Pump segment having connected, parallel branch line

Pumpensegment mit angeschlossener, paralleler Verzweigungsleitung

 Tubes de pompage comprenant une conduite auxiliaire se raccordant parallèlement à la conduite principale

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BACKGROUND OF THE INVENTION

[0001] Arterial sets for hemodialysis are known to conventionally carry a blood flow tubing between a connector for the arterial fistula of the patient at one end of the set and a connector to the dialyzer at the other end of the set. Between the set ends, an enlarged-diameter pump tube segment is provided, being tubing which fits into the track of a roller pump for rolling compression by the rollers of the pump. This provides the necessary pressure to circulate the blood at a desired flow rate through the entire system from the patient, through the dialyzer, and back to the patient.

[0002] Additionally, both arterial and venous dialysis sets typically carry a so-called “drip chamber”, although at current blood flows through dialyzers, the volume of blood passing through the set is much greater than that represented by a “drip”.

[0003] Hemodialysis is a relatively expensive medical procedure, since it is typically performed about three times a week on a continuing basis through the remaining life of the patient, or at least until a kidney transplant is obtained. Thus, there is significant need to reduce the cost of dialysis, which of course includes the cost of the blood sets used, and are typically disposed of after one use. Even a relatively small cost reduction in the manufacture of blood sets for dialysis can result in significant cost savings, because of the large numbers of such blood sets that are used.

[0004] At the present time, blood sets for dialysis which carry a pump segment substantially all have such pump segments that terminate in branching connectors. The branching connectors also receive the ends of the other portions of the blood flow conduit of the set, with such flow conduit portions being generally of less outer diameter than the pump segment. Also, each of the connectors at opposite ends of the pump segment typically carry a branch line which connects with the pump segment at a 90° angle. One of these branch lines is for connection to a set for saline solution supply, while the other of the branch lines typically connects to a source of heparin.

[0005] Pump sets are typically packaged in a rolled-up manner of substantially circular appearance, so that the package may be compact and neat. However, because of the presence of the perpendicular branch lines, the rolling of the set into a circular array for packaging is not easily done in an automated manner, but rather must be accomplished substantially by hand. This of course adds to the cost of packaging of the set, which adds to the overall set cost.

[0006] In addition, this 90 degree branch attachment results in complicated set-up, twisted lines, and the like by the following action: The orientation of the inlet 90 degree branch can by manipulated by the healthcare worker when the pump segment connector is attached to the first end of the U-shaped pump housing. For example, the inlet end pump segment connector can be oriented so the 90 degree branch can be pointed outwardly, parallel to the face plate of the machine. This facilitates easy attachment of the branch (IV) line to the typical line that connects at the inlet end of the pump tubing saline source.

[0007] However, the outlet 90 degree branch attachment cannot be so easily manipulated because its orientation is determined by the pronation (twisting) of the pump segment, being rotated in its U-shape by the pump rollers. Thus, while it is desirable for the outlet 90 degree branch attachment to be pointed outwardly, parallel to the face of the machine (for attachment to the heparin syringe pump), it ends up in a random location, pointing to the right, left, forward or back towards the face plate.

[0008] This leads to difficult set-up and even kinks in this attachment line as it must be redirected. Finally, the pump segment tends to continue to pronate during the procedure through the continued rotation of the pump rollers. The 90 degree attachment and connected line thus gets further twisted.

[0009] The above problems of the necessity of accomplishing a packaging of the set by hand and the twisting of the connected lines due to pronation of the pump segment also hold true for the set disclosed in US-A-5061365, the features of which have been appreciated in the precharacterizing portion of claim 1. This reference shows a heparin branch line connecting at a right angle at one end of the pump tubing and a saline line the branch line connection of which is spaced from the other end of the pump tubing. Both branch lines show the above typical 90 degree attachment. According to EP-A-105096, which discloses a similar set of tubing as US-A-5061365, no perpendicular branch lines are present, but a more or less 45 degree arrangement of the connection to the branch line is shown.


[0011] The invention set as defined in claim 1 solves the above problems. Advantageous further developments are defined in the subclaims.

[0012] According to the characterizing features of claim 1 the set is more capable of being assembled and packaged in an automated manner by rolling it up into a circular array free of set components extending substantially inwardly from said circular array and whereby pronation of the pump segment does not orient said branch line in a wrong direction.

[0013] By the present invention, a set for conveying blood between a patient and a hemodialyzer (or another blood treatment apparatus) is provided, in which the set is significantly more capable of automated rolling into a circular array, so that the sets may be packaged in a more automated packaging process than the sets of the prior art. The set of this invention may be automatically rolled, installed in a package, and sealed therein without
being touched by human hands. Thus, the set of this invention may exhibit a reduced overall cost, when compared with prior art sets which are otherwise comparable. Also, by this invention a set is provided in which the set up of the pump segment attachment lines is more convenient and less likely to kink.

DESCRIPTION OF THE INVENTION

[0014] In accordance with this invention, a set for conveying blood between a patient and blood treatment apparatus is provided which comprises a blood flow conduit means for connecting the conduit with a patient's vascular system and means for connecting the conduit with the blood treatment apparatus. A portion of the conduit of the set comprises a tubular pump segment which is connected at least at one pump segment and with a connector. The above connector or connectors also each connect in substantially straight-line relation to other portions of the blood flow conduit.

[0015] At least one of the connectors also connects to a branch line in a relation which is substantially parallel to the connection of the connected other portion of the blood flow conduit (and may also be generally parallel to the connection of the pump segment). Typically, both of the connectors at opposed ends of the pump segment each carry the substantially parallel branch line connection with a branch conduit.

[0016] By this means, the set of this invention is more capable of being rolled up and packaged in an automated manner than corresponding prior art sets. Specifically, the rolled-up set will be free of tubular members which project inwardly from the circular set in generally radial manner, so that the space within the rolled-up set is essentially free of set components.

[0017] Also, by this means the branch conduits may be shorter. Because pronation of the pump segment connector does not orient the conduit in the wrong direction, the branch conduits can be shorter, while still being capable to mate distally with a machine mounted connector, for example a heparin line conduit connecting to a syringe may mate with the connector of this invention. Also, set up is easier, and kinks are less likely.

[0018] The tubular pump segment is typically of greater diameter than the other portions of the blood flow conduit adjacent the connectors, with the exception of course of a drip chamber and the like, which is typically present. Also, the branch line or lines present which connect with the connectors at the ends of the pump segment are typically of less diameter than the other portions of the blood flow conduit adjacent the connectors. Specifically, it is preferred for the set of this invention to have a pump segment of an outer diameter of 8.5 to 12.5 millimeters; a blood flow conduit adjacent the connectors having an outer diameter of about 4.5 to 7.5 millimeters; and the branch line or branch lines having an outer diameter of about 1.6 to 4.0 millimeters. Some sets of the prior art have tubing diameters similar to the above.

[0019] Thus, a set for hemodialysis or the like is provided in which the functioning is equivalent to or better than that of prior art sets, but the set may be rolled by automated means into a circular array without inconvenient, inwardly extending branching sets from the circular array toward the origin of the circle, which facilitates automated packaging of the set of this invention and eliminates branch conduit kinking and permits a reduction in the length of branch lines.

DESCRIPTION OF THE DRAWINGS

[0020] In the drawings, Fig. 1 is an elevational view of the set of this invention, shown mounted in a roller pump;

Fig. 2 is a plan view of the set of Fig. 1, shown in its rolled, packaged configuration prior to unwinding and use; and

Fig. 3 is an enlarged elevational view, taken partly in vertical section, of one of the connectors of the set of Fig. 1.

DESCRIPTION OF SPECIFIC EMBODIMENTS

[0021] Referring to the drawings, arterial set 10 for hemodialysis is shown, comprising a proximal length of blood tubing 12 terminating in a connector 14 for connection with a patient's fistula through a needle.

[0022] Tubing 12 carries a conventional injection site 16, and communicates with a conventional blood chamber 18. Blood chamber 18 carries a pressure monitor line, as well as a second length of blood flow conduit 22.

[0023] Blood flow conduit 22 communicates through a third conduit connector 24 with a length of roller pump tubing 26, which is shown to be mounted in a roller pump system 28, illustrated in broken lines.

[0024] A second, third conduit connector 30 terminates the other end of roller pump tubing, and connects with a third length of blood flow conduit 32. The other end of blood flow conduit 32 is terminated with a connector 34 for a hemodialysis.

[0025] The particular dialysis set shown is a set for use in the "pre-pump" mode. However, the invention of this application may be used for dialysis sets in the post-pump mode as well and elsewhere.

[0026] In accordance with this invention, each of connectors 24, 30 provide connection for three separate conduits. In the case of connector 24, connection is provided for blood conduit 22, pump segment 26, and a third conduit 36, which may be used for connection with a source of saline solution or anticoagulant solution. In corresponding sets of the prior art, the saline line analogous to line 36 joins the remainder of the set in a per-
pendicular direction through a connector analogous to connector 24.

[0027] In accordance with this invention, connector 24 is provided with a pair of lumens 38, 40, which are in generally longitudinal relation to each other, and which join at one end thereof 42 as shown in Fig. 3 (although Fig. 3 is an enlarged view of connector 30, which is in reversed position but otherwise is of identical structure to connector 24).

[0028] With respect to connector 30, it provides connection between an end of pump segment 26 and blood tube 32, also providing connection with a branch conduit 44, with the connection between the conduits being in longitudinal rather than transverse relation as shown. Branch conduit 44 may connect with a source of heparin, and is held in connector lumen 38. Pump segment 26 and blood tube 32 are held in opposite end portions of lumen 40.

[0029] The respective tubes are sealed in the connectors in conventional manner.

[0030] Because of the modification of this invention, it becomes substantially easier to wrap set 10 into a generally circular array as illustrated in Fig. 2, using automated equipment if desired, thus providing further cost-reducing automation of the manufacturing process of set 10. Nevertheless, the respective longitudinal mounting of branch lines 36, 44 does not interfere with the use of the set, so that a dialysis set is provided which is fully competitive in its advantages and features with those of the prior art, but which can be manufactured with a higher degree of automation for significant cost reduction.

[0031] It is preferred for pump segment 26 to have an outer diameter of 8.5 to 12.5 mm, while blood flow conduits 22, 32 have an outer diameter of 4.5 to 7.5 mm. The branch lines 36, 44 may preferably have an outer diameter of 1.6 to 4.0 mm. Connectors 24, 30 may be made by injection molding, being proportioned in their respective longitudinal lumens 38, 40 to receive the respective tubular conduits of desired size as described above.

[0032] The above has been offered for illustrative purposes only, and is not intended to limit the scope of the invention of this application, which is as defined in the claims below.

Claims

1. A set (10) for conveying blood between a patient and a blood treatment apparatus, the set comprising a blood flow conduit comprising a portion (12, 22) for connecting the conduit with a patient's vascular system; a portion (26) comprising an enlarged-diameter tubular pump segment and a portion (32) having means (34) for connecting the conduit with the blood treatment apparatus; the tubular pump segment portion being connected at each end with a connector (24,30), said connectors also each connecting the pump segment portion (26) in substantially straight-line relation to the other portions (22,32) of said blood flow conduit; at least one of said connectors also connecting to a branch line (36,44), characterized in that the at least one of said connectors connecting to a branch line (36,44) is provided with a pair of lumens (38,40), that the pair of lumens (38,40) are in a longitudinal relation to each other, and that the connector also connects the tubular pump segment portion (26) in a substantially straight-line relation with the branch line (36,44), whereby the connection of the branch line is in a relation substantially parallel to the connection of the connected other portion (22,32) of the blood flow conduit and whereby the set is more cabable of being assembled and packaged in an automated manner by rolling it up into a circular array free of set components extending substantially inwardly from said circular array and whereby pronation of the pump segment (26) does not orient said branch line (36,44) in a wrong direction.

2. The set of Claim 1 in which both of said connectors (24, 30) carry said substantially parallel branch lines.

3. The set of Claims 1 and 2 in which the enlarged diameter of said tubular pump segment portion (26) is greater than the diameter of said other portions (12, 22, 32) of said blood flow conduit adjacent said connectors, and said branch line (36 or 44) is of less diameter than said other portions of said blood flow conduit adjacent said connectors.

4. The set of Claims 1 and 2 in which said pump segment portion (26) has an outer diameter of 8.5 to 12.5 mm.

5. The set of Claims 1 - 3 in which said blood flow conduit portion (22, 32) adjacent said connectors has an outer diameter of 4.5 to 7.5 mm.

6. The set of Claims 1 - 4 in which said branch (36, 44) line has an outer diameter of 1.6 to 4.0 mm.

7. The set of any of the preceding claims in which the pump segment portion (26) and said connected other blood flow conduit portion (22,32) are positioned in said connector (24,30) to provide a greater degree of straight flow between said pump segment portion (26) and said conduit portion (22,32) than is provided through the connector (24,30) between said pump segment portion (26) and said branch line (36,44).
Patentansprüche

1. Set (10) zum Transport von Blut zwischen einem Patienten und einer Blutbehandlungsvorrichtung, wobei das Set eine Blutstromungsleitung umfaßt, aufweisend einen Abschnitt (12, 22) zur Verbindung der Leitung mit dem Vascularsystem eines Patienten; einen Abschnitt (26), aufweisend ein röhrenartiges Pumpsegment mit vergrößertem Durchmesser und einen Abschnitt (32) mit einer Einrichtung (34) zur Verbindung der Leitung mit der Blutbehandlungsvorrichtung; wobei der röhrenartige Pumpsegmentabschnitt an jedem Ende mit einem Anschlußstück (24, 30) verbunden ist, diese Anschlußstücke jeweils auch den Pumpsegmentabschnitt (26) in einem inwendigen geradlinigen Bezug an die anderen Abschnitten (22, 32) der Blutstromungsleitung anschließen und wobei zumindest eines der Anschlußstücke auch eine Verzweigungslung (36, 44) anschließt, dadurch gekennzeichnet, daß dieses zumindest eine der Anschlußstücke, welches eine Verzweigungslung (36, 44) anschließt, mit einem Paar Lumen (38, 40) versehen ist, daß die Lumen (38, 40) dieses Paars untereinander in longitudinaler Beziehung stehen und daß das Anschlußstück auch den röhrenartigen Pumpsegmentabschnitt (26) in einem inwendigen geradlinigen Bezug zur Verzweigungsleitung (36, 44) anschließt, wobei der Anschluß der Verzweigungslung in einem inwendigen parallelen Bezug zum Anschluß des angeschlossenen anderen Abschnitts (22, 32) der Blutstromungsleitung steht und wobei das Set besser auf einer automatisierten Weise zusammenführbar und verpackbar ist durch seinen Aufrollen zu einer kreisförmigen Anordnung, die frei von Setkomponenten ist, welche sich von der kreisförmigen Anordnung im wesentlichen einwärts erstrecken, und wobei eine Pronation des Pumpsegments (26) keine Orientierung der Verzweigungslung (36, 44) in eine falsche Richtung bewirkt.

2. Set nach Anspruch 1, in welchem beide Anschlußstücke (24, 30) im wesentlichen parallele Verzweigungsleitungen führen.

3. Set nach Anspruch 1 und Anspruch 2, in welchem der röhrenartige Pumpsegmentabschnitt (26) einen größeren Durchmesser als die anderen Abschnitte (12, 22, 32) der Blutstromungsleitung benachbart zu diesen Anschlußstücken aufweist, und die Verzweigungslung (36 oder 44) einen geringeren Durchmesser als die anderen Abschnitte der Blutstromungsleitung benachbart zu diesen Anschlußstücken aufweist.

4. Set nach Anspruch 1 und Anspruch 2, in welchem der Pumpsegmentabschnitt (26) einen Außendurchmesser von 8,5 bis 12,5 mm aufweist.

5. Set nach Anspruch 1 bis 3, in welchem der zu den Anschlußstücken benachbarte Blutstromungsleitungsabschnitt (22, 32) einen Außendurchmesser von 4,5 bis 7,5 mm aufweist.

6. Set nach Anspruch 1 bis 4, in welchem die Verzweigungslung (36, 44) einen Außendurchmesser von 1,6 bis 4,0 mm aufweist.

7. Set nach einem der vorhergehenden Ansprüche, in welchem der Pumpsegmentabschnitt (26) und der angeschlossene andere Blutstromungsleitungsabschnitt (22, 32) im Anschlußstück (24, 30) so positioniert sind, daß eine höhergradig geradlinige Strömung zwischen dem Pumpsegmentabschnitt (26) und dem Leitungsabschnitt (22, 32) vorgesehen ist, als sie durch das Verbindungsstück (24, 30) zwischen dem Pumpsegmentabschnitt (26) und der Verzweigungslung (36, 44) vorgesehen ist.

Revendications

1. Ensemble (10) pour transporter du sang entre un patient et un dispositif de traitement du sang, l'ensemble comportant un conduit d'écoulement de sang comportant une partie (12, 22) destinée à relier le conduit à un système vasculaire de patient ; une partie (26) comportant un segment de pompage tubulaire de diamètre agrandi et une partie (32) ayant des moyens (34) pour relier le conduit au dispositif de traitement du sang ; la partie de segment de pompage tubulaire étant reliée à chaque extrémité à un connecteur (24, 30), lesdits connecteurs reliant aussi chacun la partie de segment de pompage (26) dans une disposition pratiquement en ligne droite aux autres parties (22, 32) dudit conduit d'écoulement de sang ; au moins un desdits connecteurs reliant aussi une conduite de dérivation (36, 44), caractérisé en ce que le au moins un desdits connecteurs reliant une conduite de dérivation (36, 44) est muni de deux passages (38, 40), en ce que les deux passages (38, 40) sont dans une disposition longitudinale l’un par rapport à l’autre, et en ce que le connecteur relie aussi la partie de segment de pompage tubulaire (26) dans une disposition pratiquement en ligne droite à la conduite de dérivation (36, 44), de sorte que la connexion de la conduite de dérivation est dans une disposition pratiquement parallèle à la connexion de l'autre partie connectée (22, 32) dudit conduit d'écoulement de sang et de sorte que l'ensemble peut mieux être assemblé et emballé de manière automatisée en le roulant jusqu'à une disposition circulaire sans avoir un composant de
l'ensemble s'étendant pratiquement vers l'intérieur à partir de ladite disposition circulaire et de sorte qu'une pronation du segment de pompage (26) n'orient pas ladite conduite de dérivation (36, 44) dans une mauvaise direction.

2. Ensemble selon la revendication 1, dans lequel les deux connecteurs (24, 30) supportent lesdites conduites de dérivation sensiblement parallèles.

3. Ensemble selon les revendications 1 et 2, dans lequel le diamètre agrandi de ladite partie de segment de pompage tubulaire (26) est plus grand que le diamètre desdites autres parties (12, 22, 32) dudit conduit d'écoulement de sang adjacentes auxdits connecteurs, et ladite conduite de dérivation (36 ou 44) a un diamètre plus petit que lesdites autres parties dudit conduit d'écoulement de sang adjacentes auxdits connecteurs.

4. Ensemble selon les revendications 1 et 2, dans lequel ladite partie de segment de pompage (26) a un diamètre extérieur de 8,5 à 12,5 mm.

5. Ensemble selon l'une quelconque des revendications 1 à 3, dans lequel ladite partie de conduit d'écoulement de sang (22, 32) adjacente auxdits connecteurs a un diamètre extérieur de 4,5 à 7,5 mm.

6. Ensemble selon l'une quelconque des revendications 1 à 4, dans lequel ladite conduite de dérivation (36, 44) a un diamètre extérieur de 1,6 à 4,0 mm.

7. Ensemble selon l'une quelconque des revendications précédentes, dans lequel la partie de segment de pompage (26) et ladite autre partie de conduit d'écoulement de sang connectée (22, 32) sont positionnées dans ledit connecteur (24, 30) pour fournir un plus grand degré d'écoulement rectiligne entre ladite partie de segment de pompage (26) et ladite partie de conduit (22, 32) que cela n'est fourni à travers le connecteur (24, 30) situé entre ladite partie de segment de pompage (26) et ladite conduite de dérivation (36, 44).