DRUG DELIVERY SYSTEM

The present invention relates to drug delivery systems, particularly systems for continuous delivery of drugs utilising pumps of the negative pressure type.

It is known in the prior art to administer fluids to a patient in a number of ways. For example, a solution such as saline, glucose or an electrolyte in a glass or flexible container may be fed intravenously to a patient's venous access site via a length of flexible plastic tubing such a polyvinylchloride tubing. Flow from the container to the patient may be regulated by means of a roller clamp.

However, such gravity feed type systems are of limited application. This is particularly so where continuous or controlled application of drugs is required. For example, in the treatment of pain related conditions, it is known in the art to use a number of electronic pumping systems to deliver drugs to the patient. A number of positive pressure pumps, e.g. of the plunger type, are known in the field. An example thereof is the pump sold under the trade designation "Lifecare PCA+2 Infusion System" available from Abbott Laboratories. However, such positive feed systems suffer from a number of difficulties including the fact that with positive pressure systems, after the pump stops, contents may continue to be expelled or sucked back because of the positive pressure already created in the syringe or the like, thus making control less accurate. Further, with systems such as the Abbott Lifecare system, specially designed drug vials must be utilised.

It is also known in the prior art, for example via United States Patents 4,559,038 and 4,565,542, to utilise negative pressure pump systems for the delivery of drugs. For example, a peristaltic pumping action is particularly well suited for the medical field. This is because peristaltic pumping action may be applied externally of the tubing carrying the intravenous or like fluid. Thus, sterile conditions of the fluid are maintained within the tubing, whilst imparting propulsion to the fluid. The peristaltic pumping action may also be

applied to any point along the tubing. In a common type of peristaltic pump known in the prior art, a driving motor is connected to an array of cams angularly spaced from each other. The cams in turn drive cam followers connected to corresponding pressure fingers. These elements cooperate to impart a linear wave motion on the pressure fingers.

Whilst such negative pressure systems provide significant advantages over the positive pressure systems known in the art, difficulties still remain with the peristaltic pump type arrangements. For example, containers utilised with the peristaltic systems are normally empty bags which must be filled with a medicament by the operator. Such containers are inconvenient to fill, difficult to use, and increase the danger of inadvertent spillage or contamination. Alternatively where the medicament is provided in a disposable casette form, the casettes are very expensive to replace.

Accordingly, it is an object of the present invention to overcome, or at least alleviate, one or more of the difficulties or deficiencies related to the prior art.

Accordingly, in a first aspect of the present invention, there is provided a suction delivery device including

an adaptor including

a front closed end and rear open end defining a fluid pathway extending longitudinally therethrough;

a connection nozzle in the front closed end thereof defining the inner terminus of the pathway;

a connection socket in the rear open end thereof, adapted in use to receive and connect to a penetrable plunger of a cylindrical medicament vial having an upper end closed by the penetrable plunger; and

a tubular spike protruding into the socket and terminating beyond the rear open end thereof

and arranged, in use, to penetrate the plunger to flow connect the vial with the pathway in fluid tight communication;

a length of tubing having

an inner and outer open end, the inner open end communicating with the connection nozzle of the adaptor and arranged, in use, to flow connect the fluid pathway of the adaptor with the interior of the flexible tubing for fluid tight flow;

the suction delivery device being arranged, in use, to coact with a means for applying a pumping action on the exterior of the tubing to provide fluid propulsion intermediate the inner and outer end thereof.

If desired, the tubing may be connected at its inner end to a plurality of adaptor-vial units thus increasing the capacity of the suction delivery device.

It will be understood that the suction delivery device according to the present invention may function as follows:

After the adaptor is connected to the cylindrical medicament vial and the spike penetrates the penetrable plunger, the tubing may then be primed. This may be achieved by standing the vial on its base and depressing the adaptor, thus causing the fluid to flow into the tubing and priming the device. When the pumping means is turned on, fluid is drawn from the container and the negative pressure created by the fluid removal causes the plunger to progress towards the vial base. The plunger is able to move along the vial because the priming operation breaks the initial friction set between the plunger and vial.

The suction pumping operation of the device will cause liquid transfer from the cylindrical medicament vial via the adaptor to the patient, and simultaneously compensating vial movement longitudinally relative to the penetrable plunger under external atmospheric pressure, reduces the chamber volume by an amount generally equal to the liquid transfer.

The suction delivery device may include a cylindrical medicament vial. The cylindrical medicament vial may be of standard known type. The cylindrical medicament vial may be of the shell glass vial type. The vial may include a pharmaceutical product. The pharmaceutical product may be of any suitable type. The pharmaceutical may include a narcotic drug. The narcotics included may be selected from one or more of morphine, meperidine, fentanyl, hydromorphone; and salts thereof and the like.

The pharmaceutical may include an anti-cancer formulation. The anti-cancer formulation may be selected from one or more of anthracyclines, such as doxorubicin, cytarabine, vinblastine, cisplatin, bleomycin, mitomycin; and salts thereof, and the like.

The adaptor according to the present invention may be fabricated from conventional materials and components. A plastics material may be used for the general construction thereof. An injection moulding construction may be used.

The tubular spike or needle may be formed in metal, for example stainless steel.

The adaptor may be of generally cylindrical shape. The adaptor may include a generally radial front wall forming its closed end. The connection nozzle may be of generally cylindrical shape. The connection nozzle may taper towards its outer end.

The connection socket defines an axial cylindrical recess and the tubular spike may define an axial hollow cylindrical tubular portion centrally arranged coaxially with the cylindrical recess.

The connection socket may further include an internal thread connection formation adapted, in use, to mate with a counterpart external thread connection formation on the penetrable plunger of a corresponding vial to be connected thereto.

The tubular spike may include a pointed free end and a base end mounted centrally within the front wall of the adaptor.

The tubing of the suction delivery device may be of any suitable type. The tubing may be flexible. The tubing may be of the non-collapsible type. The tubing may be selected to have a low priming volume. The tubing may be of the non-kink, non-collapsible type. The tubing may be of the non-kink microbore type.

In a preferred aspect, the tubing may include a section in the region of the pumping means to permit accurate fluid delivery to the patient. The tubing may include a section formed from a silicone type material, at least in the region of the pumping means. A silastic type material is preferred.

In a further preferred aspect, the tubing of the suction delivery device may include a coiled section proximate the inner end thereof.

The coiled section may assist in the assembly of the component part of the suction delivery device. The coiled section may further reduce the likelihood of collapse of the flexible tubing during use. In use, the coiled tubing uncoils and allows the plunger to move freely towards the closed end of the vial.

As described above, the flexible tubing is connected to the connection nozzle of the adaptor in fluid tight manner. The flexible tubing may overlay the connection nozzle of the adaptor. Alternatively the inner open end of the tubing terminates in a connection nozzle counterpart to the connection nozzle of the adaptor.

The counterpart connection nozzle may include a sleeve section adapted to receive the inner open end of the tubing. The sleeve may be sized so that the tubing is compressed therewithin to provide a fluid tight fit.

More preferably the connection nozzle on the adaptor has a luer lock connector to mate with a counterpart luer lock connector on the counterpart connection nozzle on the inner end of the length of tubing.

Accordingly in this embodiment the suction delivery device may further include a sealing means connecting the inner end of the flexible tubing to the connection nozzle of the adaptor.

The sealing means may be a clamp or like arrangement. A sealing ring may be used. A flexible sealing ring, for example of the O-ring type, may be used. The sealing ring may be formed of an elastomeric material.

The pumping means used in connection with the suction delivery device may be of any suitable type. A peristaltic pump may be used. A linear peristaltic pump may be used. A peristaltic pump sold under the trade designation Deltec Cadd-PCA and available from Pharmacia has been found to be suitable.

It will be understood the suction delivery apparatus device is particularly suitable for Patient Controlled Analgesia (PCA) and like applications. Alternatively, continuous delivery or pulsed delivery may also be suitable.

The suction delivery device may be provided in a ready-to-use kit form. The kit may include one or more adaptors as described above, one or more lengths of tubing, one or more filled cylindrical medicament vials and optionally housing incorporating the tubing arrangements described above. Such kits are particularly suitable for use both in hospital and home treatment environments for intravenous, subcutaneous or epidural drug delivery.

The kit according to the present invention has the added advantage that standard medicament vials may be utilised therewith.

As described above, the suction delivery device, in use, requires a priming step to initiate product delivery. This may be achieved by standing the vial on its base and depressing the adaptor. In order to assist in the priming step the adaptor may include at least one finger tab on the outer surface thereof.

Preferably the adaptor includes a pair of finger tabs mounted on opposite sides of the adaptor. The finger tab or tabs may be formed integrally with the adaptor.

In a preferred embodiment two or more adaptor-vial units may be included in the suction delivery

device. This increases the capacity of the device which may be important in continuous infusion applications. In such embodiments, the lengths of tubing extending from each unit may be joined in a single length of tubing prior to contact with the pumping means.

Accordingly, in a preferred form there is provided a suction delivery device including

a first adaptor including

a front closed end and rear open end defining a fluid pathway extending longitudinally therethrough;

a connection nozzle in the front closed end thereof defining the inner terminus of the pathway;

a connection socket in the rear open end thereof, adapted in use to receive and connect to a penetrable plunger of a first cylindrical medicament vial having an upper end closed by the penetrable plunger; and

a tubular spike protruding into the socket and terminating beyond the rear open end thereof and arranged, in use, to penetrate the plunger to flow connect the vial with the pathway in fluid tight communication;

a first length of tubing having

an inner and outer open end, the inner open end communicating with the connection nozzle of the adaptor and arranged, in use, to flow connect the fluid pathway of the adaptor with the interior of the flexible tubing for fluid tight flow;

a second adaptor including

a front closed end and rear open end defining a fluid pathway extending longitudinally therethrough;

a connection nozzle in the front closed end thereof defining the inner terminus of the pathway;

a connection socket in the rear open end

thereof, adapted in use to receive and connect to a penetrable plunger of a second cylindrical medicament vial having an upper end closed by the penetrable plunger; and

a tubular spike protruding into the socket and terminating beyond the rear open end thereof and arranged, in use, to penetrate the plunger to flow connect the vial with the pathway in fluid tight communication;

a second length of tubing having

an inner and outer open end thereof, the inner open end communicating with the connection nozzle of the second adaptor, the outer open end being flow connected with the first length of tubing intermediate its respective ends.

the suction delivery device being arranged, in use, to coact with a means for applying a pumping action on the exterior of the tubing to provide fluid propulsion intermediate the inner and outer end thereof;

In a preferred form, the suction delivery device may include

a junction member having first and second inlet arms communicating with an outlet arm;

the first inlet arm arranged, in use, to flow connect with the outer end of the first length of tubing;

the second inlet arm arranged, in use, to flow connect with the outer end of the second length of tubing;

a third length of tubing having an inner end and outer end, the inner end arranged, in use, to flow connect with the outlet arm of the junction member; the suction delivery device being arranged in use to coact with means for applying a pumping action on the exterior of the third length of tubing to provide fluid propulsion intermediate the inner and outer end thereof.

The junction member may be a Y-shaped or T-shaped junction. The junction member may include sealing means for sealing connection to the respective lengths of tubing.

It has been found that by attaching a pair of cylindrical medicament vials in parallel, the linear

peristaltic action of the pump creates a negative pressure in the tubing which sucks fluid from either of the vials. Accordingly, if one vial empties before the other, the pump will automatically draw fluid from the other vial.

The suction delivery device may be designed for mounting onto a pump. Accordingly, in a further preferred aspect the suction delivery device as described above further includes a housing enclosing the tubing and adaptor and arranged, in use, to be releasably connected to the pumping means.

The housing may be connected to any portion of the pumping means, in use. The housing of the suction delivery device may be adapted for snap-fit connection to the pumping means. Alternatively the housing may be removably hinged to the pumping means at one end and are held by a locking mechanism at the other end. The housing may be formed of a plastics material. The housing may also function to provide containment of fluid should the cylindrical medicament vial or vials suffer a breakage.

The housing may have associated with it a pressure plate, the housing being attached to the pressure plate. The pressure plate is adapted to interface with the pump body, and connect thereto. The pressure plate may connect to the pump body by known means, for example by hooks or other locking mechanisms. The tubing is positioned to run across the face of the pressure plate where the peristaltic action of the pump is able to act upon the tubing.

Preferably the housing includes a hollow body having a closed inner end and an open outer end and including a base wall defining the closed inner end and a connection formation proximate the outer end thereof.

The housing may include at least one mounting means within the hollow body arranged to releasably hold at least one cylindrical medicament vial. One or more clamping means may be used. A biased clamp is preferred.

In an alternative embodiment, the housing of the suction delivery device may include a hollow longitudinal outer shell releasably connected to the base wall of the

hollow body, and having a front closed end and a rear open end, the hollow outer shell being adapted to receive and enclose a cylindrical medicament vial.

The hollow longitudinal outer shell may function to protect the cylindrical medicament vial and, when removed, may provide for easy replacement of an empty medicament vial. The hollow longitudinal outer shell may be connected to the base wall of the hollow body in any suitable manner. A luer lock or like connection may be used.

In this form, the base wall of the hollow body may include a central recess adapted to receive a portion of the connection nozzle of the adaptor and counterpart connection nozzle on the inner end of the tubing.

The length of the hollow longitudinal outer shell generally corresponds to the vial length so that the position of the vial is substantially fixed in the housing. Vials of different lengths may be used within the housing by having several interchangeable hollow longitudinal outer shells of differing lengths, and sufficient tube lengths. On the other hand, in an alternative embodiment, the hollow longitudinal outer shell may contain spring means that act on the base of the vial, whereby vials of different lengths may be accommodated in the hollow longitudinal outer shell with stability.

It is desirable that the housing be at approximately equal pressure both internally and externally. Thus the housing may further include a venting means. A hydrophobic filter vent may be included.

If desired the suction delivery device may be provided in a ready-to-use form. Accordingly in a further aspect the present invention provides a medicament pumping apparatus including

a suction delivery device including

an adaptor as described above which is designed, in use, to coact with a cylindrical medicament vial; and

a length of tubing having an inner and outer

open end thereof, the inner open end communicating with the connection nozzle of the adaptor;

a pumping means for applying a pumping action on the exterior of the length of tubing to provide fluid propulsion intermediate the inner and outer end thereof; and

a housing releasably connected to the pumping means and enclosing the suction delivery device.

The present invention will now be more fully described with reference to the accompanying drawings. It should be understood, however, that the description following is illustrative only and should not be taken in any way as a restriction on the generality of the invention described above.

In the figures,

Figure 1 is a cross-sectional stylised view of a suction delivery device according to the present invention.

Figure 2 is a further embodiment of a suction delivery device according to the present invention in which a pair of medicament vials are utilised.

In more detail, Figure 1 illustrates an adaptor 1 adapted for connection to a shell glass vial 2. The adaptor 1 has an open inner end 3 and closed outer end 4. The open inner end 3 includes a connection socket 5 which is provided with an internal thread 6. In use, the adaptor 1 is connected to a penetrable plunger 7 of the shell glass vial 2. The penetrable plunger includes an external threaded section 8 screwed into the connection socket 5 of adaptor 1. The screwing motion permits the needle 9 of adaptor 1 to penetrate the penetrable plunger to flow connect the interior of the shell glass vial with the interior of the needle.

The outer end 4 of adaptor 1 includes a connection nozzle 10 connected to a counterpart connection nozzle 11, for example via a luer lock arrangement, on the end of a length of tubing 12. This connects the interior of the shell glass vial to the interior of the length of tubing via the fluid pathway defined by needle 9.

The suction delivery device includes a housing

13, which may be adapted for removable hinged connection to a pump body 14. The housing 13 includes a hinge member 13' and a latch member (not shown) which permit the housing to be locked into the base of the pump body via counterpart locking means (not shown).

The housing also includes a pressure plate 23 which interfaces with the pump body 14.

The housing 13 includes a hollow body 15 and hollow outer shell 16. The hollow outer shell 16 is releasably connected to the base wall 17 of the hollow body via luer lock tabs 18 and 18a. The shell glass vial 2 is surrounded by the hollow outer shell 16. The base wall 17 has a central recess 19 which receives the connecting portion of the adaptor 1 and counterpart connection nozzle 11.

The length of tubing 12 includes a coiled section 19 which may uncoil as the fluid contents are withdrawn from the shell glass vial 2. This assists in preventing collapse of the tubing during use and permits easy replacement of empty vials. The length of tubing 12 further includes a section of non-collapsible tubing 20 which runs along the top of pressure plate 23 and upon which the pumping action of the pump 14 is applied via reciprocating cams (not shown).

The drug delivery system according to the invention is gravity independent and therefore will operate satisfactorily regardless of orientation. The position of the pump body 14 relative to the housing 13 is not critical. As illustrated, the pump body 14 is above the housing 13, however the positions may be reversed. Also, the housing 13 may be alongside, in front of, behind, etc., the pump body in alternative embodiments in accordance with the invention.

In an alternative embodiment, as illustrated in Figure 2, the suction delivery device according to the present invention may include a pair of shell glass vials 2 and 2a connected by a pair of adaptors 4 and 4a which are in turn connected to lengths of tubing 11 and 11a. The tubing 12 and 12a are joined via a Y-shaped junction

member (not shown). Each shell glass vial 2, 2a is mounted within the housing 13 on support clips 21, 21a and 21' and 21a' respectively, between detent means 22 and 22a.

In this embodiment the housing 13 completely encloses the suction delivery device. Replacement of empty shell glass vials is achieved by removal of the housing from the pump body 14. The housing is then opened and the empty shell glass vials 2 and 2a detached from the adaptors 4 and 4a and replaced.

In order to ensure a fluid tight seal, the tubing 18 may be sealed via an O-ring 20 at the point where the tubing exits the pump body.

Finally, it is to be understood that various other modifications and/or alterations may be made without departing from the spirit of the present invention as outlined herein. For example, in the figures, the cylindrical medicament vials are shown in vertical orientation. The cylindrical medicament vials may be mounted horizontally if desired.

Claims

1. A suction delivery device including

an adaptor including

a front closed end and rear open end defining a fluid pathway extending longitudinally therethrough;

a connection nozzle in the front closed end thereof defining the inner terminus of the pathway;

a connection socket in the rear open end thereof, adapted in use to receive and connect to a penetrable plunger of a cylindrical medicament vial having an upper end closed by the penetrable plunger; and

a tubular spike protruding into the socket and terminating beyond the rear open end thereof and arranged, in use, to penetrate the plunger to flow connect the vial with the pathway in fluid tight communication;

a length of tubing having

an inner and outer open end, the inner open end communicating with the connection nozzle of the adaptor and arranged, in use, to flow connect the fluid pathway of the adaptor with the interior of the flexible tubing for fluid tight flow;

the suction delivery device being arranged, in use, to coact with a means for applying a pumping action on the exterior of the tubing to provide fluid propulsion intermediate the inner and outer end thereof.

2. A suction delivery device according to claim 1, wherein the adaptor is of generally cylindrical shape and includes a generally radial front wall forming its closed end, the connection socket defining an axial cylindrical recess, and the tubular spike defining an axial hollow cylindrical tubular portion centrally arranged coaxially with the cylindrical recess.

3. A suction delivery device according to claim 2, wherein the connection socket has an internal thread

connection formation adapted, in use, to mate with the counterpart external thread connection formation on the penetrable plunger of the corresponding cylindrical medicament vial to be connected thereto.

4. A suction delivery device according to any preceding claim, further including a cylindrical medicament vial.

5. A suction delivery device according to any preceding claim, wherein the tubing is of the non-kink, non-collapsible type and includes a coiled section proximate the inner end thereof.

6. A suction delivery device according to any preceding claim, wherein the inner open end of the tubing terminates in a connection nozzle counterpart to the connection nozzle of the adaptor.

7. A suction delivery device according to claim 6, wherein the connection nozzle on the adaptor has a luer lock connector to mate with a counterpart luer lock connector on the counterpart connection nozzle on the inner end of the length of tubing.

8. A suction delivery device including

a first adaptor including

a front closed end and rear open end defining a fluid pathway extending longitudinally therethrough;

a connection nozzle in the front closed end thereof defining the inner terminus of the pathway;

a connection socket in the rear open end thereof, adapted in use to receive and connect to a penetrable plunger of a first cylindrical medicament vial having an upper end closed by the penetrable plunger; and

a tubular spike protruding into the socket and terminating beyond the rear open end thereof and arranged, in use, to penetrate the plunger to flow connect the vial with the pathway in fluid tight communication;

a first length of tubing having

an inner and outer open end, the inner open

end communicating with the connection nozzle of the adaptor and arranged, in use, to flow connect the fluid pathway of the adaptor with the interior of the flexible tubing for fluid tight flow;

a second adaptor including

a front closed end and rear open end defining a fluid pathway extending longitudinally therethrough;

a connection nozzle in the front closed end thereof defining the inner terminus of the pathway;

a connection socket in the rear open end thereof, adapted in use to receive and connect to a penetrable plunger of a second cylindrical medicament vial having an upper end closed by the penetrable plunger; and

a tubular spike protruding into the socket and terminating beyond the rear open end thereof and arranged, in use, to penetrate the plunger to flow connect the vial with the pathway in fluid tight communication;

a second length of tubing having

an inner and outer open end thereof, the inner open end communicating with the connection nozzle of the second adaptor, the outer open end being flow connected with the first length of tubing intermediate its respective ends;

the suction delivery device being arranged, in use, to coact with a means for applying a pumping action on the exterior of the tubing to provide fluid propulsion intermediate the inner and outer end thereof;

9. A suction delivery device including

an adaptor including

a front closed end and rear open end defining a fluid pathway extending longitudinally therethrough;

a connection nozzle in the front closed end thereof defining the inner terminus of the

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pathway;

a connection socket in the rear open end thereof, adapted in use to receive and connect to a penetrable plunger of a cylindrical medicament vial having an upper end closed by the penetrable plunger; and

a tubular spike protruding into the socket and terminating beyond the rear open end thereof and arranged, in use, to penetrate the plunger to flow connect the vial with the pathway in fluid tight communication;

a length of tubing having

an inner and outer open end, the inner open end communicating with the connection nozzle of the adaptor and arranged, in use, to flow connect the fluid pathway of the adaptor with the interior of the flexible tubing for fluid tight flow;

the suction delivery device being arranged, in use, to coact with a means for applying a pumping action on the exterior of the tubing to provide fluid propulsion intermediate the inner and outer end thereof; and

a housing enclosing the tubing and adaptor and arranged, in use, to be releasably connected to the pumping means.

10. A suction delivery device according to claim 9, wherein the housing includes a hollow body having a closed inner end and an open outer end and including a base wall defining the closed inner end and a connection formation proximate the outer end thereof.

11. A suction delivery device according to claim 10, wherein the housing includes at least one mounting means within the hollow body arranged to releasably hold at least one cylindrical medicament vial.

12. A suction delivery device according to claim 11, further including at least one cylindrical medicament vial enclosed within the housing.

13. A suction delivery device according to claim 10, further including a hollow longitudinal outer shell

releasably connected to the base wall of the hollow body, and having a front closed end and a rear open end, the hollow outer shell being adapted to receive and enclose a cylindrical medicament vial.

14. A suction delivery device according to claim 13, wherein the base wall of the hollow body includes a central recess adapted to receive a portion of the connection nozzle of the adaptor, and counterpart connection nozzle on the inner end of the tubing.

15. A medicament pumping apparatus including

a suction delivery device including

an adaptor including

a front closed end and rear open end defining a fluid pathway extending longitudinally therethrough;

a connection nozzle in the front closed end thereof defining the inner terminus of the pathway;

a connection socket in the rear open end thereof, adapted in use to receive and connect to a penetrable plunger of a cylindrical medicament vial having an upper end closed by the penetrable plunger; and

a tubular spike protruding into the socket and terminating beyond the rear open end thereof and arranged, in use, to penetrate the plunger to flow connect the vial with the pathway in fluid tight communication;

a length of tubing having

an inner and outer open end, the inner open end communicating with the connection nozzle of the adaptor and arranged, in use, to flow connect the fluid pathway of the adaptor with the interior of the flexible tubing for fluid tight flow;

the suction delivery device being arranged, in use, to coact with a means for applying a pumping action on the exterior of the tubing to provide

fluid propulsion intermediate the inner and outer end thereof;

a pumping means for applying a pumping action on the exterior of the length of tubing to provide fluid propulsion intermediate the inner and outer end thereof; and

a housing releasably connected to the pumping means and enclosing the suction delivery device.

16. An adaptor including

a front closed end and rear open end defining a fluid pathway extending longitudinally therethrough;

a connecting nozzle in the front closed end thereof defining the inner terminus of the pathway;

a connection socket in the rear open end thereof, adapted to receive and connect to a penetrable plunger of a cylindrical medicament vial having an upper end closed by the penetrable plunger; and

a tubular spike protruding into the socket and terminating beyond the rear open end thereof and arranged, in use, to penetrate the plunger to flow connect the vial with the pathway in fluid tight communication.

17. An adaptor according to Claim 16, being of a generally cylindrical shape and including a generally radial front wall forming its closed end, the connection socket defining an axial cylindrical recess, and the tubular spike defining an axial hollow cylindrical tubular portion centrally arranged coaxially with the cylindrical recess.

ABSTRACT

DRUG DELIVERY SYSTEM

A suction delivery device including
an adaptor (1) including
a front closed end (4) and rear open end (3) defining a fluid pathway extending longitudinally therethrough;
a connection nozzle (10) in the front closed end thereof defining the inner terminus of the pathway;
a connection socket (5) in the rear open end thereof, adapted in use to receive and connect to a penetrable plunger (7) of a cylindrical medicament vial (2) having an upper end closed by the penetrable plunger; and
a tubular spike (9) protruding into the socket and terminating beyond the rear open end thereof and arranged, in use, to penetrate the plunger to flow connect the vial with the pathway in fluid tight communication;
a length of tubing (12) having
an inner and outer open end, the inner open end communicating with the connection nozzle of the adaptor and arranged, in use, to flow connect the fluid pathway of the adaptor with the interior of the flexible tubing for fluid tight flow;
the suction delivery device being arranged, in use, to coact with a means for applying a pumping action on the exterior of the tubing to provide fluid propulsion intermediate the inner and outer end thereof.

(Figure 1)

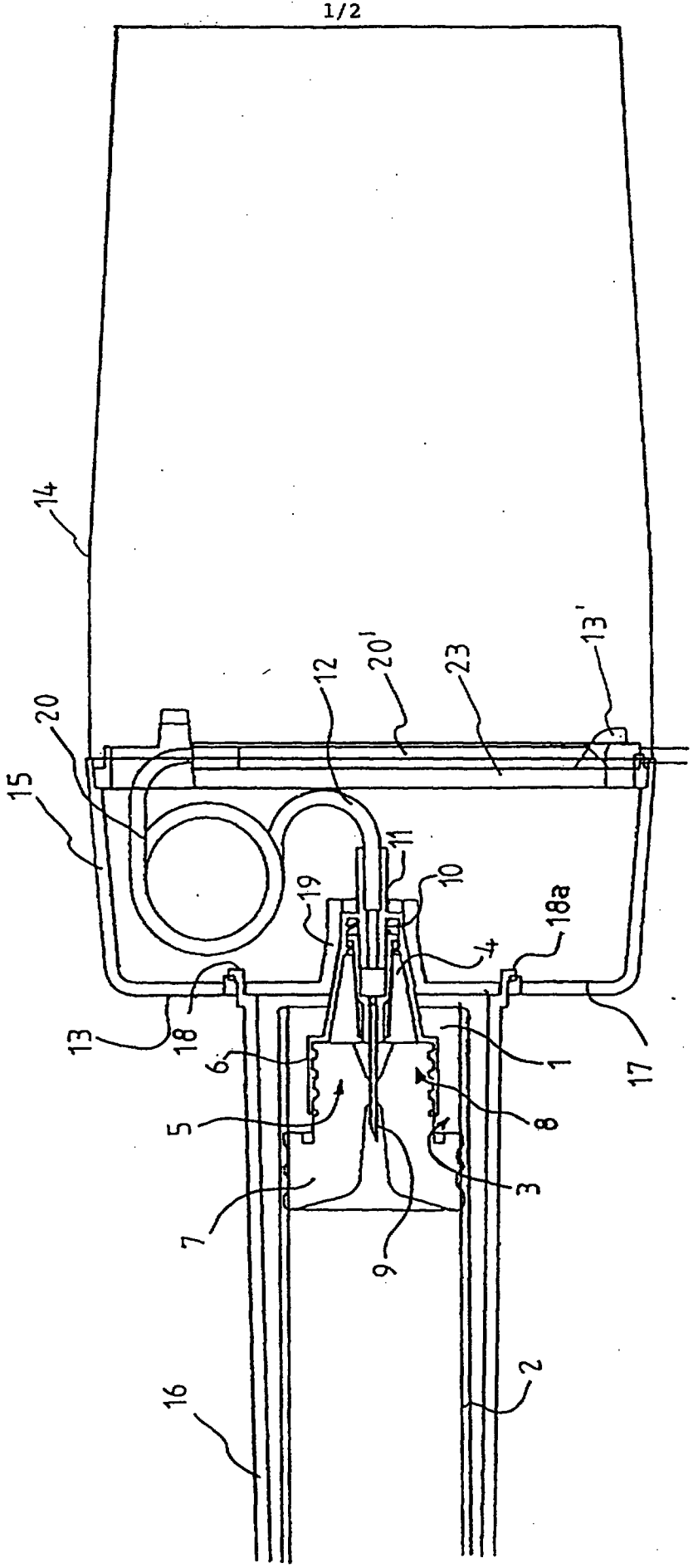


FIG 1

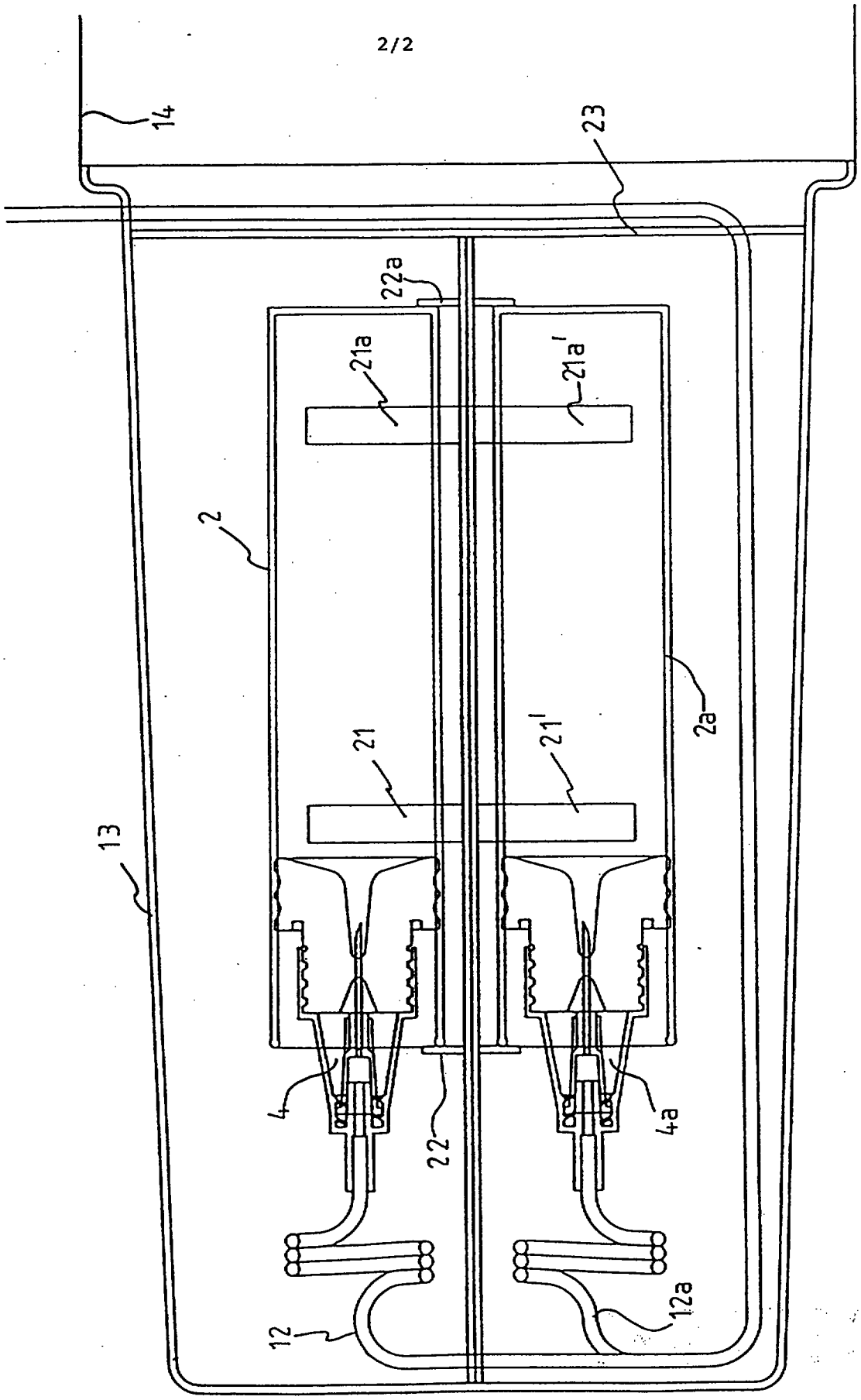


FIG 2