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(54) NEEDLE TYPE SAFETY CONNECTOR

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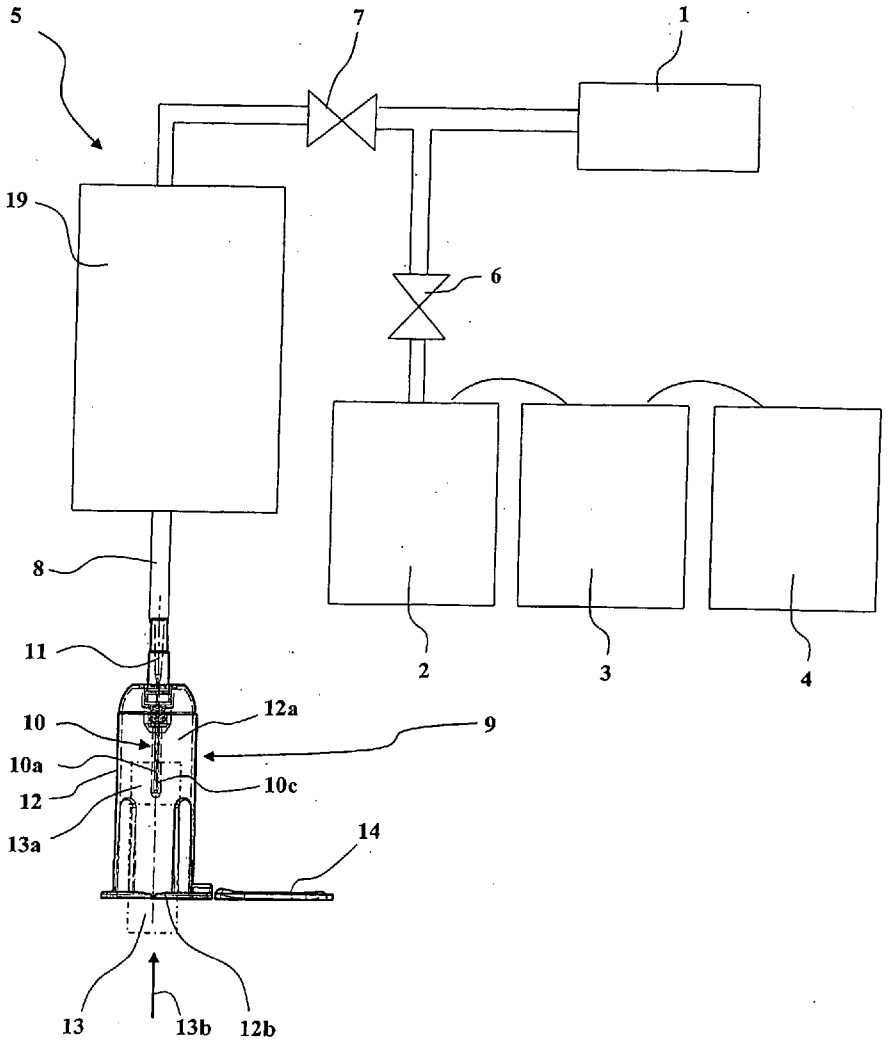
(57) **ABSTRACT**

A safety needle connector according to the invention comprises a hollow needle through which fluid may pass fastened to a needle support sleeve itself connected to a fluid tube. The needle support sleeve may be connected by clipping it axially into a receiving structure of a protective cylinder that surrounds a projecting needle portion. The receiving structure comprises receiving cylinders in which the needle support sleeve is engaged and comprising locking tongues that cooperate with a bearing flange to allow penetration of the needle support sleeve and prevent its withdrawal. A closure sleeve is engaged around the projecting needle portion to form a sealed connection in the needle passage.



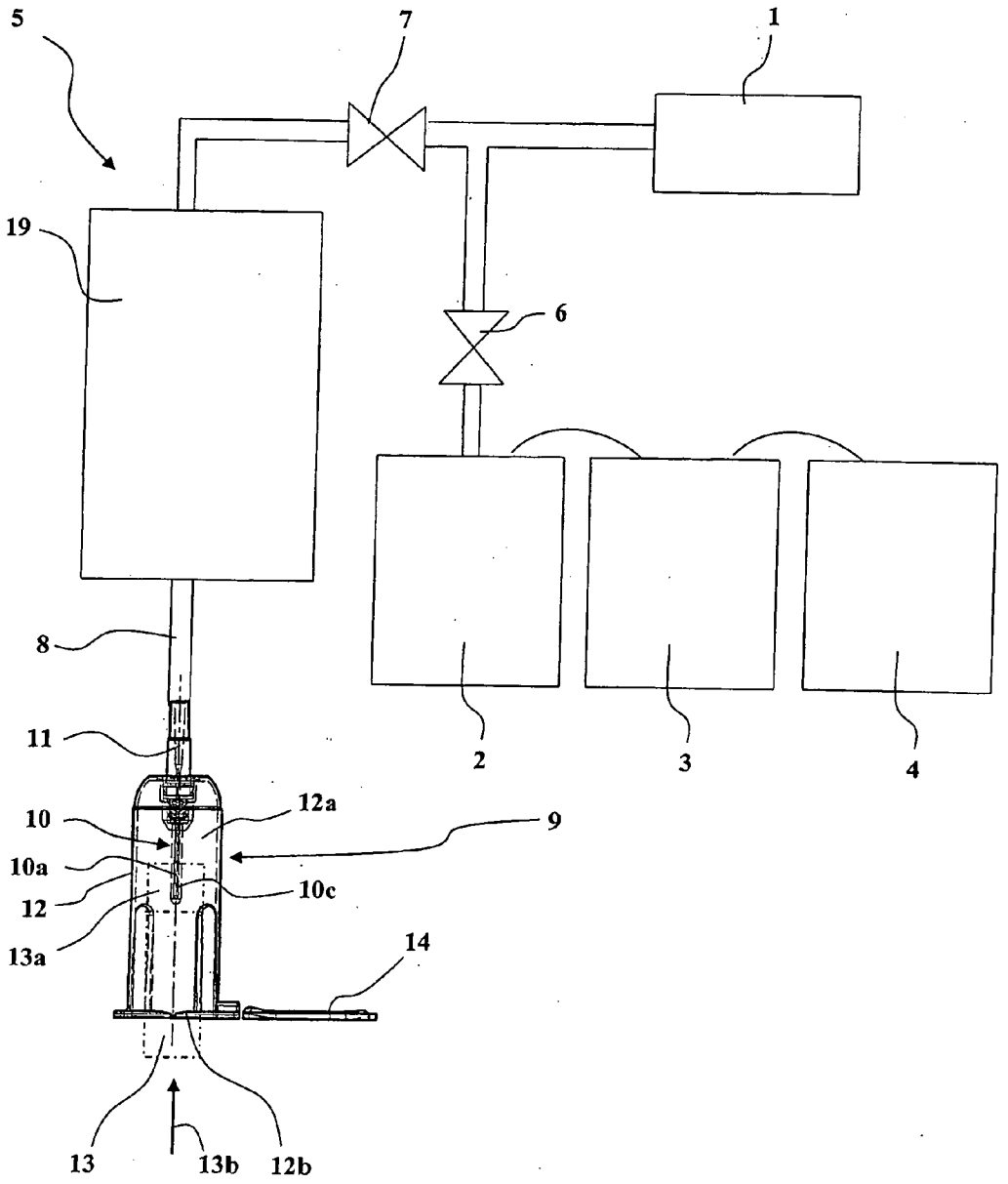


FIG. 1

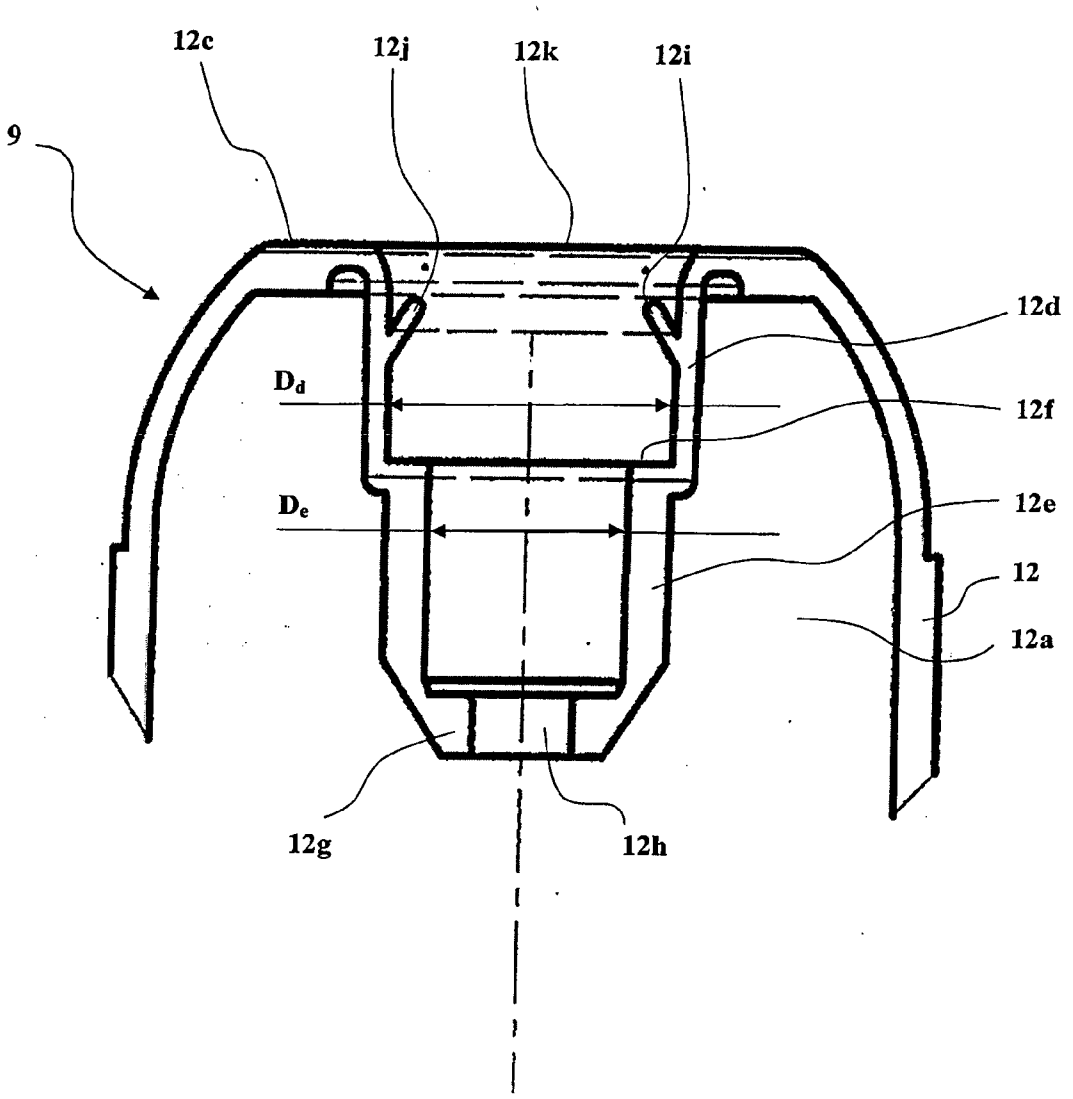
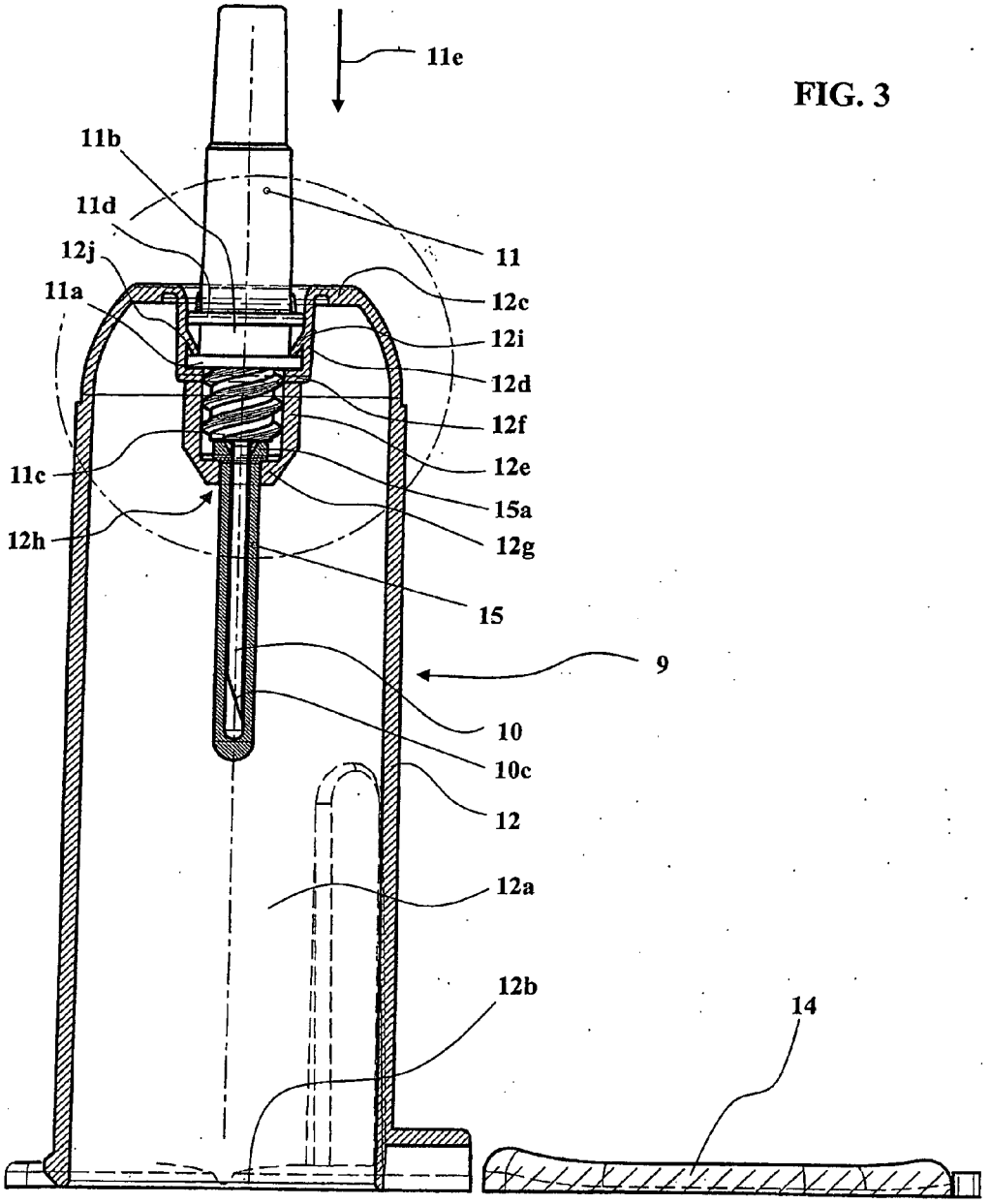


FIG. 2


11e
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12b
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FIG. 3

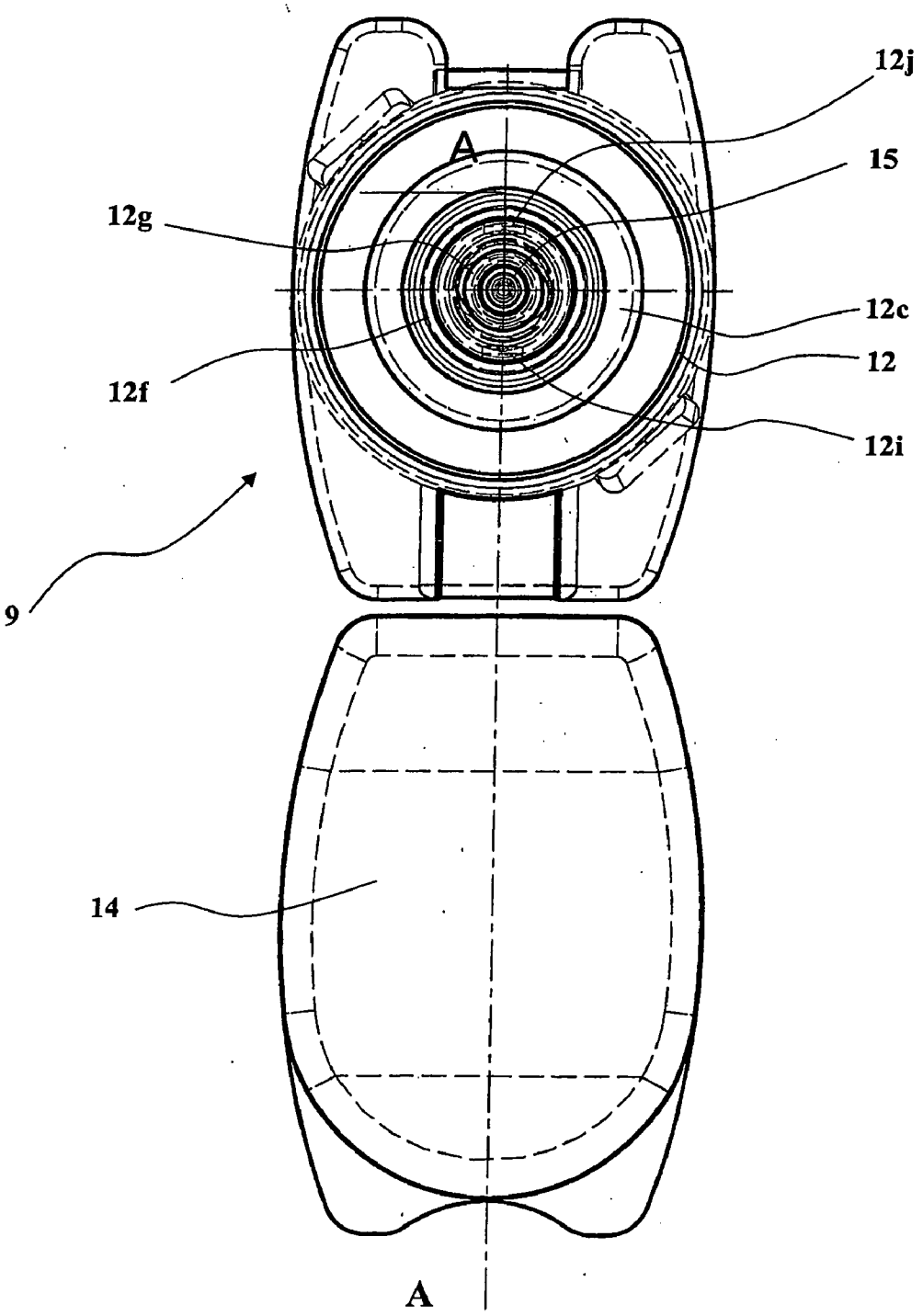

FIG. 4

NEEDLE TYPE SAFETY CONNECTOR

TECHNICAL FIELD OF THE INVENTION

[0001] The present invention relates to safety connectors for connecting a sampling container to a fluid tube. The invention relates in particular to connectors of the above kind for taking blood samples in applications in the health field.

[0002] When taking blood samples, in particular for blood donations, the blood must be systematically analyzed by taking a small sample of blood in a sampling container. To this end, a fluid tube must be removably connected and sealed to a sampling container under conditions of absolute hygiene, necessitating minimum movement of the operator to connect the sampling container to the tube and to disconnect it therefrom.

[0003] At the same time, the operator must be protected against all risks of injury and contamination by the blood sample.

[0004] To this end, there has already been designed a safety needle connector as described in the document U.S. Pat. No. 4,784,650, comprising a hollow needle through which fluid can pass, a needle support sleeve and a protective cylinder. The needle support sleeve carries the needle and connects it and seals it to the fluid tube to which it is fixed. A protruding needle portion axially extends the needle support sleeve at the end opposite the fluid tube. The protective cylinder defines an interior space containing the projecting needle portion, with an open distal end for inserting the sampling container to be connected by the needle and a closed proximal end for connection to the needle support sleeve.

[0005] In practice, it is necessary to produce the needle support sleeve and the protective cylinder as separate components, in order to be able to use different components having satisfactory properties in respect of clipping, on the one hand, and firm retention of the needle in the needle support sleeve, on the other hand.

[0006] To this end, the prior art devices comprise a safety connector in two main parts designed to be assembled together, namely a needle support sleeve and a protective cylinder, with connecting means for clipping the protective cylinder to the needle support sleeve.

[0007] The connecting means comprise a large-diameter proximal cylinder with a proximal opening followed by a smaller diameter distal cylinder whose bottom communicates with the interior of the protective cylinder via a needle passage. Retaining means are provided for axially retaining the needle support sleeve engaged in the proximal cylinder and in the distal cylinder.

[0008] In the prior art devices, the retaining means comprise clipping holes in the lateral wall of the distal cylinder in which engage protuberances on the needle support sleeve.

[0009] The prior art needle type safety connectors have drawbacks that affect their safety in use. In particular, the resistance to tearing out of the needle is poor; sometimes drops of blood may flow out of the sampling phial during the movement of withdrawing the phial, and these drops of blood may flow through the clipping holes in the proximal cylinder; there is also a non-negligible risk of permanent deformation of the distal cylinder when the needle support sleeve is pushed into the distal cylinder and the proximal cylinder; this kind of permanent deformation further increases the risks of a defective seal and of blood flowing out of the protective cylinder; because of the small axial clipping travel, it is also difficult to control the clipping of the protective cylinder onto the needle support sleeve.

SUMMARY OF THE INVENTION

[0010] The problem addressed by the present invention is that of designing a new safety needle connector structure that is easy to assemble to the needle support tube by simple clipping, that is sealed, that may be closed for safety after use, and that retains the needle sufficiently to prevent any movement caused by the axial force of pushing in the sampling phial.

[0011] To achieve the above and other objects, the invention proposes a safety needle connector comprising a hollow needle through which fluid can pass, a needle support sleeve, and a protective cylinder, the needle support sleeve carrying the needle and connecting it and sealing it to a fluid tube to which it is fixed, a projecting needle portion axially extending the needle support sleeve at the end opposite the fluid tube, the protective cylinder having an interior space containing the projecting needle portion, with an open distal end for inserting a sampling container to be connected by the needle, and with a closed proximal end with connection means for connecting it to the needle support sleeve; the connection means comprising a proximal cylinder with a large diameter and a proximal opening followed by a distal cylinder with a smaller diameter whose bottom communicates with the interior space of the protective cylinder via a needle passage and comprising retaining means for axially retaining the needle support sleeve engaged in the proximal cylinder and in the distal cylinder; according to the invention:

[0012] the lateral walls of the proximal cylinder and the distal cylinder are fluid-tight,

[0013] the needle support sleeve comprises a bearing flange conformed to penetrate with appropriate peripheral clearance into the proximal cylinder and to abut against an intermediate shoulder connecting the proximal cylinder and the distal cylinder,

[0014] the proximal cylinder comprises elastically flexible locking tongue means which when at rest, and starting from an intermediate region of the protective cylinder, are oriented in an oblique direction toward the proximal end to bear against the distal face of the bearing flange, and then, following flexing in the downstream direction of the locking tongue means upon penetration of the needle support sleeve, to bear against the proximal face of the bearing flange, thereby opposing withdrawal of the needle support sleeve from the protective cylinder.

[0015] In one advantageous embodiment of the invention the locking tongue means comprise two diametrically opposite tongues.

[0016] To provide an effective seal for the needle after removing the sampling phial, a closure sleeve is engaged around the projecting needle portion and passes through the needle passage in the bottom of the distal cylinder to provide

a seal between the needle and the bottom of the distal cylinder. Simultaneously, the sleeve retracted by virtue of elastic deformation in the axial direction when the phial is engaged around the needle, and is axially deployed again around the needle to close off its distal orifice upon withdrawal of the sampling phial.

[0017] In practice, the needle support sleeve comprises a sealing flange, offset in the upstream direction from the bearing flange, and bearing against the locking tongue means when the needle support sleeve is engaged in the protective cylinder.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] Other objects, features and advantages of the present invention will emerge from the following description of particular embodiments of the invention, which is given with reference to the appended drawings, in which

[0019] **FIG. 1** is a diagrammatic general view of a blood sampling system using a safety needle connector of the present invention;

[0020] **FIG. 2** is a partial detail view to a larger scale and in longitudinal section of one embodiment of a safety needle connector of the invention, prior to assembly;

[0021] **FIG. 3** is a view to a larger scale of the safety connector from **FIG. 1** in longitudinal section taken along the line A-A in **FIG. 4** and in the assembled state; and

[0022] **FIG. 4** is an end view of the **FIG. 3** safety connector.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0023] **FIG. 1** shows the general structure of a blood sampling device using a safety connector of the present invention.

[0024] From a blood source **1** shown diagrammatically, for example a catheter inserted into the venous system of a patient, tubes convey blood either to a series of sachets **2**, **3** and **4** or to a test sampling assembly **5**, according to the settings of valves **6** and **7** controlled by the operator.

[0025] The test sampling assembly **5** comprises a buffer sachet **19** in series in a fluid tube **8**, for example. The end of the fluid tube **8** carries the safety needle connector **9** of the invention.

[0026] The safety needle connector **9** comprises a hollow needle **10** through which fluid can pass, a needle sleeve **11**, and a protective cylinder **12**. The needle support sleeve **11** is fixed to the end of the fluid tube **8** and carries the needle **10**, which it connects and seals to the fluid tube **8**. The needle **10** has a projecting needle portion **10***a* at the end opposite the fluid tube **8** that extends the needle support sleeve **11** axially.

[0027] The protective cylinder **12** defines an interior space **12***a* whose shape is adapted to contain the whole of the projecting needle portion **10***a* to prevent any contact of an operator's hand with the sharp end portion **10***c* of the needle **10**. The protective cylinder **12** further comprises an open distal end **12***b* for inserting a sampling container **13** to be connected to the fluid tube **8**. The distal end **12***b* may be closed off by a seal **14** adapted to be folded over. In a manner that is known in the art, the sampling container **13** comprises a stopper **13***a* made from a material that may be pierced by the projecting needle portion **10***a*, and the shape of the sampling container **13** is adapted to fit into the interior space **12***a* of the protective cylinder **12**. On applying pressure **13***b* to push the sampling container **13** axially in the direction of the needle **10**, the stopper **13***a* is pierced by the needle **10**, which establishes communication between the interior of the sampling container **13** and the fluid tube **8** to introduce an appropriate quantity of blood into the sampling container **13**, which may then simply be extracted axially from the protective cylinder **12**: the stopper **13***a* closing elastically on itself to seal the sampling container **13**.

[0028] Consider now the details of the structure of the safety connector **9**, as shown in FIGS. **2** to **4**.

[0029] These figures show again the needle support sleeve **11**, the needle **10** and the protective cylinder **12**.

[0030] The protective cylinder **12** has a closed proximal end **12***c* with means for connecting it to the needle support sleeve **11**. The connecting means are adapted to enable the protective cylinder **12** and the needle support sleeve **11** to be assembled together by clipping them together by virtue of a simple movement in axial translation **11***e* toward each other. At the same time, the same movement in axial translation **11***e* toward each other makes a seal that makes it impossible for blood to flow from the interior space **12***a* of the protective cylinder **12** onto its exterior surface and onto the needle support sleeve **11**.

[0031] The connecting means for the protective cylinder **12** comprise a proximal cylinder **12***d* having an inside diameter D_d larger than the diameter of the needle support sleeve **11**. The proximal cylinder **12***d* is followed by a distal cylinder **12***e* with a smaller inside diameter D_e, with an intermediate shoulder **12***f* which connects the proximal cylinder **12***d* and the distal cylinder **12***e*.

[0032] The distal cylinder **12***e* terminates at a bottom **12***g* that communicates with the interior space **12***a* of the protective cylinder **12** via a small diameter needle passage **12***h*.

[0033] The lateral walls of the proximal cylinder **12***d* and the distal cylinder **12***e* are fluid-tight, i.e. comprise no openings that would allow a fluid such as blood to pass through them.

[0034] The needle support sleeve **11** comprises a bearing flange **11***a* shaped to penetrate into the proximal cylinder **12***d* and to abut against the intermediate shoulder **12***f* when the needle support sleeve **11** is engaged on the protective cylinder **12** in the assembly position, as shown in **FIG. 3**.

[0035] The proximal cylinder **12***d* comprises elastically flexible locking tongue means, for example two diametrically opposite tongues **12***i* and **12***j*, that cooperate with the bearing flange **11***a* to provide the clipping means opposing separation of the needle support sleeve **11** and the protective cylinder **12** when they are assembled together.

[0036] To this end, when at rest, the elastically flexible locking tongues **12***i* and **12***j* are, starting from an intermediate region of the proximal cylinder **12***d*, oriented obliquely toward the proximal end **12***k* of the proximal cylinder **12***d*, as may be seen in **FIG. 2**, and their free ends are at a distance from each other less than the diameter of the bearing flange **11***a*. As a result, when the needle support sleeve **11** is moved toward the protective cylinder **12**, the bearing flange **11***a*

bears on the free ends of the locking tongues **12***i* and **12***j*, pushing them back toward the shoulder **12***f*. The locking tongues **12***i* and **12***j* then flex until they assume an opposite oblique orientation toward the shoulder **12***f*, as may be seen in **FIG. 3**.

[0037] Because an appropriate peripheral clearance is provided between the bearing flange **11***a* and the peripheral wall of the proximal cylinder **12***d*, or because of the elasticity of the material constituting the proximal cylinder **12***d*, which is able to spread slightly when the bearing flange **11***a* passes between the locking tongues **12***i* and **12***j*, the bearing flange **11***a* may continue its travel until it abuts against the intermediate shoulder **12***f*, the locking tongues **12***i* and **12***j* then bearing against the proximal face of the bearing flange **11***a*, as may be seen in **FIG. 3**. In this position, the locking tongues **12***i* and **12***j* also bear on the adjacent cylindrical portion **11***b* of the needle support sleeve **11**, this cylindrical portion **11***b* having a diameter that is sufficient to maintain the locking tongues **12***i* and **12***j* oriented obliquely toward the shoulder **12***f*. The locking tongues **12***i* and **12***j* then oppose withdrawal of the needle support sleeve **11** from the protective cylinder **12**.

[0038] In the embodiment shown in **FIGS. 1, 3** and **4**, a closure seal **15** is fitted around the protecting needle portion **10***a* and passes through the needle passage **12***h* in the bottom **12***g* of the distal cylinder **12***e*, providing the seal between the needle **10** and the bottom **12***g* of the distal cylinder **12***e*. The closure sleeve **15** is simultaneously made from an elastically retractable material and closes the free end **10***c* of the needle **10** when there is no sampling phial **13** engaged over the needle **10**.

[0039] In the assembled position shown in **FIG. 3**, a proximal end portion **15***a* of the closure sleeve **15** is compressed axially between the distal end **11***c* of the needle support sleeve **11** and the bottom **12***g* of the distal cylinder **12***e*. This improves the seal.

[0040] In the embodiment shown in **FIGS. 1 and 3**, the needle support sleeve **11** further comprises a sealing flange **11***d* offset in the upstream direction from the bearing flange **11***a* and adapted to bear against the locking tongues **12***i* and **12***j* when the needle support sleeve **11** is engaged in the protective cylinder **12**.

[0041] The protective cylinder **12** may advantageously be molded from a first plastic material such as polypropylene.

[0042] Simultaneously, the needle support sleeve **11** may be molded from a second plastic material such as polycarbonate.

[0043] The closure sleeve **15** is advantageously made from a closed cell resilient foam or an elastically flexible elastomer such as latex.

[0044] The present invention is not limited to the embodiments that have been explicitly described and includes variants and generalizations thereof within the scope of the following claims.

There is claimed:

1. A safety needle connector comprising a hollow needle through which fluid can pass, a needle support sleeve, and a protective cylinder, the needle support sleeve carrying the needle and connecting it and sealing it to a fluid tube to which it is fixed, a projecting needle portion axially extending the needle support sleeve at the end opposite the fluid tube, the protective cylinder having an interior space containing the projecting needle portion, with an open distal end for inserting a sampling container to be connected by the needle and with a closed proximal end with connection means for connecting it to the needle support sleeve, the connection means comprising a proximal cylinder with a large diameter and a proximal opening followed by a distal cylinder with a smaller diameter whose bottom communicates with the interior space of the protective cylinder via a needle passage and comprising retaining means for axially retaining the needle support sleeve engaged in the proximal cylinder and in the distal cylinder,

wherein

the lateral walls of the proximal cylinder and the distal cylinder are fluid-tight,

the needle support sleeve comprises a bearing flange conformed to penetrate with appropriate peripheral clearance into the proximal cylinder and to abut against an intermediate shoulder connecting the proximal cylinder and the distal cylinder,

the proximal cylinder comprises elastically flexible locking tongue means which when at rest, and starting from an intermediate region of the protective cylinder, are oriented in an oblique direction toward the proximal end to bear against the distal face of the bearing flange, and then, following flexing in the downstream direction of the locking tongue means upon penetration of the needle support sleeve, to bear against the proximal face of the bearing flange, thereby opposing withdrawal of the needle support sleeve from the protective cylinder.

2. A safety connector according to claim 1, wherein the locking tongue means comprise two diametrically opposite tongues.

3. A safety connector according to claim 1, wherein a closure sleeve is engaged around the projecting needle portion and passes through the needle passage in the bottom of the distal cylinder to provide a seal between the needle and the bottom of the distal cylinder.

4. A safety connector according to claim 1, wherein the needle support sleeve comprises a sealing flange, offset in the upstream direction from the bearing flange, and bearing against the locking tongue means when the needle support sleeve is engaged in the protective cylinder.

5. A safety connector according to claim 1, wherein the protective cylinder is molded from a first plastic material such as polypropylene.

6. A safety connector according to claim 1, wherein the needle support sleeve is molded from a second plastic material such as polycarbonate.

7. A safety connector according to claim 1, wherein the closure sleeve is made from a closed cell resilient foam or an elastically flexible elastomer such as latex.

* * * * *