United States Patent

Yokoyama

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[54] **INFUSION DEVICE**

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July 12, 1969 Japan.....44/65523

[52] **U.S. Cl.** .....**128/214 R**, 128/221

[51] **Int. Cl.** **A61m 05/00**

[58] **Field of Search**.....128/214 R, 214 C, 214.2, 221; 222/81

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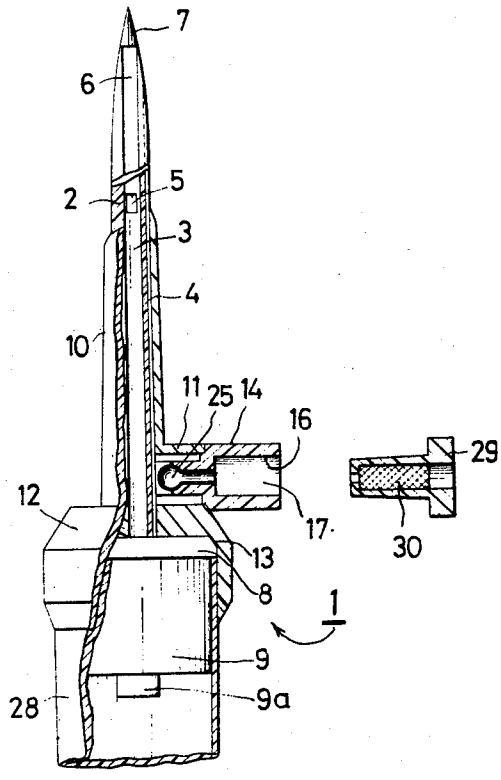
Primary Examiner—Dalton L. Truluck

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[57] **ABSTRACT**

An infusion device in which a back-flow check valve is provided at an opening communicated with an air and medical fluid injection groove formed along the length of the needle body, said check valve being made of a flexible material such as rubber or soft plastics and having its forward end formed spherically or in other similar configuration, with a slit being formed at the front thereof, and whereby either air or liquid medicine, as the case may be, caused to flow in the injected direction when so desired.

1 Claim, 5 Drawing Figures



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Fig. 1

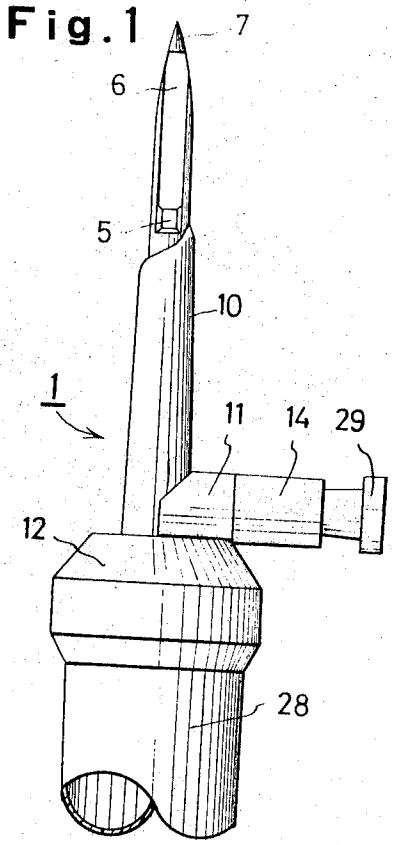


Fig. 3

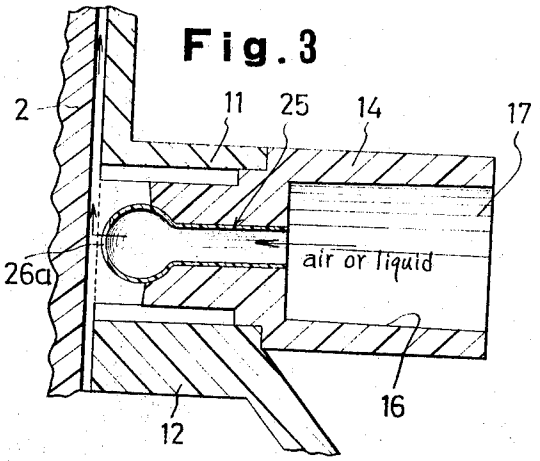


Fig. 4a

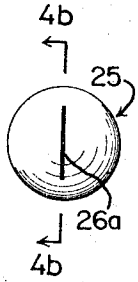


Fig. 4b

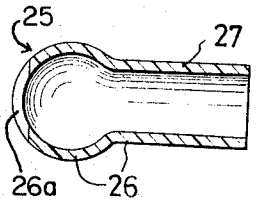
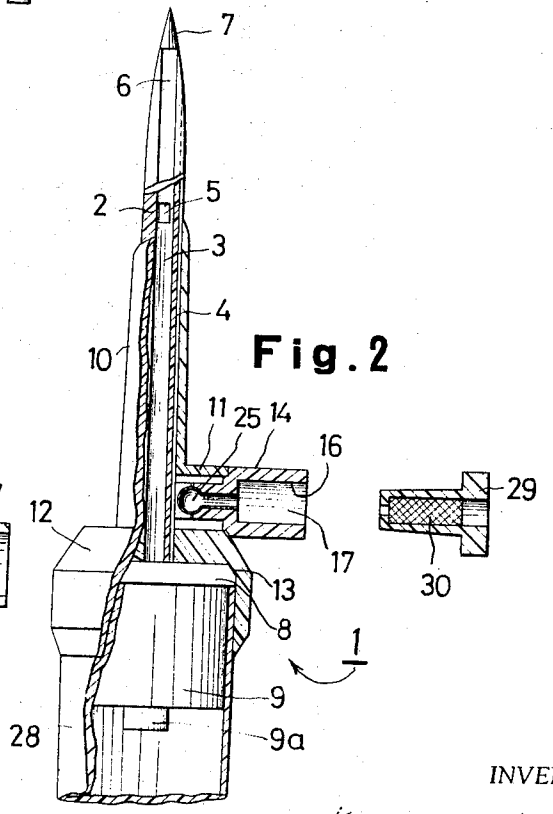


Fig. 2



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INFUSION DEVICE

The present invention relates to an infusion set and more particularly to an infusion device having an improved air and liquid medicine flowing section.

In the course of a surgical operation, there often arises an occasion when it is desired to mix some other medicine in a liquid medicine or blood during infusing or transfusing of the liquid medicine or blood from a vial or the like by an infusion or transfusion means. An infusion device designed to meet such necessity is proposed in co-pending Japanese Utility Model Registration Application No. 58,543/68 filed on July 11, 1968 by the same applicant as the present application. The infusion device of the just mentioned application comprises a branched cylinder provided at the base of the sheath of the needle body and in communication with an air injection groove, a check valve provided near the forward end of the fluid through-passage hole in said branched cylinder, and a cylindrical structure having an internal taper on its inner wall, whereby during infusion of a fluid medicine from a medicine bottle, some other desired medicine may be introduced into said medicine bottle through said cylindrical structure and air injection groove and mixed in the main fluid medicine. This infusion device, however, had several serious defects. For instance, the check valve used in the air and liquid medicine passage is small in size and is also of a type where the valve body makes mechanical motion, so that such infusion device runs into trouble during use and also could not stand long-time use.

The present invention aims at overcoming all of such defects and difficulties involved in the conventional devices, and it is therefore a primary object of the present invention to provide a novel and improved medical fluid infusing instrument characterized by use of a back-flow preventing valve with a simple structure having no mechanical movable parts such as have been used in the previously known conventional devices in the air and liquid medicine passage, so as to permit infusion and proper mixing, as desired, of some other additive medicine into the vial of a principal fluid medicine through said air and liquid medicine passage during infusion of said principal liquid medicine to a human body from the vial.

It is another object of the present invention to provide a novel medical fluid infusing instrument which can stand long-time use.

The above and other objects contemplated by the present invention are accomplished by providing a novel medical fluid infusion instrument comprising: a collecting needle body having a central hollow for formed longitudinally thereof for passage of liquid medicine and an air and liquid medicine injection groove formed longitudinally in the side wall thereof, a sheath having a branched cylindrical portion which is provided at the bottom of said sheath in communication with said air and liquid medicine injection groove and adapted to sheath or cover said needle body, and a cylindrical structure provided with a back-flow preventing valve consisting of a hollow valve section which is formed spherically or in other similar configuration of a flexible material such as rubber or resin so as to allow passage of air and liquid medicine only in the direction of injection and which has a slit formed at its front end, and a hollow conduit portion formed of same material as and integrally with said valve section, said cylindrical structure having a configuration to fit with said branched cylindrical portion.

Now, the present invention will be described in more detail by way of its preferred embodiment with reference to the accompanying drawings, in which:

FIG. 1 is a front view partially broken away of a medical fluid infusing instrument according to the present invention;

FIG. 2 is a partial vertical sectional view of the medical fluid infusing instrument of FIG. 1;

FIG. 3 is an enlarged sectional view of a part of said infusing instrument, showing the passage of air and liquid medicine;

FIG. 4*a* is a front view of a back-flow preventing valve used in the air and liquid medicine passage in the present fluid infusing instrument; and

FIG. 4*b* is a sectional view taken along the line 4*b*— 4*b* of FIG. 4*a* and in the direction of arrows in FIG. 4*a*.

Referring first to FIGS. 1 and 2, there is shown a medical fluid infusing instrument, generally designated by reference number 1, according to the present invention. Reference number 2 denotes a fluid collecting needle body which has formed in its center and longitudinally thereof a liquid medicine inlet 5 and an inner bore 3 for passage of liquid medicine leading to a bottom end portion 9*a*. At the top end of said needle body 2 is planted a needle 7 made of a hard material such as metal. Denoted by reference number 6 are the grooves for passage of liquid medicine which are formed on both sides of the needle body so as to extend from the top end of said needle body to the liquid medicine inlet 5. In the external wall of said needle body 2 is formed a longitudinally extending air and liquid medicine injection groove 4 which is reduced in width and so arranged that one end is positioned closer to the top end of the needle body 2 than to the liquid medicine inlet 5. Reference number 10 indicates a sheath covering the entire outer periphery of the needle body 2 except for the opening of the liquid medicine inlet 5, whereby said air and liquid medicine injection groove 4 is also covered, with only the end thereof being left exposed. Said sheath 10 is tapered toward its forward end so that the diameter of said forward end will be substantially equal to that of the needle body. At the base 12 of said sheath is provided a circular socket 13 which is adapted to receive a protuberance 8 on the base 9 of the needle body to thereby secure the sheath to the needle body. Right above the base of said sheath 10 is provided a protruding branched cylindrical portion 11 arranged to connect to a cylindrical structure 14 which has formed therein an air and liquid medicine a bore 17 communicated with the air and liquid medicine injection groove 4. As will be seen in the drawing (see FIG. 2), the inner wall 16 of the cylindrical structure 14 is given a taper so as to fit with a syringe or the like.

In the center of the inner end of said cylindrical structure 14 is provided a back-flow preventive valve 25 (see FIGS. 4*a* and 4*b*) which, as best shown in FIG. 3, consists of a hollow valve section 26 formed spherically or in other similar configuration with a flexible material such as rubber or plastic, with a slit 26*a* being formed at its front end, and a hollow conduit portion 27 made of the same material as and integrally with said valve section 26. The back-flow preventive valve 25 has an extremely simple structure as shown and is so constructed that the slit 26*a* is opened only when the pressure applied to its inner surface is higher than the pressure applied to its outer surface so as to allow passage of air or liquid medicine in the direction of arrow. Normally, the slit 26*a* is kept closed to inhibit movement of fluid. Reference number 28 designates a liquid dropping cylinder mounted between the bases 9 and 12, and 29 a cylindrical element in which a suitable filter means 30 is installed and which is arranged to fit into the cylindrical structure 14.

In use of the present invention, the pointed end of the needle body 2 is thrust into a rubber plug of a vial or the like in which desired liquid medicine such as for example Ringer's solution is contained in sealed state, whereby to supply said liquid medicine into the liquid dropping cylinder 28, etc., through the liquid medicine inlet 5 and the inner hollow portion 3. Usually, air is injected into said vial through the flow passage hole 17, back-flow preventive valve 25 and air and liquid medicine injection groove 4 to generate a positive pressure in said vial. In this case, since a filter-installed cylindrical element 29 is provided in the flow passage hole 17 in the cylindrical structure 14, any dust, germs or other undesirable substances mixed in the air are eliminated. Thus, when the pressure exerted by the cleaned air against the inner wall of the back-flow preventing valve 25 exceeds the pressure against its outer wall, the slit 26*a* is opened to produce an air stream running in the direction indicated by arrow in the drawing. When the pressures given to the inner and outer walls of the back-flow preventive valve 25 are equal to each other, or

when the pressure against the outer wall is larger than that against the inner wall, said slit **26***a* is kept closed to inhibit movement of air, so that there is no outflow (back-flow) of air in said vial to the outside of the fluid infusion instrument.

In the course of infusion of a liquid medicine, when it is desired to mix therein some other desired liquid medicine, the filter-attached cylindrical member **29** located in the passage **17** in the cylindrical structure **14** is removed, and instead, a suitable syringe or the like is fitted thereinto whereby to mix a desired medicine into the vial through the same route as the above-said air passage. The internal taper formed on the inner wall of the cylindrical structure **14** facilitates fitting of the syringe or the like thereinto. When other medicine is being mixed into the vial, air injection into said vial is interrupted, but since the positive pressure therein is not excessively reduced by introduction of such other medicine into the vial, there is no need of halting the liquid infusing operation. In this case, the back-flow preventing valve **25** operates in just the same manner as in the case of air injection, so that any back-flow of liquid medicine from the vial to the outside thereof through the air and liquid medicine injection groove **14** is perfectly inhibited.

Thus, according to the fluid infusing instrument of the present invention, it is possible to mix in the liquid medicine, which is being infused, other desired fluid medicine, whenever so desired, quickly and with extreme ease. Particularly, in the present invention, a back-flow preventing valve **25** having an extremely simple construction with no mechanical movable parts such as used in the conventional devices is employed in the air and liquid medicine flowing passage in the instrument, so that any possibility of causing serious troubles due to failure of check valve during fluid infusing operation is obviated to ensure safety in operation, and also the instrument can stand long use.

What I claim is:

1. A fluid infusing instrument comprising:

a fluid collecting needle body having a sharpened end and having formed therein a longitudinally extending central bore along the length of said needle body for passage therethrough of liquid medicine, said needle body also having a longitudinally extending air and liquid medicine injection groove formed in the external side wall of said needle body and along the length thereof, both said bore and said injection groove extending parallel to each other, said needle body including a side opening communicating with said bore and located below said sharpened end;

a sheath concentrically mounted on said needle body, extending from a point below said side opening and substantially the remaining length of the needle body, said sheath including a branched cylindrical portion which is located adjacent the bottom of said sheath and which communicates with said air and liquid medicine injection groove;

a hollow valve section consisting of said sheath and a cylindrical structure in said branched cylindrical portion and a back-flow preventive valve formed spherically of a flexible material with a slit being formed at the front end thereof, and a hollow conduit portion made of the same material as and integrally with said valve section and disposed to permit passage of air and liquid medicine only in the direction of injection, said valve being confined within said branched cylindrical portion, whereby air or other desired liquid medicine can be passed, as desired, in the injected direction through said air and liquid medicine injection groove, said back-flow preventive valve and said cylindrical structure.

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