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APPARATUS FOR HANDLING FLUIDS

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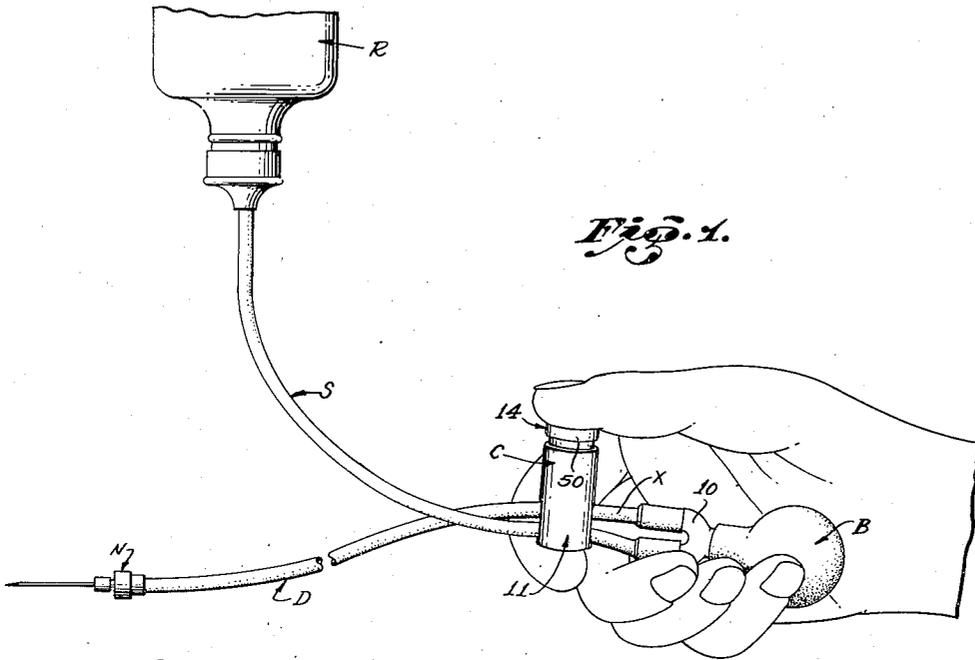


Fig. 1.

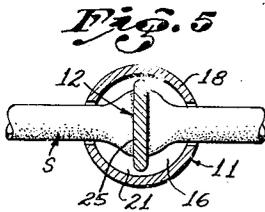


Fig. 5.

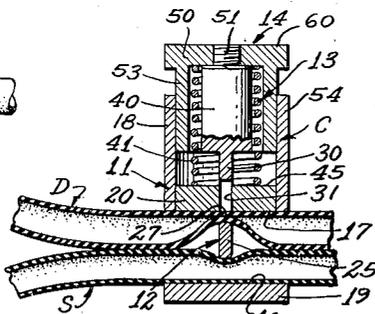


Fig. 2.

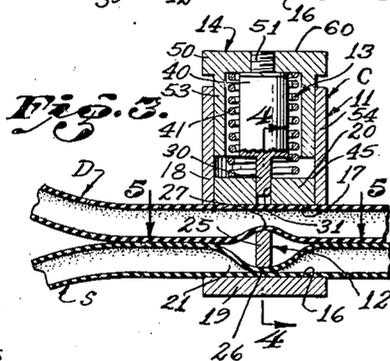


Fig. 3.

Fig. 4.

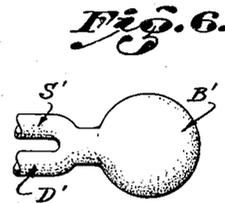
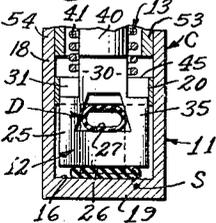


Fig. 6.

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APPARATUS FOR HANDLING FLUIDS

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9 Claims. (Cl. 251-5)

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This invention has to do with apparatus for handling fluids and it is a general object of the present invention to provide a simple, effective and improved apparatus or device useful for handling intravenous solutions, or the like.

The device provided by my present invention can be used to advantage in numerous situations where it is desired to handle or administer fluid in known quantities under control of an operator and without danger of pollution or contamination. For example, the invention can be used to advantage in handling intravenous solutions where it is vitally important that the solution be kept absolutely sterile and at the same time be administered in given or known quantities under full control of the operator. It is to be understood, however, that such specific reference is made merely for sake of example, and that the broader principles of my invention are not to be considered as limited thereby.

It is a general object of the present invention to provide apparatus for handling fluids, as for instance intravenous solutions, to receive them from a reservoir and deliver them to a patient without the use of a syringe or like device or unit of equipment, such as introduce uncertainties or hazards that should be avoided.

It is another object of my present invention to provide apparatus of the general character referred to operable to deliver predetermined quantities of fluid at intervals under full control of the operator. With the apparatus that I have provided a given known quantity of fluid may be delivered each time the device is operated, and the operator has full control of the quantity and speed at which the fluid is delivered, both as to the speed of delivery, in the course of delivering a given quantity, and as to the rapidity with which quantities are delivered.

Another object of the present invention is to provide apparatus of the general character referred to which is entirely sealed, eliminating completely all danger of contamination or pollution from an outside source in the course of delivery of fluid from a reservoir to a patient or points of use. Because of this feature of the present apparatus it is highly advantageous for use in handling intravenous solutions or in laboratories, or the like, where great care must be exercised.

It is another object of my present invention to provide apparatus of the general character referred to in which the flow of fluid is under full control of the operator without the utiliza-

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tion of valves or other parts of a similar nature in contact with the fluid.

It is another object of my present invention to provide apparatus for handling intravenous solutions which can be used without danger of the needle or applicator becoming clogged. With ordinary apparatus it sometimes happens that there is a reverse flow that results in blood entering the needle to clog it. However, with the apparatus that I have provided, reverse flow is avoided so that the needle will not become clogged.

It is another object of my present invention to provide apparatus of the general character referred to which can be completely and thoroughly sterilized. The present invention provides a combination and arrangement of parts that are in no way injured by ordinary methods of sterilization, and the construction is such that the apparatus can be sterilized as a unit or with the various parts assembled.

Another object of the present invention is to provide apparatus of the character referred to which is flexible in use and which is such that the operating part to be engaged by the operator can be located at any desired remote point, as for instance, at a point far enough removed from the patient that the anesthetist does not interfere with the operation to be performed.

A further object of my present invention is to provide apparatus of the character referred to which handles a fluid or solution without loss or with a minimum of waste.

It is a further object of this invention to provide apparatus of the general character referred to which is completely operable by one hand. With my invention the apparatus is fully operable through manipulation of a bulb and a control, both of which can be conveniently handled and operated in one hand.

Another object of this invention is to provide apparatus of the general character referred to which is such that it can be manipulated or operated to effectively agitate fluid in a reservoir from which it is being drawn. There are situations where it is important that the fluid being handled be agitated or possibly kept agitated in the course of operation, all of which can be readily accomplished with the apparatus of the present invention without resorting to stirring or like operations likely to contaminate the fluid.

The various objects and features of my invention will be fully understood from the following detailed description of typical preferred forms and applications of my invention, throughout

which description reference is made to the accompanying drawings, in which:

Fig. 1 is a complete view of the apparatus provided by my invention showing the bulb and control in the hand of an operator. Fig. 2 is a vertical detailed sectional view of the control, showing it in the normal position. Fig. 3 is a view similar to Fig. 2 showing the control fully operated or depressed. Fig. 4 is a detailed transverse sectional view taken as indicated by line 4—4 of Fig. 3. Fig. 5 is a detailed transverse sectional view taken as indicated by line 5—5 on Fig. 3, and Fig. 6 is a view showing a modified form of construction.

Since I am describing the present invention for handling intravenous solutions I have shown it in combination with a reservoir R carrying a supply of a suitable solution and an injection device or applicator N suitable for application to the body of a patient. In using the term "applicator" I mean to include any device or implement for handling or applying fluid handled by the apparatus, as for example, a needle such as is shown in the drawings.

My present invention may be considered, broadly, as including the reservoir R and needle N. However, more specifically it includes, generally, a supply conduit S, a bulb B, a delivery conduit D and a control C. In the preferred arrangement each conduit is a single elongate tube such as a rubber tube, and the two conduits are joined to the bulb B, which is preferably a common closed rubber bulb, by means of a fitting 10. In practice the fitting may be formed of a suitable material such as glass or the like, and may have a stem by which it is connected to the bulb B and branches both in communication with the stem and adapted to make connection with the conduits S and D. In the form shown in Fig. 6 the two conduits S' and D' are joined directly to the bulb B', thus eliminating the fitting 10.

In the preferred arrangement of parts the circuit or path of the fluid is simple and direct. In the drawings I have shown a typical arrangement where fluid from the reservoir R enters directly into the receiving end of the conduit S, and the conduit S extends uninterruptedly from the reservoir R to the bulb B where it is connected to the bulb by the fitting 10. The delivery conduit D receives fluid from the bulb B through the fitting 10 and extends continuously or uninterruptedly from that point to the needle N where the fluid is to be delivered. It is to be observed that the parts just described form a continuous fluid passage with no interruptions or outside openings to admit matter of any kind from the outside or to allow for leakage or waste of the fluid being handled. With the arrangement I have provided the connections between the conduits S and D and the reservoir R, fitting 10 and needle N may be simple slip joints such as are commonly employed in connection with rubber tubing and the like, which type of joint when properly established is tight and dependable.

The control C provided by my invention is applied to the conduits S and D, preferably at a point adjacent or closed to the point where the conduits join the fitting 10 so that the control can be engaged and operated by fingers or the thumb of the hand employed to grasp and operate the bulb B. This arrangement and relationship of parts is clearly illustrated in Fig. 1 of the drawings.

The control involves primarily a body 11 applied to the conduits S and D, a shutter 12 car-

ried by the body to engage and act upon the conduits as will be hereinafter described, means 13 normally yieldingly holding the shutter in one position, and means 14 whereby the shutter can be readily operated to the other position.

The body 10 is a suitably shaped block of rigid material adapted to embrace the conduits S and D. In the preferred form of the invention the body is an elongate tube having a single opening extending transversely through it, and the two conduits S and D are carried in side by side relationship in the single body opening. In practice the body opening can be varied considerably in form or configuration. In the case illustrated I have shown the opening substantially rectangular in cross section so that it has a flat bottom wall 16 and a corresponding flat top wall 17. In the particular form of construction illustrated the body has a tubular side wall 18 through which the opening is formed, and the flat bottom 16 is formed by a closure 19 that closes the lower end of the body while the flat top 17 is formed by a partition 20 fixed in the body a suitable distance above the bottom. The opening provided in the body wall 18 is preferably just sufficiently wide to accommodate the conduits S and D when they are arranged one above the other, that is, the width of the opening corresponds to the diameter of the conduits, it being preferred to employ two conduits that are equal in diameter. The length of the opening in the body is preferably made to accommodate the two conduits or, in other words, it is made to equal the combined diameters of the two conduits. The cylindrical wall 18 of the body is preferably proportioned so that its inner wall is considerably larger in diameter than the width of the opening across the body so that the body opening is, in effect, enlarged laterally between the two sides where it passes through the body opening, as clearly shown in Fig. 5 of the drawings. This enlargement or chamber 21 is provided to accommodate the conduits when they are flattened, as will be hereinafter described, and as shown in Fig. 5 of the drawings.

The chamber 21 in addition to being defined by the inner curved wall of the body is defined by the flat bottom 16 and the flat top 17, as shown throughout the drawings. The shutter 12 is carried by the body to be operable to pinch or flatten the conduits one at a time, or in other words, between an up position where it flattens conduit D, and a down position where it flattens conduit S. The shutter includes, primarily, a web 25 extending transversely through the chamber 21 and located between the two tubes that pass through the chamber. The web 25 has a lower edge 26 adapted to be moved against the tube S to pinch it against the bottom 16, and has an upper edge 27 adapted to be moved against the tube D to pinch it against the top 17. When the web 25 is in an up position, as shown in Fig. 2, the tube D is pinched against the bottom 17 so that it is closed against passage of fluid therethrough, while the tube S is not pinched but is open for free flow of fluid. When the web 25 is in a down position, as shown in Fig. 3 the reverse is true, that is, the tube S is pinched or closed against flow of fluid therethrough while the tube D is open.

In accordance with my invention the web 25 may be supported and operated in various manners. However, in the preferred arrangement it has a flat plate like extension 30 slidably carried in a slot 31 formed through the partition 20

provided in the body. The web 25 may be joined to the extension 30 by spaced leg portions 35 which straddle the conduit S as clearly shown in Fig. 4. In actual construction the parts just described are formed by first providing a flat plate and by providing a single opening or hole therethrough to pass the conduit D and to form or establish the top edge 27 of the web and to form the two legs 35. In the preferred arrangement the web 25 extends almost completely across the chamber 21 formed in the body, whereas the extension 30 is of reduced width as shown in Fig. 4.

The means 13 normally yieldingly holding the shutter in one position preferably acts to hold it up or in the position shown in Fig. 2 of the drawings. In the particular form of the invention illustrated the means 13 involves a stem 40 projecting upwardly from the extension 30 to a point well above the partition 20 and a spring 41 acts through the stem 40 to normally yieldingly hold the extension 30 and, therefore, the web 25 in the up position. The spring 41 is preferably a helical compression spring surrounding the stem 40 and acting between the upper side 45 of the partition 20 and the lower side of a head 50 applied to the upper end of the stem 40. In the particular construction illustrated the head of the stem is screw threaded to a pin-like projection 51 on the upper end of the stem part 40 and the head has a depending sleeve 53 which is in effect a part of the stem which surrounds the spring and slidably fits into the upper end portion of the body, that is, into the portion 54 of the body which projects upwardly above the partition 20.

The means 14 provided for operating the parts just described may include independent operating parts connected to the parts so far described. However, I prefer to simply provide a finished face or thumb rest 60 at the upper end of the head 50 to be conveniently engaged by the thumb of the operator when the device is in use, as shown in Fig. 1.

When the parts are in the normal position, as shown in Fig. 2, the web 25 is up and its edge 27 pinches the tube D against the wall 17 flattening it against the wall and closing the tube against the passage of fluid. When the control C is fully operated or the head 50 is depressed, as shown in Fig. 3, the edge 26 of the web pinches the tube S flattening it against the bottom 16 as shown in Fig. 5, and preventing the passage of fluid therethrough.

With the control constructed as above described it is a very simple matter to slide the conduits or tubes S and D through the control or, in other words, to adjust the control along the conduits to any desired position. It is preferred to locate the control C close to the bulb B and yet allow a short length X of the conduits to occur between the control and the bulb, or between the control and the fitting 10 to allow the parts to readily adjust or accommodate themselves to the hand of the user. With the parts assembled and ready for operation fluid from the reservoir R is admitted into the bulb B when the head 50 is up or released, so that the conduit S is not pinched against the bottom wall 16. The device can be manipulated so that fluid from the reservoir R flows through the conduit S into the bulb B to fill it, and out through the conduit D and needle N, so that the apparatus is full or flooded. Thereafter, if it is desired to agitate the fluid in the reservoir R the control

can be left unactuated and the bulb B manipulated causing fluid to surge back and forth in the conduit S and consequently to disturb the fluid present in the reservoir R. During normal operation of the apparatus a charge or body of fluid from the reservoir R having been admitted to the bulb B is discharged through the needle N by pressing the bulb B when the head 50 is depressed or in the position shown in Fig. 3. Following the discharge of the fluid through the needle the control C is released allowing the parts to move to the position shown in Fig. 2, so that the conduit S is open and the conduit D is closed, whereupon the bulb is released allowing a charge of fluid to flow from the reservoir into the bulb. It will be apparent that by repeating the operation just described charges of fluid from the reservoir R may be delivered to the needle N of any desired quantity, or at any desired speed and at any suitable intervals. Likewise, it will be apparent that the control and bulb can be arranged at any desired location and can be very easily handled or manipulated by one hand and with very little practice an operator can handle the apparatus very skillfully.

Having described only typical preferred forms and applications of my invention, I do not wish to be limited or restricted to the specific details herein set forth, but wish to reserve to myself any variations or modifications that may appear to those skilled in the art and fall within the scope of the following claims.

Having described my invention, I claim:

1. A control for two resilient tubes including, a body having an opening passing the tubes and a guideway angularly related to the opening, and a web slidably carried by the guideway in the body and having a portion between the tubes shiftable relative to the body to alternately pinch the tubes.

2. A control for two resilient tubes including, a body having an opening passing the tubes in side by side relationship, the body having a guideway angularly related to the opening, and a web slidably carried by the guideway in the body, the web having a part extending between the tubes and being shiftable so said part alternately pinches the tubes.

3. A control for two resilient tubes including, a body having a transverse opening passing the tubes and having a guideway normal to the opening, a web slidably carried by the body and having a part to engage between the tubes and shiftable to alternately pinch the tubes, and means normally yieldingly holding the web in position where it pinches one of the tubes and projects from the body to be engageable for operation.

4. A control for two resilient tubes including, a body having an opening passing the tubes and having a guideway normal to the opening, a web carried by the guideway with a part engaging both tubes and shiftable to alternately pinch the tubes, and means normally yieldingly holding the web in position where it pinches one of the tubes, said means including a stem through which the web is operable to pinch the other tube, the stem having sliding engagement with the body.

5. A control for two resilient tubes including, a body having an opening passing the tubes and having a guideway normal to the opening, a web carried by the guideway with a part engaging both tubes and shiftable to alternately pinch the tubes, and means normally yieldingly holding the web in position where it pinches one of the tubes and including a stem coupled with the web

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whereby the web is operable to pinch the other tube, the stem having sliding engagement with the body and having a head projecting from one end of the body to be engaged by an operator.

6. A control for two resilient tubes including an elongate body having a transverse opening passing the tubes in side by side relation and having opposed walls against which the tubes bear, the body having a guideway normal to the opening, a web slidably carried in the guideway and having a part in the opening between the tubes transverse of the tubes and operable toward either of the walls, a spring in the body, a stem on the web, the spring engaging the stem and normally yieldingly urging the web toward one wall, the stem having a part projecting from the body through which the stem and web are operable against the spring.

7. A control for two resilient tubes including, a body having an opening passing the tubes and having a guideway normal to the opening, a web carried by the guideway shiftable to alternately pinch the tubes, and means normally yieldingly holding the web in position where it pinches one of the tubes and including a stem through which the web is operable to pinch the other tube and which is slidably supported by the body, the stem having a head projecting from one end of the body to be engaged by an operator, said means further including a spring in the body engaging the head.

8. A control for two resilient tubes including, an elongate body having an opening passing the tubes and having a guideway normal to the opening and having a bore entering it from one end, a web carried by the body shiftable to alternately pinch the tubes, and means normally yieldingly holding the web in position where it pinches one of the tubes and including a stem coupled to the

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web and through which the web is operable to pinch the other tube, the stem having a head slidably carried in the bore of the body and projecting from one end of the body to be engaged by an operator.

9. A control for two resilient tubes including, an elongate body having an opening passing the tubes and having a guideway normal to the opening and having a bore entering it from one end, a web carried by the body shiftable to alternately pinch the tubes, and means normally yieldingly holding the web in position where it pinches one of the tubes and including a stem attached to the web and operating the web to pinch the other tube, the stem having a head slidably carried in the bore of the body and projecting from one end of the body to be engaged by an operator, said means including a spring in the body surrounding the stem and engaging the head.

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