **518** of the clamp **520** and rotating the clamp section **504** outwardly, i.e., away from the tube **310** and refrigerated compartment **220** and sliding the clamp section **504** upwardly and out of the clamp receiving slots **516**. After the clamp section **504** is removed from the frame section **316**, a tube in the frame section **316** can be removed directly from the frame section **316** because the frame section **316**, being U-shaped, has an open passageway between the two opposing side walls **506** and **508**.

The first side **506**, second side **508** and third side **517** of the frame section **316** are considered herein as being substantially U-shaped, i.e., they have a shape reminiscent of the Arabic letter "U." The open space between the two opposing sides and "in front of" the third side defines an open passageway that receives a tube **310** of a liquid container.

The frame section depicted in FIG. **5** is actually an assembly of three separate components shown in FIGS. **6**A and **6**B. FIG. **6**A is a perspective view of a frame section **600** assembled. FIG. **6**B is an exploded view of the frame section **600** depicted in FIG. **6**A.

Referring to both FIGS. **6**A and **6**B, the frame section **600** is comprised of a left side or portion **602**, an opposing left side or portion **604** and a thermally-conductive body **606** enclosed by end sections **622** of the left portion **602** and right portion **604**. The thermally-conductive body **606** conducts heat. It is referred to hereinafter as a heat sink for brevity because its function is to carry heat away from (sink) a flexible tube in the pinch valve. In an alternate embodiment, however, wherein liquid in a tube **310** is to be kept warm or hot, the thermally-conductive body **606** carries heat toward a flexible tube in the pinch valve but is nevertheless still considered to be a heat sink.

Referring now to FIG. **6**B, both sides **602** and **604** have a base portion or section **622** having a horizontally-oriented notch **608** the horizontal side walls **610** of which are separated from each other by a vertical distance great enough to receive the heat sink **606** between them. A front face **605** opposite the base portion **622** is formed with an opening **614** into a clamp-receiving slot **612** formed into the left side portion **602** and right side portion **604**.

The clamp-receiving slot **612** receives protuberances that extend outwardly from the sides of the aforementioned removable clamp section **504**. The clamp-receiving slot **612** has a width dimension (orthogonal to the length of the clamp-receiving slot **612**) and a depth into the sides of the clamp sections. The width and depth of the clamp receiving slot **612** are selected to provide a slip fit to a substantially rectangular protuberance **512** from the side wall **514** of a clamp section **504**. The clamp receiving slot **612** thus receives the clamp section **504** into the frame section **316**.

As shown in FIG. **6**B, the clamp receiving slots **612** have an opening **614** at the front faces **605** of both the left side **602** and right side **604**. The slots **612** angle downwardly from the opening **614** and terminate at substantially circular receiving holes or cut outs **618** located at what is considered to be the

bottom of the clamp-receiving slot, which is also near the bottom **616** of the left side **602** and the bottom **616** of the right side **604**.

(The right side **604** of the frame section **600** is a mirror image of the left side **602**. When the left side **602** and right side **604** are assembled as shown in FIG. **6**A, the right side **604** has a clamp receiving slot and cut out directly opposite the clamp receiving slot **612** and cut out **618** formed in the left side **602**. Only the opening **620** of the clamp receiving slot **612** formed into the right side **604** is visible.)

When the left side **602** and the right side **604** are assembled together with the heat sink **606** enclosed between them, the assembled frame section **600**, which is depicted in FIG. **6**A, can be seen to have two opposing and spaced apart sides **602** and **604** and a third side **623** formed in part by the heat sink **606** enclosed within the slots or notches **608** therein. The side walls **610** of the notch **608** and the heat sink **606** thus form the third side **623** of the U-shaped frame section **600**. The horizontal separation distance between the opposing sides **602** and **604** defines an open passageway **630**, which is the open space between the opposing and spaced apart side walls **602** and **604** and in front of the third wall or side **623**.

FIG. **7**A is a perspective view of the heat sink **606**. The heat sink **606** is made of a thermally-conductive material, examples of which include aluminum, copper or brass. The heat sink has a top surface **700** a bottom surface **702** opposite the top surface **700**, a front face **704**, which when installed into the clamp section **504** abuts a flexible tube **310**, a rear face **706** opposite the front face **704**, a right side **708** and a left side **710**.

FIG. **7**B is a top view of the heat sink **706**. The right side **708** and left side **710** can be seen in FIG. **7**B as substantially planar. The front face **704**, however, has a channel **712** sized to receive a tube **310**. In one embodiment the channel **712** has a cross sectional shape (when viewed from the top) which is an arc of a circle. In another embodiment the channel **712** is an arc of an ellipse. The channel **712** has a width **714** and a depth **716** sufficient to receive a flexible tube **310** that extends from a liquid holding tank **302** and which tends to locate or fix a tube **310** into the center of the frame section **316**. An advantage of having a channel **712** formed into the front face over a flat surface is that a tube **310** located into the channel **712** will tend to stay in the channel **712** while the tube **310** is being pinched and un-pinched.

FIG. **7**C is a right-side view of the heat sink **606**. The top face **700** and the bottom face **702** can be seen to be substantially planar. The front face **704** has a second and recessed lower front face **720**, that is substantially vertical, substantially planar and setback into the body of the heat sink **606** from the upper front face **724** by a distance substantially equal to the depth **716** of the channel **712**. The extended face or projecting face **724** transitions to the recessed face **720** by a chamfer **722**. The recessed lower front face **720** is the surface against which a pinch bar in the clamp part of the pinch valve **314** exerts a compressive, pinching force on the flexible tube resting in the channel **712**.

The back face **706** of the heat sink **606** has a second, horizontally-oriented channel **726**. The cross sectional shape of the second channel **726** (when viewed from either side) is either an arc of a circle or an arc of an ellipse. The second channel **726** has a depth and a width configured to mate with the outside surface of a length of tubing of a refrigeration system evaporator coil, not shown but well known to those of ordinary skill in the mechanical art. The mechanical attachment of a refrigeration coil into the second channel **726** provides a direct thermal mechanical coupling of the heat sink **606** to an evaporator coil of a refrigeration system. In another embodiment, the back face **706** is smooth and has attached to it, the cold side of a Peltier device. In another embodiment, the channel **726** formed in the back face **706** has an electric heating element attached to it, which provides heat energy into the heat sink **606**. In yet another embodiment, the channel **727** has a tube through which a hot or heated liquid is passed and which provides heat energy into the heat sink. In yet another embodiment, a smooth back face **706** has the hot side of a Peltier device attached to it, which also provides heat energy into the heat sink **606**. Regardless of whether the heat sink back face **706** is attached to a source of heat energy or a heat sink, the direct, mechanical coupling of the heat sink **606** to a heat transfer device, such as an evaporator coil, a Peltier device, or a heating element, significantly improves heat transfer to and from liquids in a flexible tube **310** that abuts the front face **704** and which is held in the first channel **712**. The shape of the first channel being substantially similar to the shape of a tube **310** increases the surface areas of the tube **310** and heat sink **606** through which heat can be conducted.

FIG. **8**A is a perspective of a preferred embodiment of a removable clamp part, renumbered in FIGS. **8**A and **8**B starting with reference numeral **800**. The clamp part **800** depicted in FIG. **8** is identical to the clamp part identified by reference numeral **504** in FIG. **5** and which is shown in FIG. **5** as ready for removal from, or insertion into, the clamp portion **502**.

In FIG. **8**A, the clamp part **800** is comprised of a clamp body **802** the shape of which is reminiscent of a rectangular parallelepiped or cuboid. One side of the cuboid-shaped clamp body, which is not visible in FIG. **8**A, is open. The open side of the clamp part **800** is best seen in FIG. **8**B, wherein the clamp part **800** is depicted with the open side facing upwardly.

Referring now to both FIGS. **8**A and **8**B, the clamp body has a top side **804** a bottom side **806** a right side **808** and a left side **810**, not visible in FIG. **8**A. A front side **812** faces an operator of the valve when it is installed in the refrigerated cabinet.

A curved handle **814** extends downwardly from the bottom side **806**. The bottom side **806** is thus formed with a slot, which the handle **814** projects outwardly from and translates in. The handle **814** has a bottom end **820** and an opposing top end **822**. The curvature of the handle **814** allows the top end **822** to extend into an open side **826** of a wedge-shaped pinch bar **824** with the bottom end **820** extending away from the cabinet facilitating actuation of the valve by lifting or depressing the handle **814**.

The top end **822** of the handle **814** is mounted into a pyramidal or wedge-shaped pinch bar **824** using a pin **828** that extends through the right side **808** and the left side **810** of the clamp body **802**. The pin **828** also extends through an elongated slot **830**, which extends through the right side **832** of the pinch bar **824** and the left side **834** of the pinch bar **824**.

The elongated slot **830** can be seen as bordered by two substantially cuboid-shaped protuberances **836**A and **836**B extending outwardly from the right side **832** of the pinch bar **824**. An identical set of protuberances extend from the left side **834** but cannot be seen in FIG. **8**B. The protuberances **836**A and **836**B are separated by a distance slightly greater than the width of two cuboid extensions **838**A and **838**B, which extend from the left interior side **810** and the right interior side **808** of the clamp body **802**, i.e., into the open interior space **840** of the clamp body **802**.

With regard to the clamp body **802** and more particularly the pinch bar **824**, the distance separating the left side **834** from the right side **832** of the clamp body **824** is less than the separation distance between the left side **810** and the right side **808** of the clamp body **802**. The pinch bar **824** is thus able

to freely translate back and forth (as shown in FIG. **8**A) or up and down as shown in FIG. **8**B responsive to bias exerted on the bottom face **844** of the pinch bar **824** by two coil springs **842**. The springs **842** bias the pinch bar **824** outwardly from the interior space **840** of the clamp body **802**, which is toward the lower flat face **720** of the heat sink **606**.

The pinch bar **824** translates back and forth on a track or slide comprised of the protuberances **836**A and **836**B that extend outwardly from the opposite sides of the pinch bar **824**. The protuberances **836**A and **836**B ride against the side walls of the cuboid extensions **838**A and **838**B from the left and right sides **810** and **808** of the clamp body **802**.

The pin **828**, which also extends through the elongated slot **830**, provides a pivot for the top end **822** of the handle **814**. Upward or downward movement of the bottom end **820** of the handle **814** drives the pinch bar **824** backwardly, against the force exerted on the pinch bar **824** by the springs. Upward or downward movement of the bottom end **820** of the handle **814** thus causes the pinch bar **824** to be retracted inwardly into the clamp body releasing or un-pinching a hose **310** in the frame portion.

FIG. **8**C is a perspective view of the open interior **840** of the clamp body **802**. The open slot **816** in the bottom face **806** described above and which accommodates vertical translation of the handle is visible in FIG. **8**C as are the protuberances **838**A and **838**B that extend inwardly from the left side **810** and right side **808** of the clamp body **804**.

A hole **845** through the two opposite sides is sized and configured to receive the pin **828** around which the top end **822** of the handle **814** pivots. A clamp **846** with an edge **847** is formed at the top **804** of the clamp body **802**, extending upwardly from the top side **804** to provide a latch for cantilevered arms that extend from the third side of the U-shaped clamp portion.

FIG. **8**C shows one of two substantially rectangular-shaped protuberances **848** located near the open side of the cuboid-shaped clamp body **802**, away from the front face **812** and close to the bottom face **806**. The protuberances **848** are dimensioned to slide freely into the clamp receiving slots **612** described above and shown in FIGS. **6**A and **6**B. The rectangular shape of the protuberances **848** allows them to slide up and down the slots **612**. When the protuberances **848** are rotated in the aforementioned cut-outs **618**, their rectangular shape precludes them from sliding out of the clamp receiving slots **612**.

The protuberance length is less than the diameter of the cut-out **618** formed at the bottom of the clamp receiving slot. The protuberance length is chosen such that when the protuberances **848** are inside the cut out **618** and rotated by even a small angle, as happens when the clamp body is latched into place, the protuberance length prevents the clamp body **802** from sliding upwardly, i.e., out of the frame section. Rotation of the clamp body **602** in the frame section to a latched position thus locks the clamp body into the frame section.

FIG. **8**D is a perspective view of the substantially wedge-shaped pinch bar **824** viewed from the apex edge **850**. The elongated slot **830**, which rides over the pin **828**, extends through both the left side **834** and the right side **832**. The substantially rectangular-shaped protuberances **836**A and **836**B that extend outwardly from the sides can define a slot **830** between the two protuberances **836**A and **836**B.

FIG. **9** is a perspective of the assembled clamp section, viewed from the top of the open side of the clamp body **802**. A pair of holes **902** are formed into the opposing sides **808** and **810** of the clamp body to receive optional roll pins, not shown. The function of this feature is to limit the travel of the lever **814** to one direction. A similar pair of holes **904** located below the pin **828** can receive a second stop pin (not visible) the function of which is to limit the travel of the handle in an opposite direction. Insertion of a pin through the upper holes **902** or lower holes thus limits the travel of the lever to only an upwardly or downwardly direction. A pin through either pair of holes **902** and **904** preventing the top surface **906** of the handle **814** from rotating in one direction or the other around the pivot point **828**. A pin in the upper holes **902** prevents the handle **814** from being upwardly lifted. A pin in the lower holes **914** prevents the handle **814** from being depressed downwardly.

The pin **828** around which the pinch bar **824** rotates functions as an axle. Upward or downward movement of the end of the handle **814**, relative to horizontal, causes the wedge-shaped pinch bar **824** to translate toward or away from the third side of the U-shaped clamp section. The upward or downward handle movement thus pinches and un-pinches a plastic tube in the clamp section.

In a preferred embodiment, the handle **814** is formed of a stamped metal. The frame section is comprised of an injection molded plastic such as nylon or fiberglass. The clamp section **504** is also comprised of an injection molded plastic such as nylon or fiberglass. The heat transfer body or heat sink **606** is preferably comprised of a thermally-conductive material such as brass, copper or aluminum.

Those of ordinary skill in the art will recognize that the pinch valve described above has a valve frame that is open and capable of directly receiving a tube from a liquid reservoir without having to feed or "snake" the tube through a pinch bar assembly as prior art valves require. Moreover, the third side or back side of the frame section can be shaped with the side walls to provide a substantially concave shape which will locate a flexible tube directly in front of the pinch bar.

The heat sink or thermally conductive body being thermally and mechanically coupled to a heat transfer device such as those described above provides improved heat transfer over prior art devices. Such a feature assists in providing temperature stability to liquids trapped in a plastic tubing above the pinch valve keeping liquids therein hot or cold as necessary. Heat transfer through the thermally conductive body being by way of conduction rather than radiation or convection provides more thermal heat transfer than prior art pinch valves provide.

The foregoing description is for purposes of illustration only. The true scope of the invention is set forth in the appurtenant claims.

What is claimed is:

1. A pinch valve comprising:

a substantially U-shaped frame section comprising, opposing and spaced-apart first and second sides and a third side extending between and joining the first and second sides, the first and second sides having a clamp-receiving slot, the third side of the frame section comprising a thermally conductive body, which is coupled to a heat transfer device, the first, second and third sides defining a substantially U-shaped open passageway; and

a clamp, configured to be removable from the substantially U-shaped frame section and configured to direct a pinching force toward the substantially U-shaped frame section.

2. The pinch valve of claim **1**, wherein the removable clamp has first and second sides, the first side of the clamp having a protuberance configured to be received into the clamp-receiving slot in the first side of the frame section, the second side of the clamp having a protuberance configured to be received into the clamp-receiving slot in the second side of the frame section.

3. The valve of claim 2, wherein the protuberances are substantially cuboid shaped having a length, width and height, the clamp receiving slot having a width, a depth, first and second ends and a cutout at the second end, the width of the protuberances and the width of the slot being selected to provide a clearance fit between them, the cutout having a diameter and a depth selected to allow the cuboid-shaped protuberances to rotate inside the cutout.

4. The valve of claim 1, wherein the third side of the frame section is configured to receive a tube and to locate the tube at least near the center of the frame section.

5. The valve of claim 1, wherein the thermally-conductive body is comprised of a unitary block of metal having opposing first and second sides, the first side having a first channel, the second side having a second channel.

6. The valve of claim 1, wherein the clamp is comprised of a pinch bar and a lever configured to translate upwardly and downwardly relative to a lever rest position, upward and downward translation of the lever causing the pinch bar to translate away from the third side of the frame.

7. The valve of claim 6, wherein the pinch bar translates in first and second slots formed into the first and second sides of the clamp.

8. A liquid dispenser comprising:

a cabinet; and

at least one valve, the at least one valve comprising:

a valve frame section comprising, opposing and spaced-apart first and second sides and having a third side extending between and joining the first and second sides, each of the first and second sides having a clamp-receiving slot, the first, second and third sides defining a tube-receiving passageway, the third side comprising a thermally conductive body coupled to a heat transfer device; and

a clamp, which is removable from the valve frame section and configured to direct a pinching force toward the valve frame section, the clamp comprising first and second sides, the first and second sides of the clamp having a protuberance configured to be received into said clamp-receiving slot.

9. The valve of claim 8, wherein the thermally-conductive body is comprised of a unitary block of metal having opposing first and second sides, the first side having a first channel, the second side having a second channel.

10. The liquid dispenser of claim 8, wherein the clamp is comprised of a pinch bar and a lever configured to translate upwardly and downwardly relative to a lever rest position, both upward and downward translation around the axle relative to the rest position causing the pinch bar to translate away from the frame.

11. The liquid dispenser of claim 8, wherein the clamp is comprised of a pinch bar, a lever, and a lever stop pin, the lever and stop pin being configured to allow the clamp to translate only upwardly or only downwardly relative to a lever rest position, translation of the lever causing the pinch bar to translate away from the frame.

12. The valve of claim 10, wherein lever rotates around a substantially horizontal axis, translation of the lever between the first and second positions of the lever being in a vertical plane.

13. A pinch valve comprising:

a substantially U-shaped frame section comprising, opposing and spaced-apart first and second sides and a third side extending between and joining the first and second sides, the third side of the frame section comprising a thermally conductive body, which is coupled to a heat transfer device, the first, second and third sides defining a substantially U-shaped open passageway; and

a clamp, configured to be removable from the substantially U-shaped frame section and configured to direct a pinching force toward the substantially U-shaped frame section.

* * * * *