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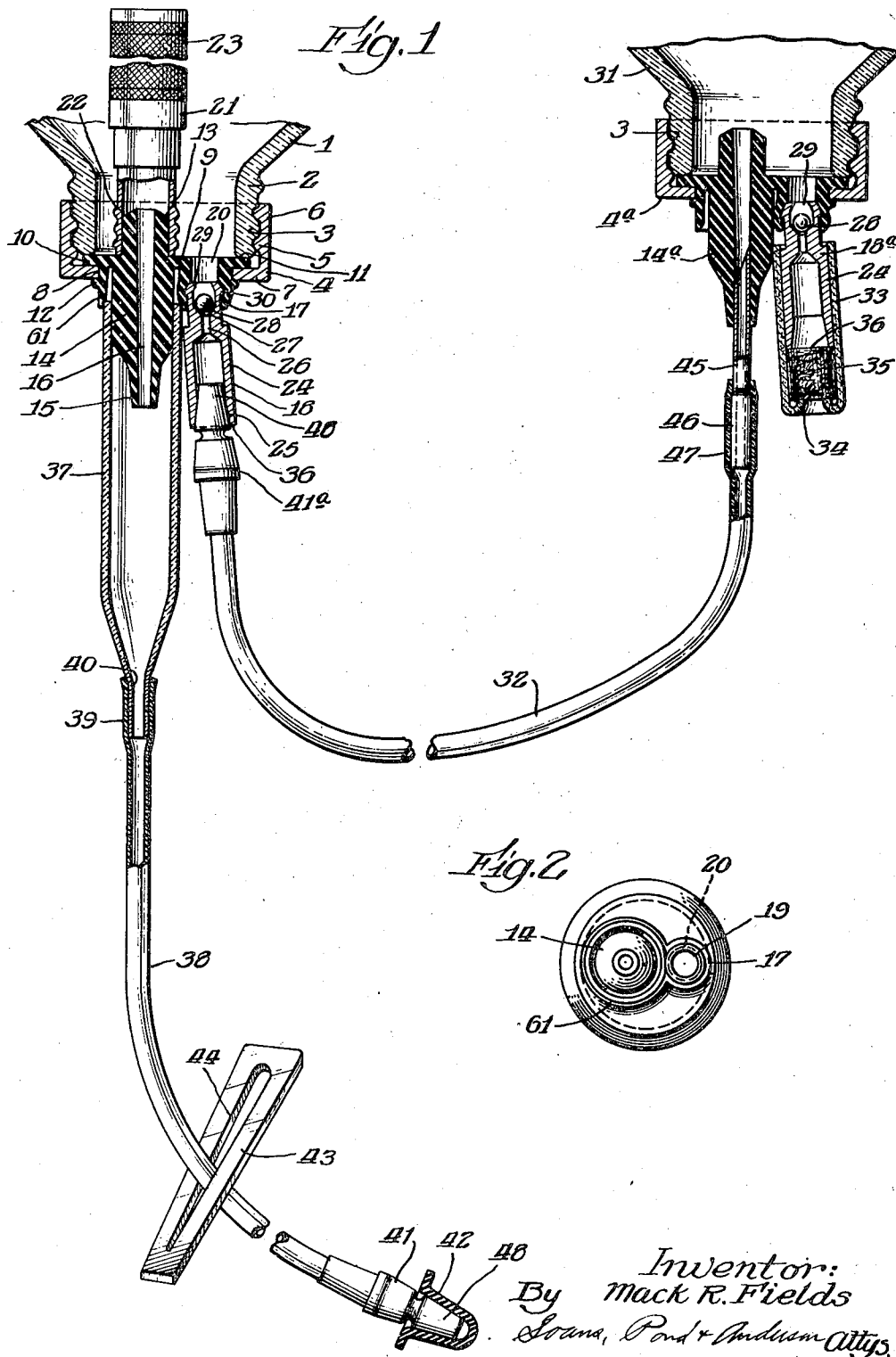
M. R. FIELDS

2,452,644

APPARATUS FOR INTRAVENOUS ADMINISTRATION OF LIQUIDS

Filed Oct. 5, 1946

2 Sheets-Sheet 1



Inventor:  
By Mack R. Fields  
Loana, Pond & Anderson Attys.

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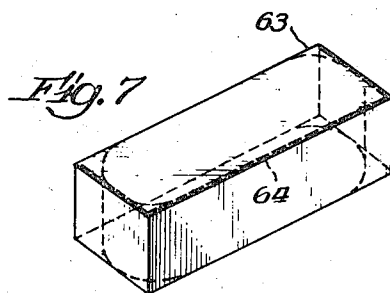
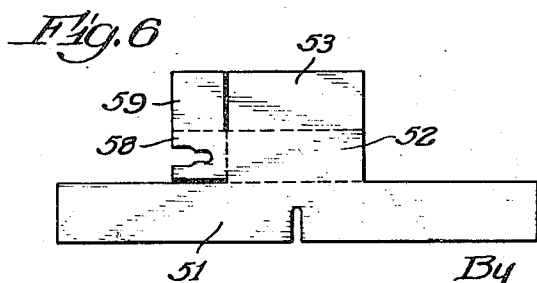
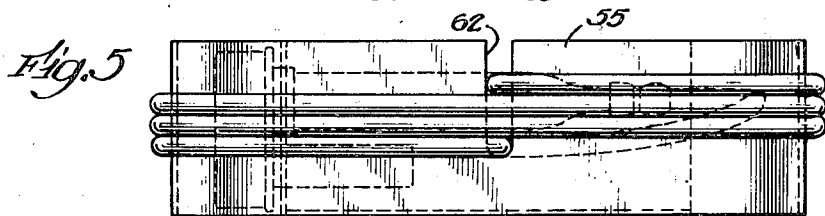
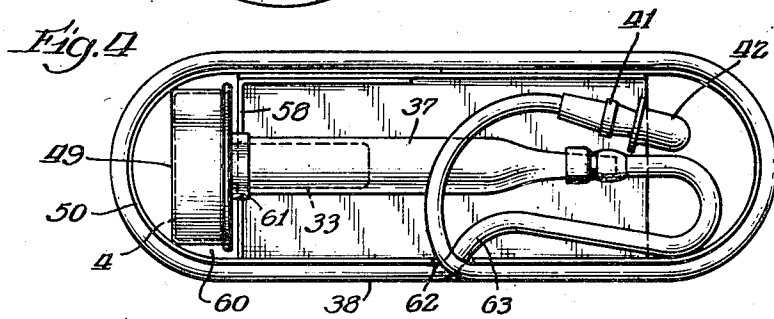
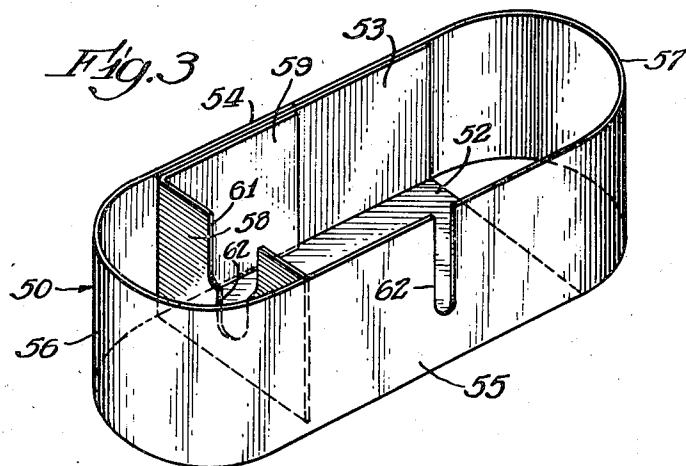
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# APPARATUS FOR INTRAVENOUS ADMINISTRATION OF LIQUIDS

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2 Sheets-Sheet 2



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Mack R. Fields

By Loane, Pond & Anderson Attys.

## UNITED STATES PATENT OFFICE

2,452,644

## APPARATUS FOR INTRAVENOUS ADMINISTRATION OF LIQUIDS

Mack R. Fields, Chicago, Ill., assignor to Abbott Laboratories, North Chicago, Ill., a corporation of Illinois

Application October 5, 1946, Serial No. 701,519

8 Claims. (Cl. 128—214)

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This invention relates to apparatus for intravenous administration of liquids, and it has particular reference to the construction of a dispensing cap for containers of liquids which are intravenously administered, and to tubing equipment used in connection with such a cap for conducting the liquid to or from the container.

The main object of the invention is to provide apparatus of the character indicated which can be produced and sold at such cost that it may economically be used only one time and then disposed of, thereby to eliminate the practice of re-sterilizing and reusing apparatus of the kind mentioned; to provide means for maintaining initial sterility of the apparatus so that when it is to be placed in use, it is immediately ready for use; to provide a practical, convenient and readily openable package for the apparatus, and which package will adequately protect the apparatus and maintain it in an externally clean and internally sterile condition; and other objects and advantages of the invention will be understood by reference to the following specification and accompanying drawings wherein there is illustrated apparatus embodying a selected form of the invention.

In the drawings (2 sheets):

Fig. 1 is an illustration partially in section showing the details of construction of an improved cap element, and of the manner in which various parts of the apparatus are connected to the cap;

Fig. 2 is an end elevation of the outside end of a part of the cap structure;

Fig. 3 is a perspective showing a part of a package structure for packaging the apparatus;

Figs. 4 and 5 are a top elevation and side elevation, respectively, showing the manner in which one commercial unit of the apparatus is associated with the packaging element of Fig. 3;

Fig. 6 is a plan of the blank from which the packaging element shown in Fig. 3 is formed; and

Fig. 7 is a perspective illustrating the completed package.

The improved apparatus herein illustrated is usually employed in connection with a glass or other suitable bottle represented at 1, the bottle being suspended in inverted position so that its mouth 2 projects downwardly. The mouth 2 is provided with suitable external screw threading represented at 3. A cap 4 preferably formed of hard rubber or plastic material or other suitable material is provided with internal screw threading 5 on the inside of its cylindrical flange or

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skirt portion 6, the said screw threading being such as to fit the screw threading on the mouth of the bottle.

The end wall 7 of the cap is provided with a central opening 8 and a relatively soft rubber member 9 is suitably associated with the rigid cap member 4. The resilient rubber member 9 comprises a main disc portion 10 of such size that a peripheral portion of the disc is adapted to overlap a portion of the cap end 7 so that such peripheral portion will be disposed between the end 11 of the bottle and the end wall 7 of the rigid cap element. The disc 10 is, therefore, operative to serve as a gasket to assure a tight joint between the cap 4 and the bottle 1.

The resilient member 9 may be anchored to the cap by being provided with a portion which extends outwardly through the opening 8 in the cap and beyond the outer wall of the cap end, and an outwardly projecting annular rib 12 in such relation to the outside face of the cap wall 7 as to serve the indicated purpose. The resilient member 9 may be assembled into interlocked relation with the rigid cap member 4 by reason of the resiliency of the member 9 which permits it to be distorted sufficiently to enable the ribbed portion 12 to be passed through the smaller opening 8 of the cap.

On the inside surface of the resilient plug member 9 there is provided an upstanding or projecting cylindrical portion 13, and in co-axial alignment with said inwardly or upwardly projecting portion there is provided an outwardly or downwardly projecting cylindrical portion 14 which terminates in a tapering or nozzle-like reduced diameter end portion 15. A continuous hole 16 is formed in an axial position in the oppositely projecting portions 13 and 14 to provide an outlet opening for liquid in the bottle 1.

Alongside the downwardly projecting portion 14 there is also provided another but smaller downwardly projecting portion 17, the same being of generally cylindrical form and provided with an opening for receiving a fitting 18 which constitutes an inlet member for controlling the entrance for air or other fluid into the bottle 1. The projection 17 is provided with a small opening 19 in its outer end for receiving and tightly fitting around an end portion of the fitting 18, and said opening 19 communicates with a larger opening 20 on the inside of the member 9.

In some instances the liquid which is to be administered from the bottle 1 must be passed through a strainer before it enters the tubing on its way to the injection needle. Such a strainer

is represented at 21. It is provided at its lower end with a hollow portion 22 which will fit snugly over the upwardly projecting portion 13 of the resilient member, the fit being such that the member 13 will be slightly compressed when the strainer portion 22 is forced thereover. The friction fit of the strainer on the part 13 provides an adequate attachment of the strainer to the cap wall also permitting the strainer to be readily removed from the cap when removal is desired. Similarly, a strainer may be readily applied to the cap whenever desired merely by pressing the strainer end over the projection 13, the application of the strainer being also somewhat facilitated by rotating the strainer while pressing it toward the disc portion 10 of the cap structure. The details of the strainer structure are not important in connection with the present invention, and for purposes of this application it is sufficient to merely explain that in the form of strainer illustrated, a fine mesh screen element 23 embodied in the upper portion of the strainer strains the liquid as it passes through the screen into the interior of the strainer.

The fitting 18 may be of stainless steel or other suitable material, and its construction in this instance comprises a tubular cylindrical portion 24 provided with a slightly flared inside entrance portion 25. At its opposite end the tubular portion 24 communicates with one end of a reduced passageway 26 the other end of which communicates with a larger or counterbored opening portion 27. A suitable ball valve member 28 is disposed in the enlarged opening portion 27 and is locked therein by one or more inwardly offset end portions of the fitting as indicated at 29. The ball 28 is free to move in the direction of the axis of the fitting 18 so that when the ball rests on the shoulder between the openings 26 and 27, a passage of liquid downwardly through the opening 20 and the fitting 18 will be prevented. However, when air or other fluid is caused to flow upwardly through the fitting 18, the ball will be readily displaced upwardly to permit the passage of such air or fluid upwardly through the fitting and into the bottle 1. The ball 28 is, of course, of such size that when it is raised from the seat between the openings 26 and 27, fluid may pass upwardly around the ball.

The check valve end of the fitting 18 is provided with a circumferential rib or enlargement 30 which becomes embedded in the projection 17 to anchor the fitting to the resilient rubber element 9 of the cap structure.

In some instances, an air filter is applied to the fitting 18 as shown in connection with the cap structure applied to the bottle 31 which is connected by the flexible tube 32 to the fitting 18 as shown in Fig. 1. In the illustration shown in Fig. 1, the bottle 31 is connected to the bottle 1 through the tube 32 for the purpose of supplying additional liquid to the bottle 1 as is sometimes required where an extra large volume of liquid is to be injected into a patient. In many instances, the amount of liquid to be injected is no more than the quantity which a single bottle can hold in which case the tube 32 and second bottle 31 would not be employed. Instead of connecting a liquid supply tube 32 to the fitting 18, an air filter would be applied directly to the fitting 18 as shown in connection with the fitting 18a which is carried by the cap structure 4a for the bottle 31. The cap structure 4a is the same as the cap structure 4, and the fitting 18a is the same as the fitting 18.

The air filter element consists of a fiberboard or paper tube 33 which is of such internal diameter as to be a snug friction fit on the main cylindrical portion 24 of the fitting 18 or 18a. The paperboard tube is somewhat longer than the portion 24 of the fitting and has one end rebent inwardly as indicated at 34 to provide a retainer for a wad 35 of cotton or other suitable air filtering material. Such wad of cotton will, of course, be confined between the intumed end portion 34 of the filter tube and the outer end 36 of the fitting 18 or 18a. The paper filter element including the filter material therein is of such character that it may be sterilized by heat or otherwise while in place on a cap structure, sterilization by live steam being preferable although not essential.

On the bottle 1 which represents the cap structure with associated elements for delivering fluid to a patient, a sight tube or drip tube 37 is provided, said tube being of transparent material such as glass and being of such internal diameter as to fit snugly around the outside of the main body portion of the nozzle 14. The resiliency of the material of which the nozzle 14 is formed serves, of course, to permit some distortion or compression of the nozzle 14 to the end that a very tight and leak-proof fit may be obtained between the tube 37 and the nozzle merely by a force fit of the sight tube over the nozzle.

A length of thermoplastic tubing 38 of suitable small diameter is secured at one end as shown at 39 to a reduced discharge end portion 40 of the sight tube and at its other end said tube 38 is provided with a needle adapter fitting 41. The fitting 41 may be made of stainless steel or other suitable metal construction, and it is so formed that the tube 38 may be securely united to the fitting by means of a leakproof joint. One suitable construction is shown in my co-pending application Serial No. 671,736. The fitting 41 is provided with a tapered end portion 48 of such form that the usual injection needle may be attached thereto by more or less conventional means. A cap 42 is applied to the free end of the needle adapter fitting 41 and is frictionally held thereon. Said cap may be of resilient rubber or other similar resilient material which can be easily removed when it is desired to attach a needle to the fitting. The material of which the cap 42 is formed should be of such material that it will withstand the effects of heat or other sterilizing procedure by which the entire cap structure with attached elements is sterilized.

A flow controlling device is associated with the flexible tubing 38. Said device comprises a sheet metal member 43 which is provided with a tapering slot 44 through which the tube 38 passes. By adjusting the slotted member 43 transversely of the tube 38, the tube will be more or less closed as the tube is forced into the narrow end portion of the slot, thereby to restrict the flow of fluid through the tube. At the wider end of the slot, it is of at least slightly smaller than the outside diameter of the tube, so that the latter will be compressed sufficiently to cause the flow controller to be effectively held in place on the tube by the resiliency or expansive pressure of the tube. Gauge marks may be provided on the control device for indicating the setting thereof.

When a second bottle of fluid is to be connected to a first bottle represented in Fig. 1, the cap structure 4a instead of having a sight tube such as 37 attached to its outlet nozzle 14a is operative to receive a large sized needle-like tube

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45 which may be inserted into the opening of the nozzle as shown. The fit of the tube 45 in the nozzle opening is such that there will be no leakage possible between the nozzle and tube 45. The needle tube 45 has its outer end provided with an enlargement as shown at 46 for tightly receiving an end portion 47 of the connecting tube 32, the other end of which is connected to the fitting 18 by means of an end fitting 41a which is of the same construction as the needle fitting 41. The tapered end portion 48 of the fitting, which fits a portion of an injection needle, also fits snugly into the flared portion 25 of the fitting 18. The fit between the tapered needle adapter end portion 48 and the flared end portion 25 of the fitting 18 is such that the parts will be frictionally locked in assembled relation without leakage between them.

The principal unit according to the present invention would comprise the cap structure 4 with the inlet fitting 18 and an air filter member 33 and filtering medium 35 on the fitting 18, a sight tube 37 on the nozzle 14, a suitable length of tubing 38, the flow control member 43 on the tube 38, the needle adapter fitting 41 attached to the tube 38, the protective cap or cover 42, and a protective cover 49 (Fig. 4) on the cap 4. This structure is represented in Figs. 4 and 5 of the drawings in a partially packaged condition. Such a principal unit of apparatus is capable of being sterilized in its assembled condition in an autoclave or other suitable sterilizing equipment. While being sterilized, the protective covers 42 and 49 should be in place on the fitting 41 and cap 4 respectively. The cover 49 may be of thin resilient rubber or other material which will stretch and fit tightly over the rigid outer element of the cap and hold itself in place thereon.

When the described principal unit of apparatus has been sterilized, it may be handled to the extent necessary for packaging purposes without danger of contaminating any of the internal or vital external surfaces of the apparatus so that the packaged unit may be delivered in effectively sterilized condition to the user of the apparatus.

One convenient method of packaging the apparatus is to provide a paperboard loop or receptacle 50 (Fig. 3) formed from a blank such as represented in Fig. 6. The blank comprises a main side wall panel 51 and a pair of auxiliary panels 52 and 53. The side wall panel 51 is bent to form an elongated loop having sides 54 and 55 and rounded end portions 56 and 57. The side wall 54 is formed by abutting end portions of the main panel 51. The auxiliary panel 52 is folded inwardly from the bottom edge of the side wall 55 to form a partial bottom for the loop, and the panel 53 is folded upwardly and secured to the abutting end portions which form the side wall 54. The panel 52 has foldably connected to it an end extension 58 which is folded upwardly from the end of the bottom forming portion 52, and said extension 58 has a flap 59 foldably connected to one of its sides, said flap 59 being folded to and secured in overlapping position on the inside of the panel 53. The extension 58 forms a partition in the loop member 50 to provide an end space or chamber 60 which is adapted to house the main cap structure 4 with its protective cap 49 thereon. Said partition member 58 is suitably notched as indicated at 61 and 62 to receive the filter tube element 33 in place on the fitting 18 and the sight tube 37, the upper portion 61 of the notch in said partition being of such width as to receive therein the diameter of a lip-like circumferential flange

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12a which projects from the cap element 9 in slightly spaced relation to the nozzle 14 as best shown in Figs. 1 and 2. The notch portion 62 in said partition is of such width as to receive the diameter of the boss 17 which receives the fitting 18.

The filter member 33 and the sight tube 37 carried by the cap structure, will project into the main portion of the receptacle formed by the loop 50 and the tube 38 is bent reversely and extended outwardly through a slot 55a in the side wall 5 as indicated at 63. The tube 38 is then wrapped a few turns (according to its length) around the outside of the loop and then brought inwardly through said slot 55a into the interior of the loop where the capped free end of the tube is permitted to rest. The tube 38 is effectively held in place around the loop 50 as an incident to its being coiled snugly around the loop and its close fit in its passage through the slot 55a of the side wall of the loop.

The paperboard loop with the apparatus packaged therein and thereon may next be enclosed in any suitable outer container 63 of paperboard or other material as represented in Fig. 7. Said outer container will preferably be provided with scoring such as represented at 64 for facilitating opening of the package to permit the removal of the loop 50 with its content. In this instance, the container 63 is illustrated as having its top wall scored for affording a full opening to the interior thereof. However, either of the other walls of the container may be similarly provided with means for opening of the container. The outer container should, however, be of such size that the tubing 38 wrapped around the outside of the loop 50 will fit snugly within the container so as to permit shifting of the packaged material within the outer container. Although it is not essential, it is desirable that the outer container be of sufficient rigidity to prevent collapsing of the tubing 38 between the walls of the outer container and the walls of the loop 50.

By packaging the apparatus in the described manner, the parts are held in fixed position with the tubing so arranged that it is free of sharp bends or kinks. Certain kinds of tubing tend to set in any position in which it is held for an extended period. By supporting the apparatus in the manner explained, the formation of objectionable bends or kinks, either initially or because of shifting of the parts in the package, is prevented.

Auxiliary equipment such as the cap 4a with its means for delivering liquid from one bottle to another, and an air filter may be sterilized, protected and packaged in a manner similar to that illustrated in Figs. 3 to 7, inclusive.

The tube 38 is preferably of a synthetic plastic composition of a kind now available on the market and which is sufficiently transparent to permit visual inspection of the flow of liquid through the tube, effectively resistant to chemical action by any of the liquids which would ordinarily be conducted therein in connection with intravenous or like injections, flexible and resilient with the capacity of withstanding heat sterilization in an autoclave without too seriously impairing its resiliency characteristic which is relied upon for holding the tube end on the sight tube 37 and on the needle element 45, and it is smooth surfaced inside and out, and is produced with a high degree of uniformity in respect of its internal and external diameters so that a selected size of tubing will practically always fit with the same degree of tightness on other parts of a specified size. The

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resiliency of the material is also such that the tube will automatically expand when the flow controlling device 43 is adjusted from a closed position to an open position, even after the tube has been subjected to sterilizing treatment. Tubing of this character is considerably less expensive than the equivalent rubber tubing which has most commonly been used in connection with venoclysis sets. The metal fittings such as 48 and 41 are of simple character and construction so that they are of low cost, and the glass sight tube 37 and the parts of the cap 4 are also of such low cost that all of these parts may be disposed of after they have been used once without adding excessively to the cost of a blood transfusion or the administration of liquid by means of this type of apparatus. Disposal of the equipment after use eliminates the conventional practice of re-sterilizing the equipment with the attendant uncertainties as to thoroughness of the sterilization and in this respect any slight increase in the cost of employing disposable equipment such as here described is fully justified, in that any danger of infecting the patient by reason of inadequately sterilized equipment is eliminated.

The outer shell of the cap 4 never comes into direct contact with any of the liquid being administered. If desired, said outer cap element may be preserved and sterilized as a safety measure and re-assembled with a new inner member 9. This practice, however, would involve extra handling of the sterilized member 9 which would probably be somewhat objectionable because of the danger of contaminating the same. The metal fitting 18 and the glass sight tube 37 may be separated from the other parts if desired and re-sterilized for re-use, sterilization of these parts being readily accomplished without any questions as to the sufficiency of the sterilizing operation. However, for the reasons already indicated in respect of the necessity of handling the parts for assembling with other elements, it is preferable that all of these parts be disposed after a single use so as to obtain the greatest benefits of certainty of complete sterilization of new equipment.

Various other arrangements for packaging the apparatus may, of course, be employed, and various changes may be made in the structure without departing from the invention.

I claim:

1. Apparatus for intravenous administration of liquids, comprising a length of flexible tubing, a fitting on one end of said tubing for detachable connection to a needle, a bottle cap provided with means for detachably connecting the cap to a bottle, an outwardly projecting outlet nozzle for discharging liquid from a bottle to which the cap may be attached, and with an inlet passageway for permitting fluid to enter said bottle, and an apertured fitting carried by said cap in communication with said inlet passageway, said apertured fitting being a tubular member having an end portion seated in said inlet passageway, a check valve structure in the opening of said tubular member for preventing discharge of fluid from said bottle through said inlet opening, and outer and inner surfaces on its other end portion respectively adapted to detachably receive an air filter and a tube end fitting substantially as described.

2. Apparatus for the intravenous administration of fluids, comprising a bottle cap outer element having an apertured end wall and a skirt which is provided with means for attaching the cap to a bottle, a resilient member having a disc

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portion associated with the apertured wall of said outer element and having a peripheral portion overlapping the margin of the inside of said end wall around the aperture therein, said resilient member having a portion projecting from said disc portion through said aperture and provided with an enlargement overlapping the margin of the outside of said end wall around said aperture, the resiliency of said member permitting distortion thereof and assembly with said outer element, and said resilient member having one or more apertured projections for receiving one or more devices such as a sight tube, an inlet check valve, and a filter.

3. Apparatus for intravenous administration of liquids, comprising a bottle cap provided with means for detachably connecting the cap to a bottle, an outwardly projecting outlet nozzle for discharging liquid from a bottle to which the cap may be attached, and with an apertured outwardly extending projection, a length of flexible tubing having one end connected to said nozzle so as to receive the liquid therefrom and provided at its other end with a fitting for detachable connection to a needle, and a fitting mounted in said apertured projection and embodying a check valve for permitting fluid to enter a bottle to which the cap is attached, the outer end portion of said fitting having external and internal surfaces for respectively receiving an air filter and a flexible tube end fitting substantially as described.

4. Venoclysis apparatus comprising a dispensing container-closure having a wall part adapted to be seated on a container so as to extend across the mouth of the container, drip tube and strainer mounting projections integral with and extending in opposite directions from said wall part, said projections and the intervening wall part having an opening extending therethrough and constituting an outlet opening through the closure, and another projection integral with and extending from said wall part in the direction in which said drip tube mounting projection extends and in laterally spaced relation to said drip tube mounting projection, there being an opening extending through said other projection and wall part and constituting an inlet opening.

5. Venoclysis apparatus comprising a dispensing container-closure having a resilient rubber wall part adapted to be seated on a container so as to extend across the mouth of the container, drip tube and strainer mounting projections integral with and extending in opposite directions from said wall part, said projections and the intervening wall part having an opening extending therethrough and constituting an outlet opening through the closure, a drip tube having a hollow end portion surrounding said drip tube mounting projection and maintaining the latter under compression so as to be thereby frictionally yieldingly attached to the closure, a length of tubing having one end secured to the other end of said drip tube, a needle adapter secured to the other end of said length of tubing, said strainer mounting projection being adapted to be received under compression within a hollow end portion of a strainer to thereby frictionally yieldably attach such strainer to the closure, and another projection integral with and extending from said wall part in the direction in which said drip tube mounting projection extends and in laterally spaced relation to said drip tube mounting projection, there being an opening extending through said other projection and wall part and constituting an inlet opening, and a check valve structure inserted into

said inlet opening and of such size as to expand the material around said opening whereby said check valve is yieldably frictionally mounted on said closure, said check valve being arranged to prevent outflow of fluid through said inlet opening.

6. Packaged, single use, sterilized and ready for use apparatus for intravenous administration of fluids, the apparatus comprising a length of flexible, resilient material tubing, a connector secured to one end of said tubing for attaching the same to a fluid container in communication with the interior of the container, a removable protective cap enclosing a portion of said connector, a hypodermic needle adapter secured to the other end of said length of flexible tubing, and a removable protective cap enclosing a portion of said needle adapter, the packaging comprising inner and outer members, the inner member comprising a unit having said tubing wound spirally therearound so as to support said tubing against kinking, said unit having, in effect, an endless wall around which said tubing is wound as aforesaid, and said outer member being a receptacle completely enclosing said inner member and fluid administration apparatus.

7. Packaged, single use, sterilized and ready for use apparatus for intravenous administration of fluids, the apparatus comprising a length of flexible, resilient material tubing, a connector secured to one end of said tubing for attaching the same to a fluid container in communication with the interior of the container, a removable protective cap enclosing a portion of said connector, a needle adapter secured to the other end of said length of flexible tubing, and a removable protective cap enclosing a portion of said fitting, the packaging comprising inner and outer members, the inner member having a bottom and an endless band-like side wall, the side wall having said tubing looped therearound so as to be supported in predetermined, substantially fixed position by said side wall, the end portions of said tubing extending through said side wall into the interior of said inner member so as to dispose said container connector and needle adapter within the loops of tubing around said side wall, said side wall being notched to permit passage of said tubing through the side wall as aforesaid, and said outer member being a receptacle completely enclosing said inner member and fluid administration apparatus.

8. Packaged, single use, sterilized and ready for use apparatus for intravenous administration of fluids, the apparatus comprising a length of flexible, resilient material tubing, a connector secured to one end of said tubing for attaching the same to a fluid container in communication with the interior of the container, a removable protective cap enclosing a portion of said connector, a needle adapter secured to the other end of said length of flexible tubing, and a removable protective cap enclosing a portion of said fitting, the packaging comprising inner and outer members, the inner member having a bottom and an endless band-like side wall, the side wall having said tubing looped therearound so as to be supported in predetermined, substantially fixed position by said side wall, the end portions of said tubing extending through said side wall into the interior of said inner member so as to dispose said container connector and needle adapter within the loops of tubing around said side wall, said side wall being notched to permit passage of said tubing through the side wall as aforesaid, said bottom wall extending between and interconnecting oppositely disposed portions of said endless band-like side wall and having a flap projecting upwardly therefrom and extending between said opposed side wall portions, said flap having a notch therein receiving and positioning a portion of said apparatus within said side wall, and said outer member being a receptacle completely enclosing said inner member and fluid administration apparatus.

MACK R. FIELDS.

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