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(54) **Tube connector**

(57) A connector 1 for joining a tube to a fluid flow system comprises a body having an integrally formed insertion sleeve 2 adapted to be inserted within a tube (not shown). A socket 3 is formed integrally with the connector body and is positioned circumferentially outwardly from the insertion sleeve to define an annular chamber 4 therebetween that is adapted to receive the free end of the tube. Holding means, such as grooves, projections, adhesives or combinations thereof, coact with the outer surface of the free end of the tube to restrain the tube against movement relative to the socket.

Fig. 1

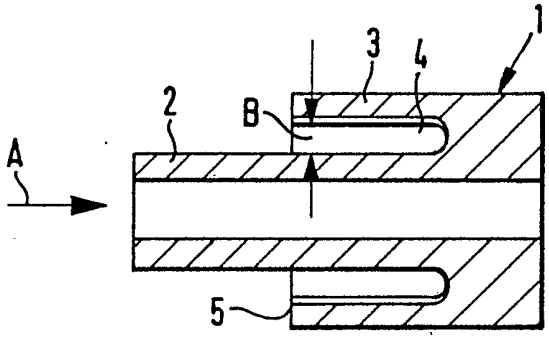

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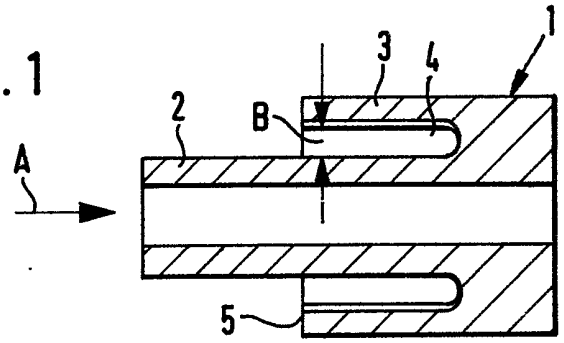
Fig. 1



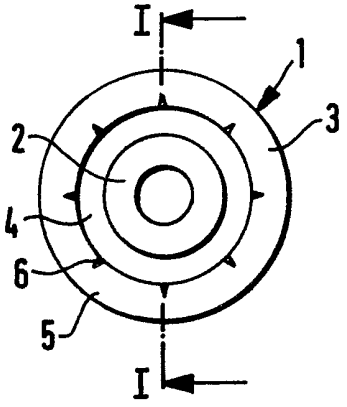
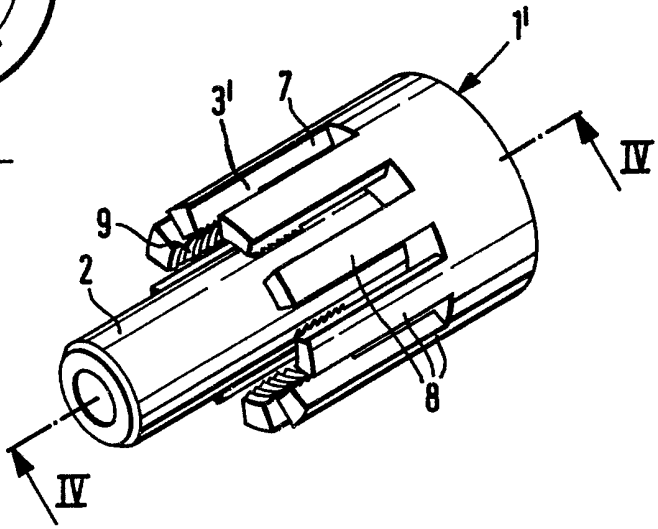


Fig. 2

Fig. 3



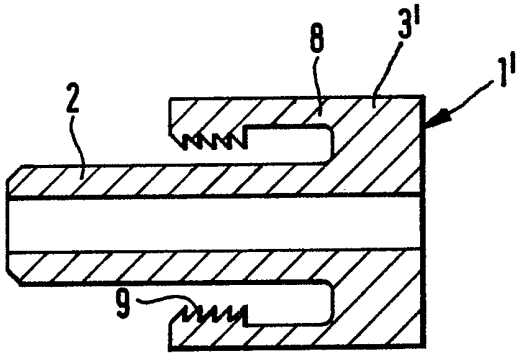


Fig. 4

SPECIFICATION

Tube connector

The invention relates to a tube connector for fluid flow systems of the type used in medicine, with the connector including an integral insertion sleeve for insertion into the lumen of a tube to be connected into the system.

These types of tube connectors serve as the connection element, specifically the adapter element in medical fluid flow systems, for example in the fluid flow systems that are used for the execution of hemodialysis. At the present time a connection member is glued onto the tube to be connected into the system in order to obtain the desired closure. In many instances difficulties occur with this and especially in those instances when the materials of the connection element and the tube cannot be glued well to each other and, on the other hand, when these materials are necessary for other reasons.

It is an object of the present invention to provide a connector of the type mentioned in which a better and a more secure connection with a tube is possible.

According to the present invention there is provided a connector for placing a tube in fluid communication with a fluid flow system comprising: a connector body, said body having a fluid flow passage therein; an insertion sleeve formed integrally with said connector body and extending outwardly from one side thereof, the outer surface of said insertion sleeve being dimensioned so as to fit in sealed relationship within the lumen of a fluid transmitting tube, said insertion sleeve having a fluid flow passage therein in communication with the fluid flow passage in said connector body; socket means formed integrally with said connector and extending outwardly from said one side of said connector body, said socket means defining a wall that is at least partially circumferentially extending and which is spaced from said insertion sleeve to define an annular chamber therebetween, said annular chamber having a dimension corresponding to the wall thickness of said fluid transmitting tube so as to embrace the outer surface of the free end of a said fluid transmitting tube; and means on said wall for cooperating with the outer surface of said fluid transmitting tube for holding the free end of a said fluid transmitting tube in said socket means.

Connectors in accordance with the present invention are provided with an integral socket, which at least in part, surrounds the insertion sleeve at a distance corresponding to about the thickness of the tube wall. Preferably the length of the socket corresponds to about half the length of the insertion sleeve.

In accordance with a further feature of the present invention the inner surface of the socket may be provided with grooves or channels that extend to the free end of the socket, and such channels can be formed as longitudinal channels or as channels that have a spiral shaped configuration.

One advantage of the present invention is that the connector is integrally formed as a combination of the insertion sleeve and the socket and that both these parts can be formed into a single unit with an adapter or similar connector to join the tube into the fluid flow system. In order to positively secure the connector to the tube, an annular space is defined between the insertion sleeve and the socket, and an optional adhesive material, for example, an epoxy resin, may be provided in the socket and/or on the outer surface of the free end of the tube. When the insertion sleeve is axially inserted into the end of the tube, the free end of the tube enters into the annular space between the sleeve and the socket, and the free end of the tube functions as a plunger, specifically as an annular piston, and displaces the adhesive outwardly into the channels. The amount of the adhesive is selected such that only the channels are filled, but if there is an excess amount of adhesive, the excess is pushed out of the open end of the channels by the piston-like action of the free end of the tube. With the above-described connector embodiment a particularly secure tube connection is obtained by the combination of an adhesive connection and a mechanical connection by virtue of the socket embracing the free end of the tube.

In accordance with a further embodiment of the invention, a connector is provided with a socket defined by a plurality of circumferentially spaced fingers separated by open notches. In this embodiment of the invention the inside surface of the fingers of the socket are provided with tube gripping means in the form of transversely extending pointed ribs or serrations, which bear against the outer surface of the tube and clamp it within the socket. This embodiment is advantageous in that it provides a purely mechanical tube connection. Through the action of the barb-like projections, the removal of the insertion sleeve that has been placed into the lumen of the tube is effectively prevented. The connector is preferably molded from a suitable plastic material, such as acrylnitrile-butadiene-styrene, polycarbonate, polyethylene or polypropylene, as will be apparent to those skilled in the art. The notches between the fingers are spaced sufficiently far apart, and the fingers themselves are proportioned, such that the fingers are resilient and the pointed projections thereon are urged against the outer surface of the tube with spring action.

Preferred embodiments of the present invention will now be described by way of example only with reference to the accompanying drawings, of which:

Figure 1 is a longitudinal section through a first embodiment of a connector in accordance with the present invention;

Figure 2 is a front view of the connector illustrated in Fig. 1, seen in the direction A;

Figure 3 is a perspective representation of a second embodiment of the present invention; and

Figure 4 is a longitudinal section through the embodiment shown in Fig. 3.

The connector of Figs. 1 and 2 is designated in its entirety by reference numeral 1 and includes an integral insertion sleeve or nozzle 2 as well as an integral socket 3 that corresponds to about half the length of the insertion sleeve and which is spaced from the insertion sleeve 3 by a distance B which corresponds about to the wall thickness of the tube (not shown) in which it will be connected so that between the insertion sleeve 2 and the socket 3 there is present an annular space or chamber 4. The inside of the socket 3 presents up to its free end 5 channels 6 which are distributed over its surface and which in the represented embodiment are formed as longitudinal channels.

The fixation of the tube takes place in the described manner. The connection part is only schematically represented and can, for example, be formed on its right side in Fig. 1 as an adapter, as a channel or the like for being connected into a fluid flow system. For convenience of reference the solid end portion of the connector 1 is referred to herein, and in the appended claims, as the connector body. As is evident from Figs. 1 and 2, the insertion sleeve 2 and the connector body include coaxial fluid flow passages. It will also be evident that the outer surface of insertion sleeve 2 and the inner surface of socket 3 are spaced concentrically outwardly of the axis of the fluid flow passages.

As is noted above, the connector of Figs. 1 and 2 is particularly suited for use with a tenacious adhesive, such as an epoxy resin. The adhesive may be applied to the outer surface of the tube, or to the inner surface of the socket, or to both; and as the free end of the tube is inserted axially into the socket it will act as plunger or piston forcing the adhesive to flow into the grooves 6 (and outwardly of the open ends of the grooves 6 if an excess amount of adhesive is used).

The further embodiment illustrated in Figs. 3 and 4 makes it possible to realize an exclusively mechanical connection of tube (not shown) with the connector being designated in its entirety by reference character 1′. Connector 1′ includes an integral insertion sleeve 2 as well as with a circumferentially discontinuous socket 3′ whose surface is interrupted by circumferentially spaced notches 7. The fingers or ribs that are formed as a result of these notches present means for the retention of the tube, and such means is defined by pointed barb-like projections 9. In accordance with another aspect of the connector of Figs. 3 and 4, the distance between the fingers 8 and the insertion sleeve 2 is smaller at the free end of the fingers than at the end of the annular channel 4, so that when a tube (not shown) is introduced into the annular channel 4, the transversely disposed pointed projections or serrations 9 at the outer ends of the fingers 8 bear against the outer surface of the tube and prevent it from being removed from the socket.

It is particularly useful in this embodiment as has been illustrated in Fig. 3 — that the width of the notches 7 corresponds at least to the width of the fingers 8, as this permits a simple removal from the mold in a manufacture of the connection part by means of the spray casting procedure.

Figures 8 are proportioned such that they are flexible and resilient, and hence the pointed projections are resiliently urged against the outer surface of the tube to prevent it from moving relative to the socket.

CLAIMS

1. A connector for placing a tube in fluid communication with a fluid flow system comprising: a connector body, said body having a fluid flow passage therein; an insertion sleeve formed integrally with said connector body and extending outwardly from one side thereof, the outer surface of said insertion sleeve being dimensioned so as to fit in sealed relationship within the lumen of a fluid transmitting tube, said insertion sleeve having a fluid flow passage therein in communication with the fluid flow passage in said connector body; socket means formed integrally with said connector and extending outwardly from said one side of said connector body, said socket means defining a wall that is at least partially circumferentially extending and which is spaced from said insertion sleeve to define an annular chamber therebetween, said annular chamber having a dimension corresponding to the wall thickness of said fluid transmitting tube so as to embrace the outer surface of the free end of a said fluid transmitting tube; and means on said wall for cooperating with the outer surface of said fluid transmitting tube for holding the free end of said fluid transmitting tube in said socket means.

2. A connector according to claim 1 wherein the fluid flow passages in said connector body and said insertion sleeve are coaxial with one another.

3. A connector according to claim 1 or 2 wherein the outer surface of said insertion sleeve and said wall are generally concentric with one another.

4. A connector according to any preceding claim wherein said insertion sleeve projects outwardly from said socket means.

5. A connector according to claim 4 wherein said insertion sleeve projects outwardly from said socket means by a dimension generally equal to the length of said socket means.

6. A connector according to any preceding claim wherein said holding means is provided by grooves in said wall.

7. A connector according to claim 6 wherein said holding means further includes adhesive means on said wall.

8. A connector according to claim 6 or 7 wherein said grooves extend longitudinally of said socket means.

9. A connector according to claim 8 wherein said grooves extend generally from end to end of said socket means.

10. A connector according to claim 6 or 7

wherein said grooves are generally transverse to the length of said socket means.

11. A connector according to any of claims 6 to 10 wherein said grooves are generally parallel with one another.

12. A connector according to any preceding claim wherein said wall is circumferentially continuous.

13. A connector according to any of claims 1 to 12 wherein said wall is circumferentially discontinuous and formed by a plurality of circumferentially spaced fingers.

14. A connector according to claim 13 wherein said holding means is defined by pointed projections on said wall and adapted to bear against the outer surface of a said fluid transmitting tube.

15. A connector according to claim 14 wherein said pointed projections are generally transverse to the length of said socket means.

16. A connector according to any of claims 13 to 15 wherein the space between said fingers is at least as great as the width of the fingers.

17. A connector according to any of claims 13 to 16 wherein said fingers are flexible.

18. A connector according to claim 14 wherein said fingers are flexible and said pointed projections resiliently bear against the outer surface of said fluid transmitting tube.

19. A tube connector substantially as herein described with reference to Figs. 1 and 2, or Figs. 3 and 4 of the accompanying drawings.

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