(12) UK Patent (19) GB (11) 2536042 (13) B

(45) Date of B Publication 09.02.2022

(54) Title of the Invention: Multiport for medical device

(51) INT CL: ***F16K 11/085*** (2006.01) ***A61M 39/22*** (2006.01)

(21) Application No: **1503749.2**

(22) Date of Filing: **05.03.2015**

(60) Parent of Application No(s)
2114846.5 under section 15(9) of the Patents Act 1977

(43) Date of A Publication **07.09.2016**

(56) Documents Cited:
EP 2267345 A2 **US 5713850 A**
US 20110011474 A1

(58) Field of Search:
As for published application 2536042 A viz:
INT CL **F16K**
Other: **Online: WPI, EPODOC**
updated as appropriate

Additional Fields
INT CL **A61M**
Other: **None**

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GB 2536042 B

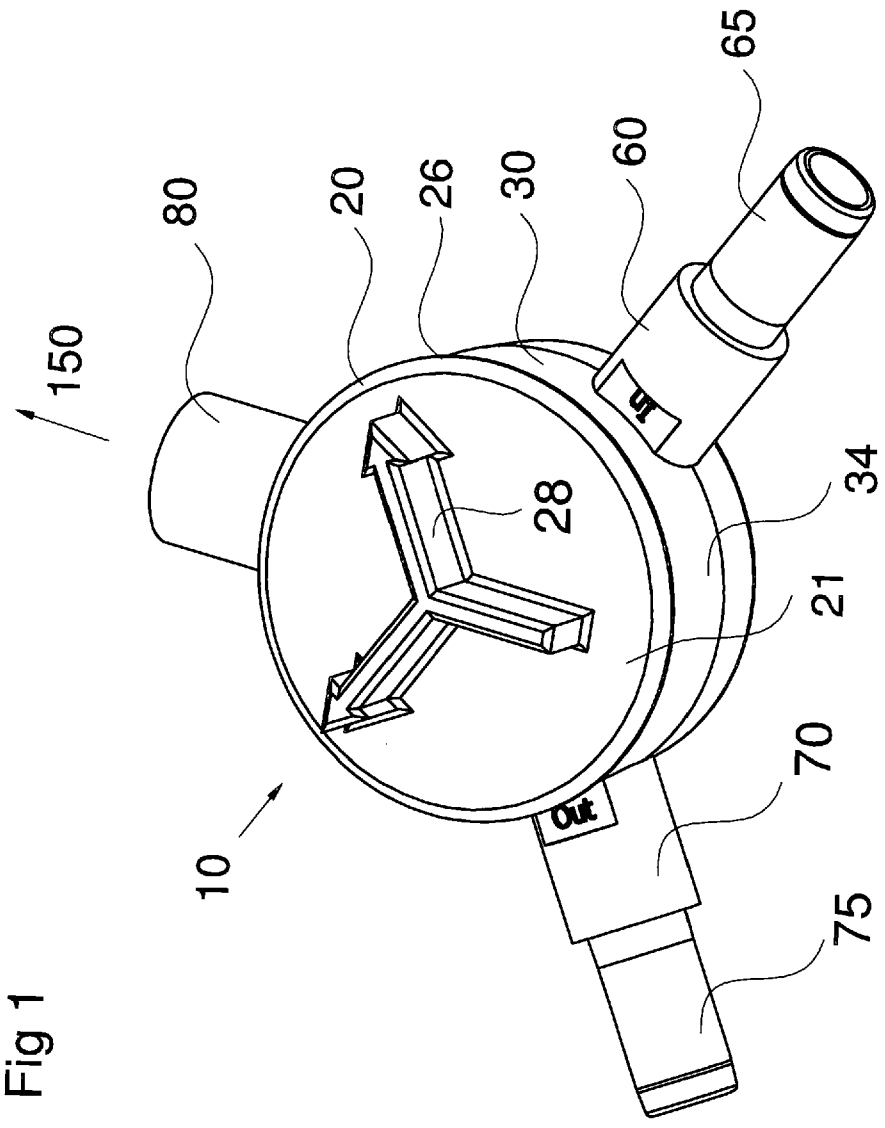
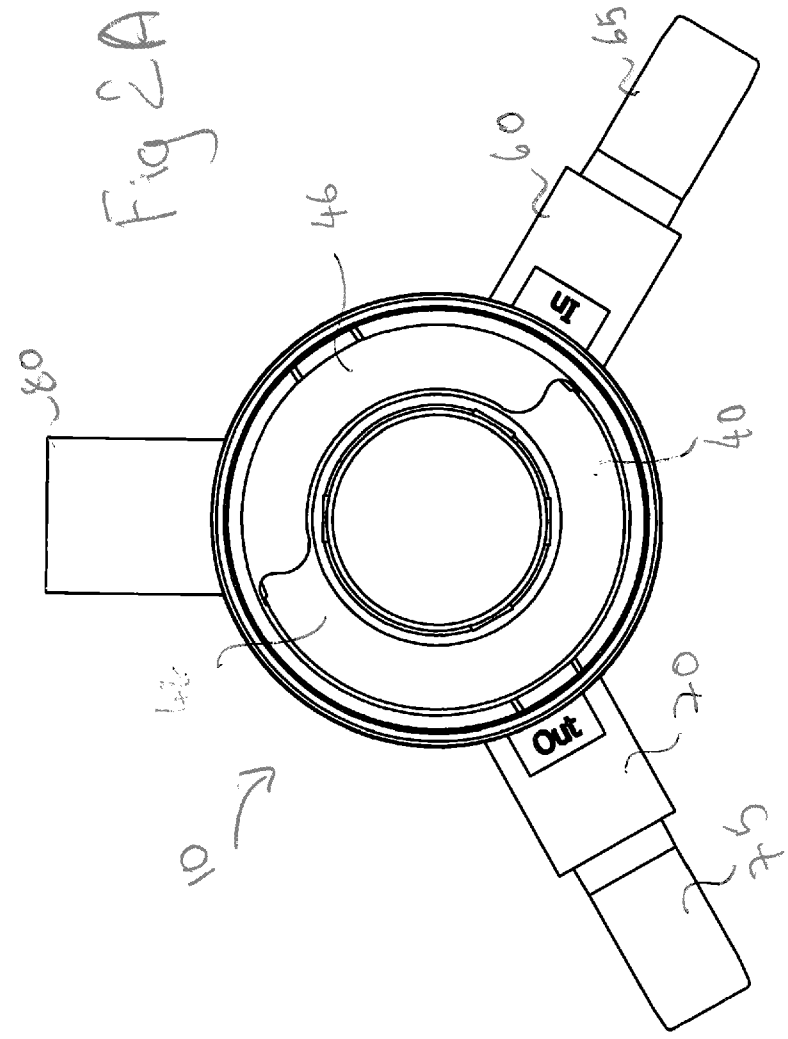


Fig 1

Fig 2A



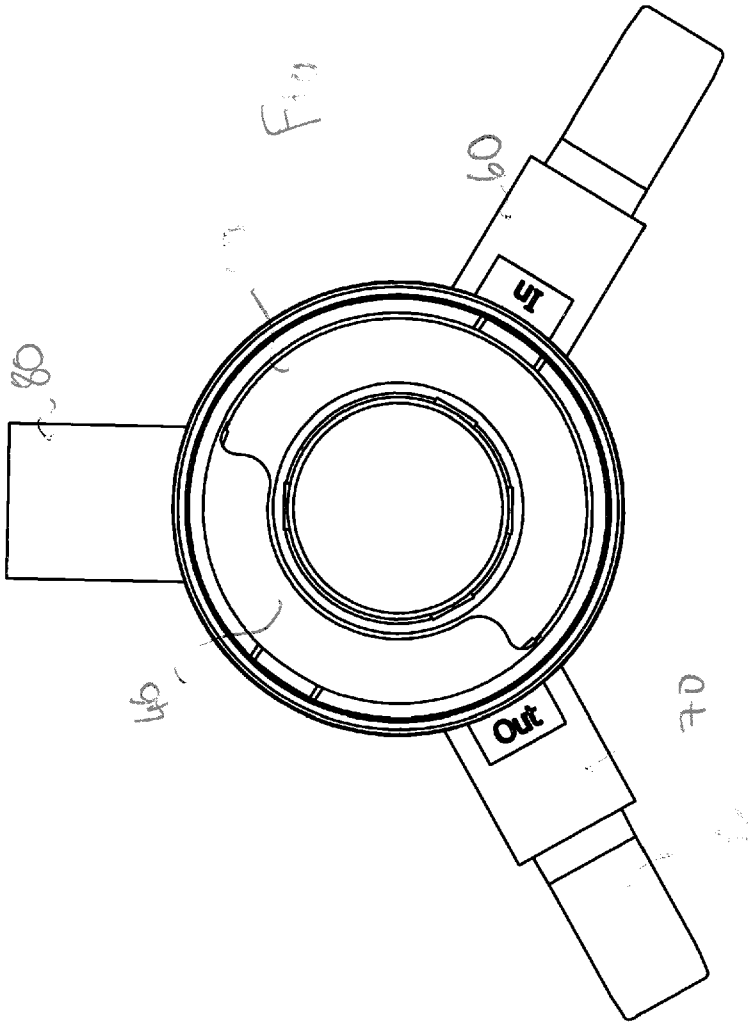
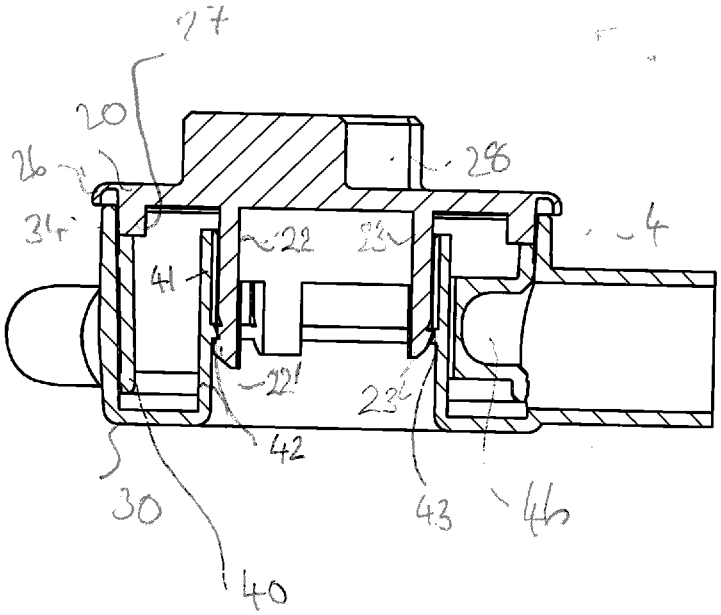

In
Out

Fig 3



Fig

Fig4

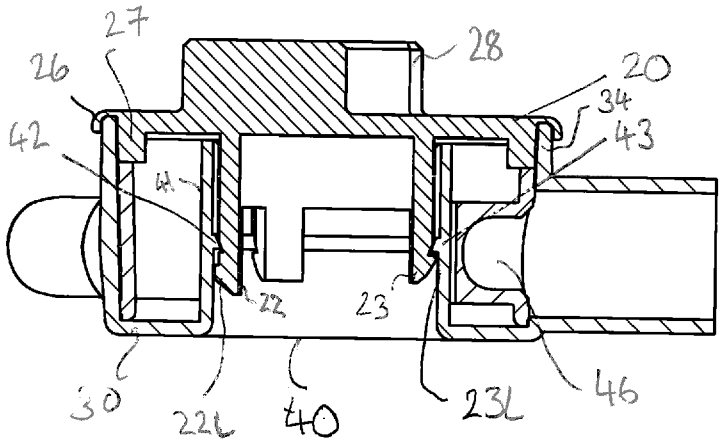


Fig 5

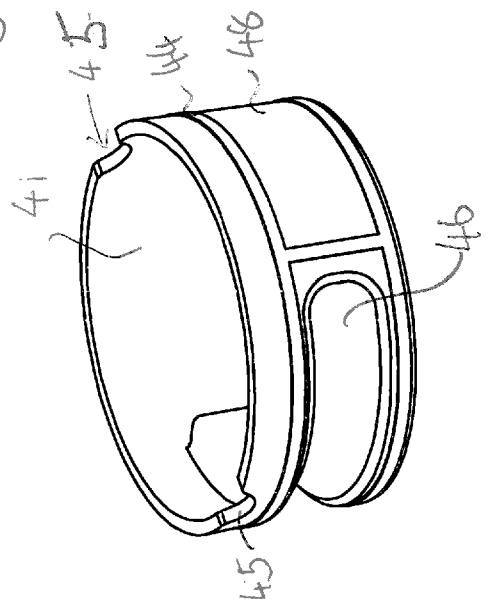
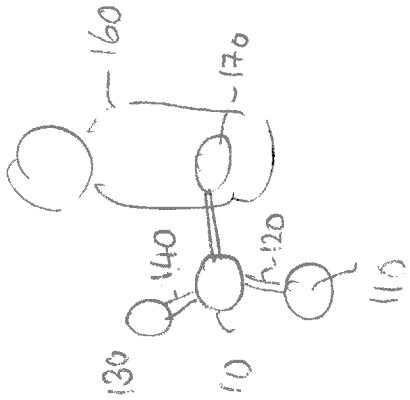


Fig 6



Description

Title: Multiport for Medical Device

Field of the invention

[0001] The invention relates to a multiport valve comprising a plurality of ports. In particular, the multiport valve can be used for medical devices, for example in a device for peritoneal dialysis

Background of the invention

[0002] Peritoneal dialysis is a treatment for patients with severe chronic kidney disease. The treatment uses the patient's peritoneum in the abdomen as a membrane, across which fluids and dissolved substances are exchanged with the blood. The dissolved substances include electrolytes, urea, glucose, albumin and other small molecules. The fluid is introduced through a permanent catheter in the abdomen and flushed out either every night, whilst the patient is asleep, or via regular exchanges throughout the day. The regular flushing throughout the day is termed "continuous ambulatory peritoneal dialysis", abbreviated to CAPD. Peritoneal dialysis can be used as an alternative to hemodialysis, but it is far less commonly used in many countries. It has comparable risks to hemodialysis, but is significant less costly. The primary advantage of CAPD is the ability to undertake treatment without the need for a patient to visit a medical facility, such as a hospital or a doctor's surgery. The primary complication of peritoneal dialysis is an infection due to the permanent presence of the catheter in the abdomen.

Prior art

[0003] One product used for continuous ambulatory peritoneal dialysis is the StaySafe ® medical device, which is commercially available from Fresenius Medical Care.

[0004] A device for continuous ambulatory peritoneal dialysis is disclosed in international patent application No. WO 2011/113615 A1 (assigned to Fresenius Medical Care Deutschland GmbH). The patent application discloses a device with a connector,

which is connected to a catheter, a container which contains an osmotically active solution and is connected to the catheter, a distributor and a hose system. The device includes a semi-permeable membrane, which is made of a cellulose membrane, for the exchange of fluids.

[0005] A further device for continuous ambulatory peritoneal dialysis is disclosed in international patent application WO 2002/032479 A2 (Levin), which includes an abdominal sac including a dialysis solution. The abdominal sac has a semi-permeable membrane wall and the abdominal sac is adapted to be retained in the abdominal region of a patient's body for receiving unconcentrated urine through the semipermeable membrane wall without permitting the dialysis solution to exit through the wall of the abdominal sac. The device further includes a conduit passing the unconcentrated urine from the abdominal sac through a section of the patient's bowel to an exit port.

[0006] A further peritoneal dialysis system is taught in European patent application No. EP 2 623 139 A1, which includes a circuit to measure the conductivity of the fluid introduced into the peritoneal cavity.

[0007] All of the prior art applications have in common that they need a valve with a number of ports in order to switch the connection of the catheter entering the abdomen between a connector tube to a sac containing an electrolytic solution and a further bag for collecting waste products. This multiport valve is a potential source of infection, as it is located outside of the body connected to the catheter entering the patient's abdomen. It therefore needs to be made and operated in manner that substantially prevents infection entering the body.

Summary of the invention

[0008] This disclosure teaches a multiport valve with at least three ports. In the case of a device for CAPD one of the ports is connected to the catheter entering the abdomen, another one of the ports is connected to a fluid bag containing electrolytic fluids and a further one of the ports is connected to a waste bag containing waste products. The three

ports are arranged circumferentially about a bottom section of the multiport valve. A top section is adapted to fit on the bottom section and has two positions. An initial position is used during rest or transportation of the multiport valve before the multiport valve is used in the CAPD device. The top section can be pushed down into a depressed position for use.

[0009] An inner ring is arranged within the bottom section of the multiport valve. This inner ring is designed to move into at least two positions. In a first position a first one of the ports is connected with a second one of the ports and in a second position the same first one of the ports is connected with a third one of the ports. The inner ring can be rotated by using a protrusion element on the outer side of the top section.

[0010] The inner ring has a seal on its outer side and the depression of the top section of the multiport valve from the initial position to the rest position enables a better sealing of the multiport valve. The seal in the initial position is not as compressed as the seal in the depressed position.

[0011] These two positions allow an easy transportation of the multiport valve in that the inner ring is not connected to the atmosphere during the transportation. On use of the multiport valve in the device the connection is made between two of the ports, which allows a fluid to flow between two of the ports. A rotation of the top section can therefore allow the device to be either in a position in which an electrolyte solution is passed into the abdomen of the patient or waste products are removed from the abdomen of the patient.

[0012] The top section is provided with a rim, which fits within the bottom section. The top section has two extension elements of differing lengths, which match to a corresponding notch on the bottom section. In the initial position, a first one of the extension elements latches into a first corresponding notch and holds the top section in position and in the initial position, a second one of the extension elements latches into a second notch and holds the top section in the depressed position within the multiport valve.

[0013] The multiport valve is provided with seals in order to prevent the entry of bacteria or virus into the multiport valve, which could course infections within the patient.

[0014] The multiport valve can be used in a drainage system, for example for continuous ambulatory peritoneal dialysis.

Description of the figures

[0015] Fig. 1 shows a perspective view of the multiport valve of this disclosure;

[0016] Fig. 2A shows a first top view of the multiport valve with the fluid tube connected between the output port and the catheter port;

[0017] Fig. 2B shows a top view of a second position of the inner tube connected between the input port and the catheter port;

[0018] Fig. 3 shows a cross-sectional view of the multiport valve in a first initial or resting position;

[0019] Fig. 4 shows a cross-sectional view of the multiport valve with the top section in a depressed or working position;

[0020] Fig. 5 shows an example of the inner ring of the multiport valve with the inner tube visible;

[0021] Fig. 6 shows an example of a continuous ambulatory peritoneal dialysis system in which the multiport valve can be used.

Detailed description of the invention

[0022] Fig. 1 shows a perspective view of a multiport valve 10 of this disclosure. The multiport valve 10 is substantially cylindrical in nature and has a top section 20 mounted on a bottom section 30. A plurality of ports 60, 70 and 80 is connected around the circumference of the wall 34 of the bottom section 30. In the example depicted in Fig. 1

three ports 60, 70 and 80 are shown. An input port 60 is connected through a connector 65 to a bag containing, for example, electrolytic fluids for dialysis (shown in Fig. 6). An output port 70 is connected through a connector 75 to a bag (not shown) for collecting waste products. A catheter port 80 can be connected to a catheter 150, which enters the patient's body. The catheter 150 is not shown in Fig. 1, but can be seen in the system depicted in Fig. 6.

[0023] The multiport valve 10 is manufactured from a plastic, such as a polyolefin, e.g. polypropylene. The top section 20 is rotatable about the bottom section 30 and fits snugly over the bottom section 30 such that rim 26 of the top section 20 fits over the top of the wall 34 of the bottom section 30 (best seen in Figs. 3 and 4). On the top surface 21 an element 28 protrudes from the top surface 21, which is used by the patient or a medical practitioner to rotate the top section 20 about the bottom section 30. It will be noted that the element 28 has two arrows, which can be used by the patient or the medical practitioner to line up the top section with the ports 60, 70 or 80. The top section 20 can be depressed into the bottom section 30 to operate the multiport valve 10, as will be explained later.

[0024] Figs. 2A and 2B show a top view of the multiport valve 10 in which the top section 20 has been removed to reveal an inner ring 40, which fits tightly into the bottom section 30 and can rotate within the bottom section 20. The inner ring 40 comprises a ring element 48 into which a tubular passage 46 is formed. This can be seen more clearly in Fig. 5. The passage 46 is designed to allow passage of a fluid from the cathode port 80 to the input port 60, as shown in Fig. 2A, or to allow passage of a fluid from the output port 70 to the cathode port 80, as is shown in Fig. 2B. The passage 46 can be rotated between either of the two positions by moving the element 28 on the top surface 21 of the multiport valve 10.

[0025] The inner ring 40 is shown in more detail in Fig. 5. It will be seen that the inner ring 40 has a seal 44 mounted on the outer circumference of the inner ring 40. The seal 44 is made, for example, from an elastomeric material and allows sealing of inner workings of the multiport valve 10 from the environment. In particular, the seal 44 ensures that no infections reach the passage 46, from where the infectious material could enter into the

body through catheter port 80, as the seal 44 is between the inner ring 44 and the inner side of the walls of the bottom section 30. The inner ring 40 has notches 42 and 43 (not shown in Fig. 5) on the inner side 41 to engage with latches on the bottom side of the top surface 20, as will be explained below. The inner ring 40 is provided with two grooves 45, located diametrically opposite each other on the upper rim. The two grooves 45 interlock with a projection on the lower surface of the top section 20 when the top section 20 is depressed into the working position (explained below) and enable the inner ring 40 to be rotated by a user using the element 28 on the top surface 21 of the top section. Thus the inner ring 40 can only be turned when the top section 20 is in the depressed or working position. This ensures that the fluid passageways are not accidentally exposed during transport of the multiport valve 10.

[0026] Figs. 3 and 4 show a cross-sectional view of the multiport valve 10 in two different positions. Fig. 3 shows the multiport valve 10 in a rest position or travelling position. This rest position is engaged after manufacture of the multiport valve 10 and before the multiport valve 10 is used. Fig. 4 shows the depressed or working position of the multiport valve 10. In this working position, the top part 20 of the multiport valve 10 has been depressed or pushed down.

[0027] It will be seen from both Figs. 3 and 4 that the top port 20 has on its bottom surface two extension elements 22 and 23 which extend into the cavity formed by the bottom part 30 and act as latches with a latch lip 22l and 23l which engage with corresponding notches 42 and 43 on the inner side 41 of the bottom section 30. In the rest or initial position shown in Fig. 3, the latch 22l on the extension element 22 latches into the notch 42 and is held in place. On depression of the top section 20, the latch 23l on the extension element 23 moves down the inner side 41 and is then latched into place in the notch 43. The depression of the top section 20 also pushes the inner ring 40 down into the inside of the bottom section 30

[0028] The top part 20 also has a protruding element 27 located near to the rim 26 on the bottom side of the top part. The protruding element 27 and the rim 26 form a cavity into which the wall 34 of the bottom section 30 fits. On depression of the top part 20, the top of

the wall 34 moves into the cavity. The protruding element 27 projects onto the top of the inner ring 40 and, on being depressed, pushes the inner ring 40 down into the bottom section. It can be seen, by comparison of the bottom of the inner ring 40 depicted in Figs. 3 and 4, that in the rest position in Fig. 3, there is a slight gap between the bottom of the inner ring 40 and the bottom section 30, whereas in Fig. 4, there is substantially no gap.

[0029] It will be noted that the wall of the inner ring 40 and the wall 34 of the bottom section 30 are inclined at a slight angle. This results in the seal 44 on the outer circumference of the inner ring 40 (shown in Fig. 5) being compressed more on depression of the top section 20. As a result, the seal 44 better seals the inside of the multiport valve 10. In other words, the seal 44 in the rest position has only a slight compressive force exerted on the seal 44, but in the working position has a much greater force exerted on the seal 44.

[0030] It is known that the seal 44 can lose at least part of its resilience when it is compressed for a long period. The time between manufacture of the multiport valve and use of the multiport valve 10 is unknown and there is therefore a risk that the seal 44 might lose at least some of its sealant properties if the time prior to use is too long. The multiport valve 10 of this disclosure reduces the risk of inadequate sealing of the inside of the multiport valve 10.

[0031] Fig. 6 shows an overview of a continuous ambulatory peritoneal dialysis system 100 comprising a waste bag 110 connected to the output port 70 of the multiport valve 10 by a connector 120. A solution bag 130 is connected to the input port 60 of the multiport valve 10 through the connector 140. A catheter 150 is connected into the abdomen 170 of a patient 160. The catheter 150 is connected to the catheter port 80 of the multiport valve 10.

[0032] The use of the multiport valve in the continuous ambulatory peritoneal dialysis system of Fig. 6 enables a simple multiport valve 10 to be developed, which is sterile and can be used by patients outside of hospitals.

[0033] It will be appreciated that the multiport valve of this disclosure can find applications in other medical fields.

Reference Numerals

10	Multiport valve
20	Top section
21	Top surface
22	Extension element
23	Extension element
26	Rim
27	Protruding element
28	Element
30	Bottom section
34	Wall
40	Inner ring
41	Inner side
42	Notch
43	Notch
44	Seal
45	Grooves
46	Tubular passage
48	Ring element
60	Input port
65	Connector
70	Output port
75	Connector
80	Catheter port
100	Continuous ambulatory peritoneal dialysis system
110	Waste bag
120	Connector
130	Solution bag
140	Connector
150	Catheter
160	Patient

170 Abdomen

Claims

1. A multiport valve (10) comprising:
   at least three ports (60, 70, 80) disposed circumferentially about a bottom section;
   a top section (20) adapted to fit on a bottom section (30) and having an initial position and a depressed position; and
   an inner ring (40) arranged to move within the bottom section (30) such that in a first position a first one of the at least three ports (60, 70, 80) is connected with a second one of the at least three ports (60, 70, 80) and in a second position the first one of the at least three ports (60, 70, 80) is connected with a third one of the at least three ports (60, 70, 80), wherein
   the inner ring (40) is turnable after depression of the top section (20).

2. The multiport valve (10) of claim 1, wherein the top section (20) and the bottom section (30) are cylindrical.

3. The multiport valve (10) of any of the above claims, wherein one of the at least three ports (60, 70, 80) is a catheter port connectable to a catheter (150) entering a patient (160).

4. The multiport valve (10) of any of the above claims, wherein one of the at least three ports (60, 70, 80) comprises a connector (75) connectable to a connector (120) of a waste bag (110).

5. The multiport valve (10) of any of the above claims, wherein one of the at least three ports (60, 70, 80) is an input port connectable to a connector (140) of a solution bag (130).

6. The multiport valve (10) of any of the above claims, wherein the top section (20) is provided with a rim (22) fitting to the bottom section (30).

7. The multiport valve (10) of any of the above claims, wherein the top section (20) is provided with at least one extension element (22, 23) matching to a notch (42, 43) on the inner ring (40).

8. The multiport valve of any of the above claims, wherein the top part (20) is provided with two extension elements (22, 23) of differing lengths and wherein in the initial position a first one of the two extension elements (22) latches into a first notch (42) on the inner ring (40) and in the depressed position a second one of the two extension elements (23) latches into a second notch (43) on the inner ring (40).

9. The multiport valve of any of the above claims, wherein the inner ring (40) is provided with a seal (44) on its outer side.

10. A drainage system (100) comprising the multiport valve (10) of any one of the above claims and a first bag (110, 130) connected to a first one of the at least three ports (60, 70, 80) and a catheter (85, 150) connected to a second one of the at least three ports (60, 70, 80).