Sept. 2, 1958 E. S. WELCH, JR 2,850,422

FLUID CONTAINER PORT STRUCTURE ATTACHING METHOD

Filed Jan. 20, 1955

Fig. 2.

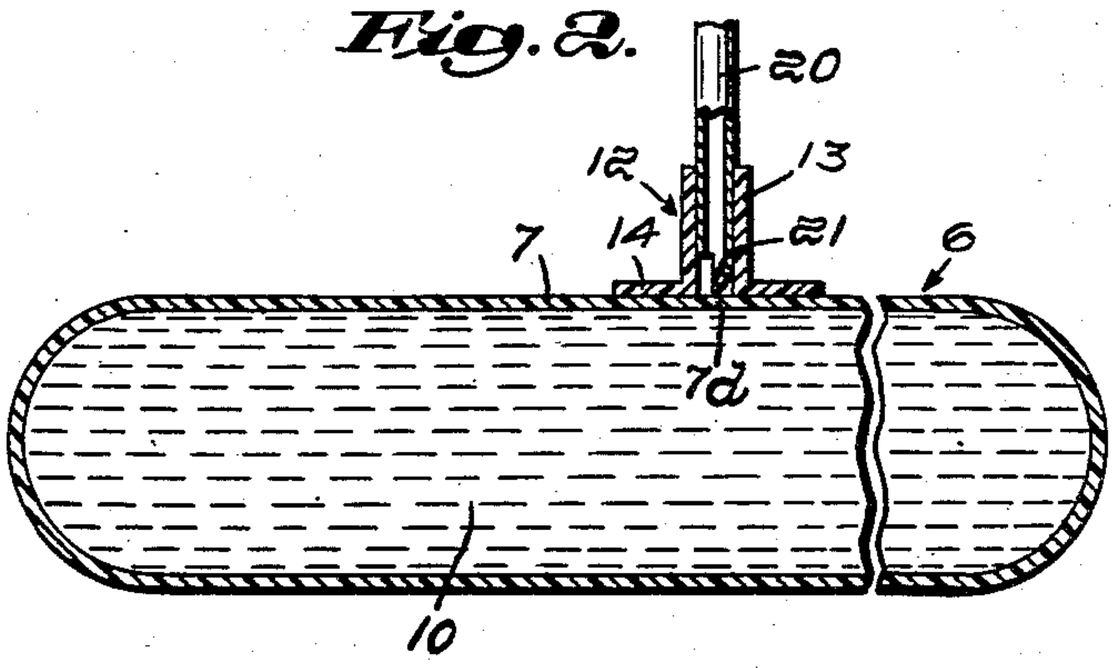

Fig. 3.

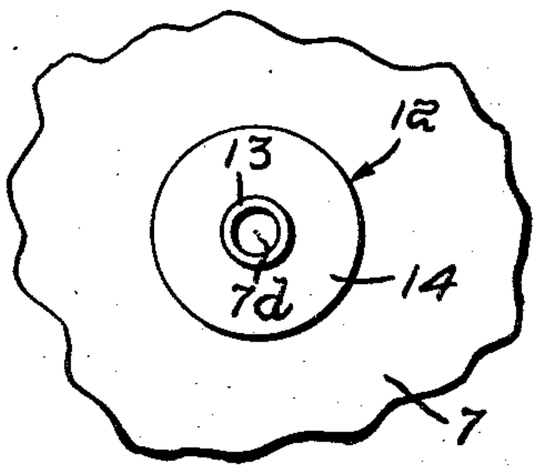

Fig. 4.

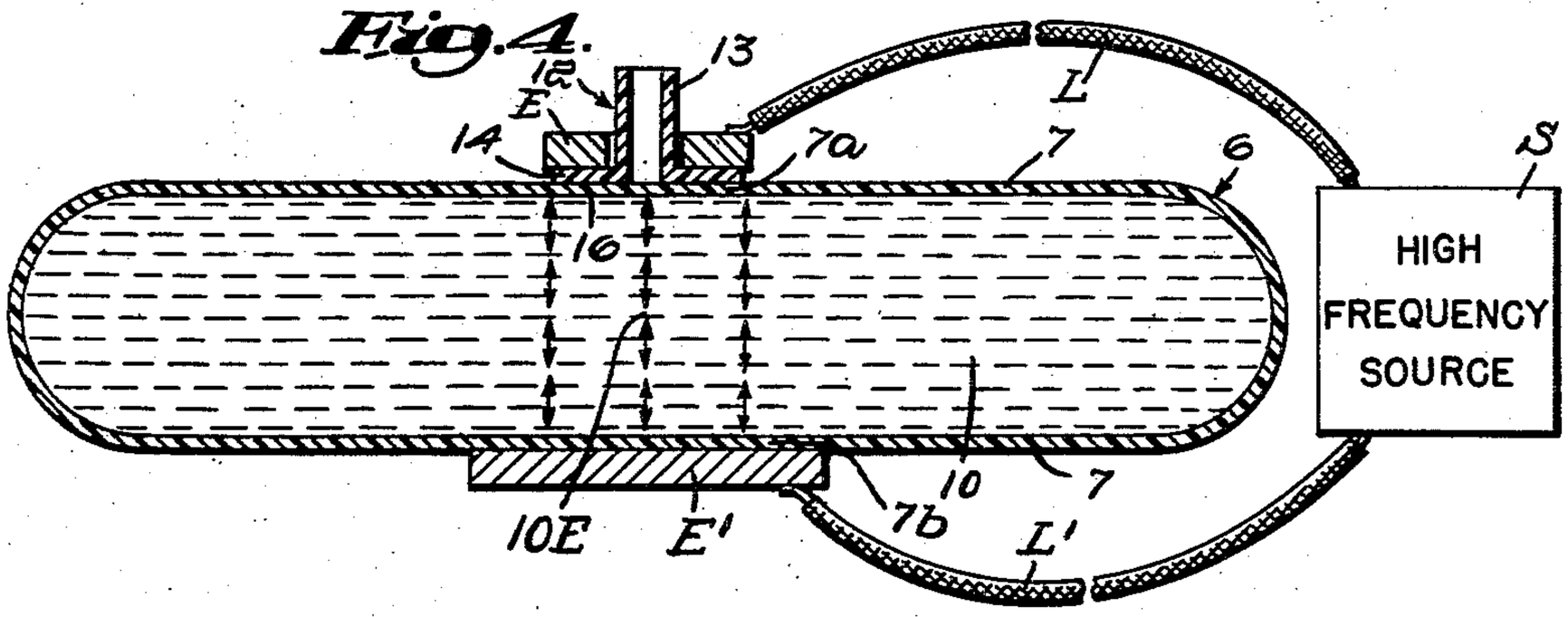

Fig. 5.

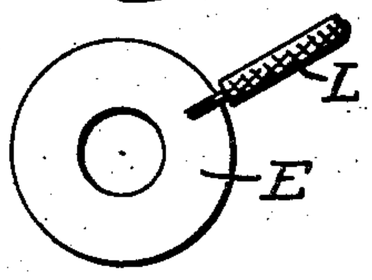

Fig. 1.

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2,850,422

Patented Sept. 2, 1958

2,850,422

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Application January 20, 1955, Serial No. 483,070

2 Claims. (Cl. 154—118)

This invention relates to the packaging of fluids in flexible heat-sealable containers and to methods and means for providing such containers with initially closed ports for subsequent access to and dispensing of the content fluid, as well as to the containers so equipped.

More particularly the invention aims to accomplish the stated ends especially in conjunction with content fluid for which it is desired to maintain a uniform, sterile and pyrogen-free condition, such for example as parenteral and intravenous solutions. Other objects for the improved container methods and product of the invention include visibility for the content fluid through the container walls, and a relatively non-frangible easily disposable and inexpensive construction for the containers.

In the drawings illustrating by way of example the method of and means for practicing the invention, together with a typical resultant product:

Fig. 1 shows a completed fluid package including the flexible container with closed outlet port and associated piercing connector;

Fig. 2 is a cross-sectional view as for example upon the line 2—2 of Fig. 1;

Fig. 3 is a plan of an area of an outer wall of the container including the outlet;

Fig. 4 is a view corresponding to Fig. 2 illustrating the outlet-forming method of the invention; and

Fig. 5 is a plan of an electrode element useful for the method of Fig. 4.

Fluid containers formed of heat-sealable plastic sheeting are known and have come into commercial use within the last few years. Such containers are fabricated either by rolling a flat section of the plastic sheeting into tubular form and uniting it by a longitudinal heat-applied seam or weld, by superimposing two layers of plastic sheeting and uniting them similarly to form either single or plural container units, or by initially extruding or otherwise molding the plastic material in the form of a seamless tube.

It is also known to fill relatively long or indefinite lengths of such plastic tubing, whether of the flat-formed or the seamless type, with the fluid to be packaged, and then to bring together and seal to each other the opposite walls of the tube across longitudinally spaced transverse zones, as by applying dielectric heating at the desired spaced intervals. This in effect divides the initial tubular section into hermetically sealed units each containing the fluid. Such sealed units may then be separated by cutting them apart centrally across the transverse heat-sealed zones. Such items as liquid soap and oil have recently been packaged in this manner. The user cuts or punctures some portion of the unit container wall to let out the content fluid.

Heretofore, however, no satisfactory provision has been made so far as I am aware for obtaining access to the fluid content of a flexible plastic container of the stated type, identified herein as collapsible, in such manner that neither the installation of the outlet means

in the course of completing the fluid package nor the subsequent release of the content fluid at the time of use shall in any manner contaminate or objectionably modify it. The desirability of the collapsible flexible plastic container for example in the medical and surgical field has been recognized, particularly under the increasing demand for commercially prepared parenteral, intravenous and other solutions. These obviously must be held in a sterile, pyrogen-free and uniform condition. And in most cases the fluid content must be deliverable from the package so as to flow in well-defined sealed sterile channels as for instance through filter and flow indicating devices and through flexible tubing to an intravenous injection medium.

In accordance with the present invention methods and means are presented providing for the removal of such fluids from the sealed collapsible plastic containers through the medium of the attachment of a coupling or exit tube to the outside surface of each container after introduction of some fluid content, either partly or wholly filling the container, and in such manner that the container wall may subsequently be punctured without loss or contamination of the fluid content. Such attachment may be made either before or after sealing off unit packages.

In the drawings, filled or partially filled unit containers or packages of fluid are designated generally at 6. Each comprises a collapsible compartment-forming wall 7 of flexible and preferably transparent or translucent plastic sheet material. Such bag-like container 6 may be formed in any known or preferred manner as already mentioned. In the example of Fig. 1 it may be assumed that the container wall 7 is of the seamless tubular construction having the wall material at the respective transverse ends brought together and united as by heat sealing as indicated at 8 and 9 respectively, or as noted it may be formed by uniting layers of plastic sheeting. In the corresponding sectional Figs. 2 and 4 fluid content is indicated at 10. Such fluid 10, in the case of packages of parenteral, intravenous and other solutions requiring a sterile pyrogen-free and uniform use standard, as for medical, surgical, hospital and like uses, may be entered into sterile lengths of the tubular well element and the latter sealed off dielectrically into unit packages at appropriately spaced transverse zones, also in the known or preferred manner described. It will be understood that the plastic sheet material desirably is selected for suitable capacity to withstand heat or other sterilizing treatment subsequent to filling and closing off of the unit packages should such be desired. Also as mentioned the sealing off into package units may be accomplished after providing the porting means as herein concerned.

Heretofore such filled collapsible containers, bags or pouch-like packages have lacked provision for sterile access to and dispensing of the fluid content. The reasons for this are several. In the use of dielectric heating for bonding together two pieces of plastic material, that art has heretofore regarded it as essential that metallic electrodes be placed directly in contact with or close to the external surfaces of the plastic members of which the juxtaposed faces are to be interbonded. Heating and consequent sealing together or welding takes place by reason of the electric field created at all areas between the opposed electrodes, these latter being connected to a high frequency source such as indicated at S in Fig. 4.

Assuming for example it is desired to provide an outlet or other port element such as designated generally at 12 in Figs. 1 to 4 comprising a tube portion 13 and a radial attaching flange 14. Such flanged porting tube 12 might be placed against the outer face of the container wall 7 and an annular or other electrode E, Figs. 4 and

5, may be engaged with the outer face of the tube flange 14. But where indefinite continuous lengths of plastic container-forming tubing are to be filled or partially filled before attachment of tubes and either before or after being sealed off into unit packages, it is impractical if not impossible to insert an opposite metallic electrode to the appropriate locations within the tubing. If on the other hand an effort is made to heat-seal in place a flanged tube without fluid content in the unit packages, by collapsing together opposed areas of the tubing wall and placing the metallic electrodes in opposition at the outside faces of the juxtaposed wall portions, then the opposed portions of the container wall **7** themselves become bonded together at the same time that the tube flange 14 is installed, with the result that the proposed container units are rendered inoperative and useless.

In accordance with the method of the present invention the collapsible tubular container units **6** are supplied with at least a partial liquid content **10**. The units may be completely filled and sealed off into unit packages or the liquid may be limited to that necessary to prevent bonding together of opposite walls **7** of the collapsible container **6**, complete filling and unit sealing being subsequent to the attachment of port tubes. Thus in carrying out the method the content liquid **10** is itself availed of as the means for the necessary holding apart or spacing of the container walls **7**, as against the closing or collapsing force applied to the electrode E in engaging the tube flange **14** against the container wall **7**.

Referring now more particularly to Fig. 4 illustrating the novel process of installing a flanged port tube **12**, the tubular wall **7** of the container or package unit **6** is shown separated diametrically by the liquid **10** throughout the cross-sectional area and particularly at the region 10E where the flanged tube **12** is to be applied.

With the tube **12** placed against the outer face of the container wall **7** wherever it is desired to be located as for example centrally near one end of the container, an annular metallic electrode E is superimposed flatwise upon the outer face of the associated flange **14**. Another metallic electrode E′ of plate or disc form and of calculated or substantially greater area is placed at the outer face of the diametrically opposite portion of the container wall **7**, while making sure that the liquid volume **10** is located or confined between the wall portions 7 having the metallic electrodes E, E′ installed thereat. The respective metallic electrodes E, E′ are connected as by the leads L and L′ to any suitable high frequency source S.

The electric field established between the metallic electrodes E and E′ is divided between two layers *7a* and *7b* of the container wall material **7**, the volume of the liquid **10** between said wall areas *7a*, *7b*, and the thicknesses of the flange **14** of the port tube **12**. It will be appreciated that it is permissible for the content liquid 10 to have either a very high resistivity along with high dielectric constant, as when the container fluid is distilled water, or sugar and water, or a low resistivity, such as it would have in the case of a salt and water solution. All that is required is a low impedance by virtue of high dielectric constant of the solution. Likewise the impedance of the container wall area *7b* contiguous to the electrode E′ is low because, as more or less diagrammatically indicated in Fig. 4, the area of said electrode E′ is made substantially larger than that of the opposite distal metallic electrode E.

Consequently a considerable fraction of the voltage of the electric field occurs within the flange **14** of the tube **12** and the herein top wall portion *7a* of the container, causing these to be heated to the appropriate bonding temperature without heating any other portion of the system to disadvantage. In this connection the interposed liquid **10** is seen not only to space and prevent interbonding of the opposite inner faces of the container wall areas *7a* and *7b* but also, in that it is employed as a capacitor, acts at the same time as a cooling agent for the non-sealing face of the plastic wall while the latter is being internally heated to bonding temperature especially at the interface **16**, Fig. 4, between the container wall *7a* and the flange **14** of the tube **12**. Thus the liquid volume **10** not only supplies a convenient means for application of an electric field to the plastic material but at the same time has the advantage of keeping the container wall from distorting or from rupturing by becoming unduly thinned or melted through the application of the tubular port element **12**.

From the foregoing description in connection with the drawings it is evident that an important feature of the method and the resulting novel product thereof lies in the effective use of a liquid capacitor for the application of dielectric heat sealing. It will be evident that this method is especially advantageous in the avoidance of progressive insertion of a metallic electrode between the walls of a tubular plastic container. Such procedure, in addition to being extremely difficult as a mechanical operation would be a source of biological contamination whereas the substance of the liquid electrode as herein contemplated generally must be filtered and pre-sterilized in any event before loading into the container. Another important advantage attendant on the method of the invention is that the container wall **7** may be left unencumbered by protruding tubes prior to tubulation and seaming of the container units themselves. This feature is an important consideration in connection with automatic or production-line processing of the containers and fluid packages.

It will be understood further that the method or process of the invention is not restricted to the application of port tubes to collapsible plastic containers but also lends itself to other plastic sealing uses as for example in connection with applying a protective hood over a port tube assembly, such as **12**, for protecting the exit or other port as a whole from contamination and physical damage before ultimate use.

In the foregoing description the invention has been disclosed with reference to containers and port tubes assumed as being of fuse-bondable thermoplastic material. The invention is equally applicable to the provision of similar tubular porting installations where the container, pack or bag element, or the flanged tube element to be applied, or both said elements, and at least at their opposed or engaged faces, are of a material not thermoplastic or thermoplastic only at excessive temperatures. In such instances the appropriate contiguous surfaces of the container or the tube or both of them are coated with a thermoplastic or other adhesive such that application of the dielectric means as herein disclosed will effect the bond, immediately and as already herein described if the adhesive is thermoplastic or by accelerating the setting of the adhesive material if of a thermal setting or of a solvent type.

In the illustrative example of the drawings the completed liquid container or package **6** is represented in Figs. 1 and 2 as including within the tubular portion **13** of the port tube **12** a tubular coupler **20** having a tight fit in the tube portion **13** and provided at the inner end with a wall-piercing point **21**, Fig. 2. The outer end portion of the coupler **20**, shown broken away, may be formed for ready connection to flexible tubing or the coupler may be constituted as an integral portion of such tubing and may be of metal, plastic or other composition. It may be included as an initial element of the completed package or may be omitted as circumstances dictate. It will be apparent that access to the fluid content **10** may be had by merely thrusting the pointed end **21** of the coupler **20**, after attachment of the tubing thereto if not integral with it, through the diaphragm-like closure portion *7d* of the container wall **7** defined within the base of the tube **12** centrally of the attaching flange **14**.

My invention, either as to product or method, is not

limited to the exemplary embodiment or steps herein illustrated or described, and I set forth its scope in my following claims.

I claim:

1. The method of dielectrically bonding a flexible thermoplastic port element to a flexible thermoplastic liquid storing container having liquid sealed in it and the wall of which container presents a heat-bondable external area which comprises positioning the element in bondable engagement externally with an imperforate heat-bondable area of one wall of the container, applying a metallic electrode to the element, locating a volume of container liquid in juxtaposition to the element and electrode, applying a second substantially larger metallic electrode externally to an imperforate area of the other wall of the container opposite the liquid volume and with the latter defining a column between the two wall areas, and connecting the metallic electrodes to a high frequency electrical source.

2. The method of dielectrically heat sealing a flexible thermoplastic liquid dispensing outlet to a flexible thermoplastic liquid storing container which comprises placing the outlet against a continuous area of a wall of the container, superimposing a metallic electrode on the outlet, applying a substantially larger metallic electrode to a wall area of said container opposite said outlet, connecting said electrodes to a high frequency electrical source so as to impress a heating electric field on said outlet and container, and locating the fluid stored in said container to provide a column of the liquid internally between said wall areas as a liquid capacitor in said field and to space and cool said container walls.

References Cited in the file of this patent

UNITED STATES PATENTS

500,773	Perelli-Minetti	July 4, 1893
1,084,944	Leonard	Jan. 20, 1914
2,298,037	Crandell	Oct. 6, 1942
2,407,833	Jablonsky	Sept. 17, 1946
2,677,459	Ritzenberg	May 4, 1954
2,770,272	Morrison	Nov. 13, 1956