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Woehr et al.

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(54) **CATHETER INSERTION DEVICE**
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(56) **References Cited**
U.S. PATENT DOCUMENTS

3,585,996 A 6/1971 Reynolds et al.
3,601,151 A 8/1971 Winnard
(Continued)

FOREIGN PATENT DOCUMENTS

AU 730988 B2 3/2001
AU 2003246358 B2 1/2004
(Continued)

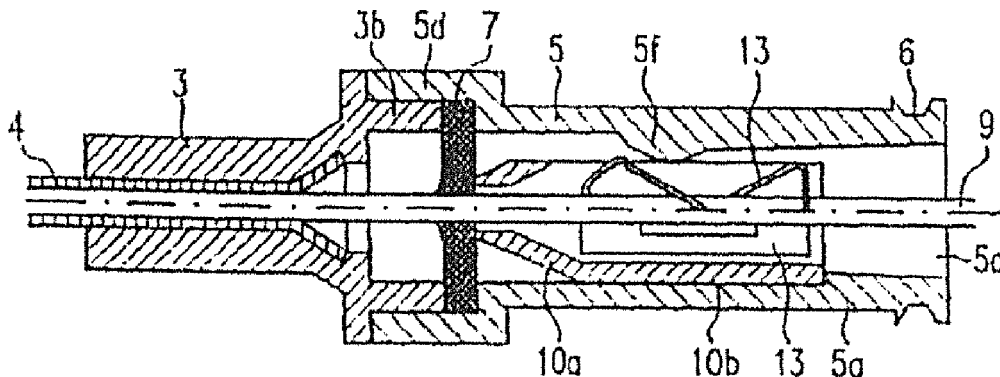
OTHER PUBLICATIONS

Statutory Declaration of Kevin Woehr, Executed on Sep. 15, 2011, In the matter of Australian Patent Application No. 2003246358 and In the matter of Opposition thereto by Terumo Corporation, including Exhibits KW-1 to KW-7 (101 pages).
(Continued)

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(57) **ABSTRACT**
Embodiments of a catheter insertion device are discussed comprising: an approximately hollow cylindrical catheter sleeve, at whose distal end a catheter is attached; a needle sleeve with a hollow needle, which is attached thereto and which, when ready for use, extends through the catheter sleeve and the catheter, and; a needle protective element that is arranged inside the catheter sleeve while being able to move on the needle. Said needle protective element has an engaging section that engages with an engaging device, which is formed in the vicinity of the needle tip, when the hollow needle is withdrawn from the catheter sleeve. A check valve is placed inside the catheter sleeve between the catheter and the needle protective element. The hollow needle, when ready for use, extends through said check valve, and the check valve automatically closes once the needle is withdrawn.

20 Claims, 3 Drawing Sheets



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(56)

References Cited

U.S. PATENT DOCUMENTS

4,143,853	A	3/1979	Abramson	5,312,355	A	5/1994	Lee
4,387,879	A	6/1983	Tauschinski	5,322,517	A	6/1994	Sircon et al.
4,449,693	A	5/1984	Gereg	5,328,482	A	7/1994	Sircon et al.
4,511,359	A	4/1985	Vaillancourt	5,334,158	A	8/1994	McLees
4,512,766	A	4/1985	Vaillancourt	5,334,159	A	8/1994	Turkel
4,578,063	A	3/1986	Inman et al.	5,344,408	A	9/1994	Partika
4,673,399	A	6/1987	Pruett	5,352,205	A	10/1994	Dales et al.
4,765,588	A	8/1988	Atkinson	5,380,305	A	1/1995	Ghoury
4,772,266	A	9/1988	Groshong	5,405,323	A	4/1995	Rogers et al.
4,795,432	A	1/1989	Karczmer	5,409,461	A	4/1995	Steinman
4,813,938	A	3/1989	Raulerson	5,419,766	A	5/1995	Chang et al.
4,842,591	A	6/1989	Luther	5,454,790	A	10/1995	Dubrul
4,846,809	A	7/1989	Sims	5,456,675	A	10/1995	Wolbring et al.
4,874,377	A	10/1989	Newgard et al.	5,458,640	A	10/1995	Gerrone
4,883,461	A	11/1989	Sawyer	5,458,658	A	10/1995	Sircon
4,917,668	A	4/1990	Haindl	5,558,651	A	9/1996	Crawford et al.
4,927,414	A	5/1990	Kulli	5,562,630	A	10/1996	Nichols
4,929,235	A	* 5/1990	Merry et al. 604/167.04	5,562,633	A	10/1996	Wozencroft
4,929,241	A	5/1990	Kulli	5,584,809	A	12/1996	Gaba
4,935,010	A	6/1990	Cox et al.	5,601,536	A	2/1997	Crawford et al.
4,944,725	A	7/1990	McDonald	5,613,663	A	3/1997	Schmidt et al.
4,952,207	A	8/1990	Lemieux	5,634,913	A	6/1997	Stinger
4,964,854	A	10/1990	Luther	5,651,772	A	7/1997	Arnett
4,966,586	A	10/1990	Vaillancourt	5,662,610	A	9/1997	Sircon
4,978,344	A	12/1990	Dombrowski et al.	5,688,253	A	11/1997	Paradis
5,051,109	A	9/1991	Simon	5,718,688	A	2/1998	Wozencroft
5,053,014	A	10/1991	Van Heugten	5,725,503	A	3/1998	Arnett
5,053,017	A	10/1991	Chamuel	5,738,144	A	4/1998	Rogers
5,062,836	A	11/1991	Wendell	5,749,857	A	5/1998	Cuppy
5,084,023	A	1/1992	Lemieux	5,749,859	A	5/1998	Powell
5,108,374	A	4/1992	Lemieux	5,779,681	A	7/1998	Bonn
5,127,905	A	7/1992	Lemieux	D397,434	S	8/1998	Pike
5,135,504	A	8/1992	McLees	5,817,069	A	10/1998	Arnett
5,147,327	A	9/1992	Johnson	5,830,189	A	11/1998	Chang
5,154,703	A	10/1992	Bonaldo	5,843,046	A	* 12/1998	Motisi et al. 604/256
5,156,596	A	10/1992	Balbierz et al.	5,851,196	A	12/1998	Arnett
5,158,554	A	10/1992	Jepson et al.	5,865,806	A	2/1999	Howell
5,180,370	A	1/1993	Gillespie	5,879,337	A	3/1999	Kuracina et al.
5,183,468	A	2/1993	McLees	5,911,705	A	6/1999	Howell
5,188,607	A	2/1993	Wu	5,911,710	A	6/1999	Barry et al.
5,195,980	A	3/1993	Catlin	5,935,104	A	8/1999	Janek et al.
5,215,528	A	6/1993	Purdy et al.	5,954,698	A	9/1999	Pike
5,234,410	A	8/1993	Graham et al.	5,967,490	A	10/1999	Pike
5,242,393	A	9/1993	Brimhall et al.	5,971,957	A	10/1999	Luther et al.
RE34,416	E	10/1993	Lemieux	6,001,080	A	12/1999	Kuracina et al.
5,269,771	A	12/1993	Thomas et al.	6,004,294	A	12/1999	Brimhall et al.
5,300,033	A	4/1994	Miller	6,077,244	A	6/2000	Botich et al.
				6,080,137	A	6/2000	Pike
				6,117,108	A	9/2000	Woehr et al.
				6,171,287	B1	1/2001	Lynn et al.
				6,203,527	B1	3/2001	Zadini et al.
				6,228,060	B1	5/2001	Howell
				6,287,278	B1	9/2001	Woehr et al.
				6,352,520	B1	3/2002	Miyazaki
				6,379,333	B1	4/2002	Brimhall et al.
				6,379,372	B1	4/2002	Dehdashtian et al.
				6,443,927	B1	9/2002	Cook
				6,443,929	B1	9/2002	Kuracina et al.
				6,485,468	B2	11/2002	Vojtasek
				6,506,181	B2	1/2003	Meng et al.
				6,533,759	B1	3/2003	Watson et al.
				6,585,704	B2	7/2003	Luther et al.
				6,595,954	B1	7/2003	Luther et al.
				6,595,955	B2	7/2003	Ferguson et al.
				6,616,630	B1	9/2003	Woehr et al.
				6,629,959	B2	10/2003	Kuracina et al.
				6,652,486	B2	* 11/2003	Bialecki et al. 604/110
				6,652,490	B2	11/2003	Howell
				6,692,471	B2	2/2004	Boudreaux
				6,699,221	B2	3/2004	Vaillancourt
				6,709,419	B2	3/2004	Woehr
				6,719,726	B2	4/2004	Meng et al.
				6,749,588	B1	6/2004	Howell et al.
				6,764,468	B1	7/2004	East
				6,860,871	B2	3/2005	Kuracina et al.
				6,883,778	B1	4/2005	Newton et al.
				6,902,546	B2	6/2005	Ferguson
				6,916,311	B2	7/2005	Vojtasek
				6,958,055	B2	10/2005	Donnan et al.

(56)

References Cited

U.S. PATENT DOCUMENTS

6,972,002	B2	12/2005	Thorne	
7,008,404	B2	3/2006	Nakajima	
7,125,396	B2	10/2006	Leinsing et al.	
7,374,554	B2	5/2008	Menzi et al.	
8,333,735	B2*	12/2012	Woehr et al.	604/164.08
8,540,728	B2*	9/2013	Woehr et al.	606/108
2002/0128604	A1	9/2002	Nakajima	
2004/0044313	A1	3/2004	Nakajima	
2005/0182363	A1*	8/2005	Kulli	604/110

FOREIGN PATENT DOCUMENTS

AU	783650	B2	11/2005
CA	2133053		3/1995
DE	30 00 903	A1	1/1980
DE	31 00 622	A1	4/1980
DE	32 10 148	A1	9/1983
DE	44 34 569	A1	3/1995
DE	201 04 539	U1	1/2002
EP	0 414 997	A1	4/1990
EP	0 554 841	A1	8/1993
EP	0 747 084	A2	12/1996
EP	0 799 626	A1	10/1997
EP	1 101 508	A2	5/2001
EP	1 101 508	A3	8/2001
EP	1 180 381	A1	2/2002
EP	1 240 916	B1	9/2002
EP	1 374 942	A1	1/2004
EP	1 374 942	B1	1/2004
GB	2 118 440	A	11/1983
WO	WO 97/45151		12/1997
WO	WO 98/53875		12/1998
WO	WO 99/26682		6/1999
WO	WO 2004/004819	A1	1/2004

OTHER PUBLICATIONS

Statutory Declaration of William Samuel Hunter, Executed and Notarized on May 11, 2010, In the matter of Australian Patent Application No. 2003246358 and In the matter of Opposition thereto by Terumo Corporation (43 pages).

Statutory Declaration of Noel J. Akers, Executed and Notarized on Aug. 17, 2011, In the matter of Australian Patent Application No. 2003246358, including Exhibit NJA-1 (48 pages).

Annex 1: Facts and Arguments to the Notice of Opposition to a European Patent; Opponent Smith Medical ASD Inc.; Patentee B. Braun Melsungen AG for Opposed Patent No. EP 1 545 681 B1; dated Oct. 21, 2008 (133 pages).

Appeal and the Grounds for Appeal Filed by Patent Proprietor Against the Decision of the Opposition Division; Opponent Smith Medical ASD Inc.; Patentee B. Braun Melsungen AG for Opposed Patent No. EP 1 545 681 B1; dated Jan. 27, 2011 (77 pages).

Response to Appeal and the Grounds for Appeal Filed by Patent Proprietor Against the Decision of the Opposition Division; Opponent Smith Medical ASD Inc.; Patentee B. Braun Melsungen AG for Opposed Patent No. EP 1 545 681 B1; dated Oct. 21, 2011 (86 pages).

Patent Abstracts of Japan; entitled "Indwelling Puncture Needle With Wing Having Branching Part", Application No. 11-021665, Publication No. 2000-217925; Published Aug. 8, 2000, Applicant Hanako Medical KK (3 pages).

Patent Abstracts of Japan; entitled "Safe Indwelling Needle", Application No. 2000-078335, Publication No. 2001-259029, Published Sep. 25, 2001, Applicant Medikit KK (7 pages).

Patent Abstracts of Japan; entitled "Safety Indwelling Needle", Application No. 2000-182911, Publication No. 2002-000727, Published Jan. 8, 2002, Applicant Medikit KK (4 pages).

Patent Abstracts of Japan; entitled "Indwelling Needle Structure", Applicant No. 2001-363865, Publication No. 2003-175112, Published Jun. 24, 2003, Applicant Mitsubishi Pencil Co LTD (5 pages).

Patent Abstracts of Japan; entitled "Indwelling Needle Structure and Seal Material Used Therefore", Application No. 2005-035112, Publication No. 2005- 261938 A, Published Sep. 29, 2005, Applicant JMS Co LTD (5 pages).

Patent Abstracts of Japan; entitled "Indwelling Needle", Application No. 2004-143931, Publication No. 2005-323762, Published Nov. 24, 2005, Applicant Medikit KK (4 pages).

Patent Abstracts of Japan; entitled "Indwelling Needle", Application No. 1996-0040652, Publication No. 9206375, Published Aug. 12, 1997, Applicant: Togo Medikit KK (2 pages).

"Conical Fittings With 6% (Luer) Taper for Syringes, Needles and Certain Other Medical Equipment—Part 2: Lock fittings," International Standar, ISO 594-2, second edition, 1998, pp. 1-11, Technical Committee ISO/TC 84, Switzerland.

Office Action mailed May 29, 2007 from corresponding U.S. Appl. No. 10/520,325, filed Sep. 12, 2005.

Final Office Action mailed Nov. 14, 2007 from corresponding U.S. Appl. No. 10/520,325, filed Sep. 12, 2005.

Office Action mailed Sep. 26, 2008 from corresponding U.S. Appl. No. 10/520,325, filed Sep. 12, 2005.

Final Office Action mailed Mar. 30, 2009 from corresponding U.S. Appl. No. 10/520,325, filed Sep. 12, 2005.

Final Office Action mailed Jan. 19, 2010 from corresponding U.S. Appl. No. 10/520,325, filed Sep. 12, 2005.

Notice of Allowance mailed Feb. 25, 2010 from corresponding U.S. Appl. No. 10/520,325, filed Sep. 12, 2005.

Office Action mailed Jun. 21, 2011 from corresponding U.S. Appl. No. 12/790,630, filed May 28, 2010.

Office Action mailed Aug. 8, 2011 from corresponding U.S. Appl. No. 12/790,630, filed May 28, 2010.

Office Action mailed Oct. 9, 2012 from corresponding U.S. Appl. No. 12/790,630, filed May 28, 2010.

Notice of Allowance mailed Nov. 7, 2012 from corresponding U.S. Appl. No. 12/790,630, filed May 28, 2010.

Office Action mailed Oct. 10, 2012 from corresponding U.S. Appl. No. 13/425,140, filed Mar. 20, 2012.

Notice of Allowance mailed Nov. 7, 2012 from corresponding U.S. Appl. No. 13/425,140, filed Mar. 20, 2012.

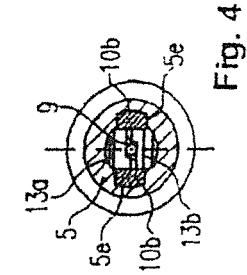
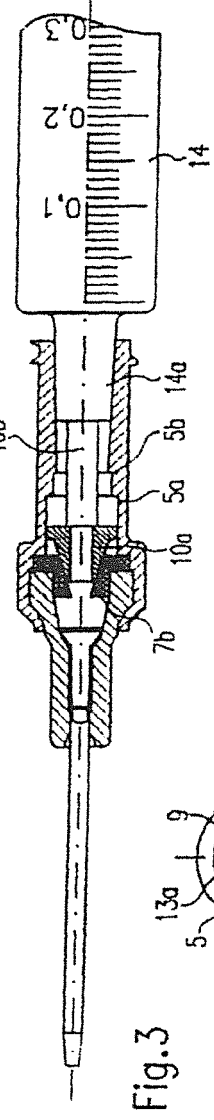
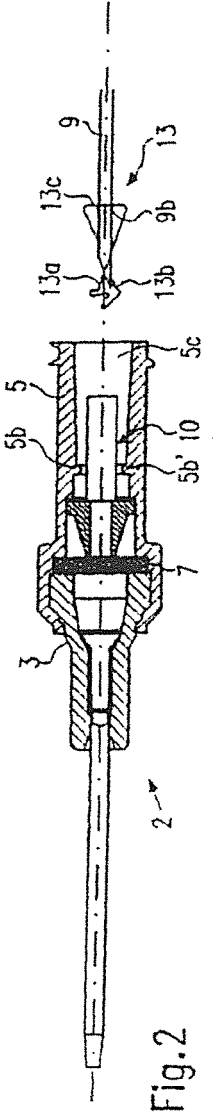
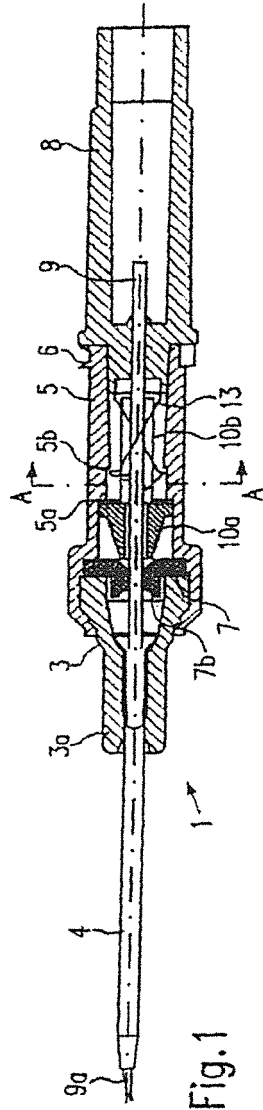
Office Action mailed Mar. 22, 2013 from corresponding U.S. Appl. No. 13/630,251, filed Sep. 28, 2013.

Notice of Allowance mailed Jun. 20, 2013 from corresponding U.S. Appl. No. 13/630,251, filed Sep. 28, 2013.

Re-Examination Report dated Aug. 30, 2013 from related Australian Application No. 2003246368 (5 pages).

Response to Re-Examination Report of Aug. 30, 2013, filed Oct. 3, 2013 from related Australian Application No. 2003246368 (8 pages).

* cited by examiner



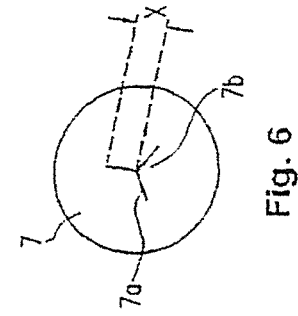


Fig. 6

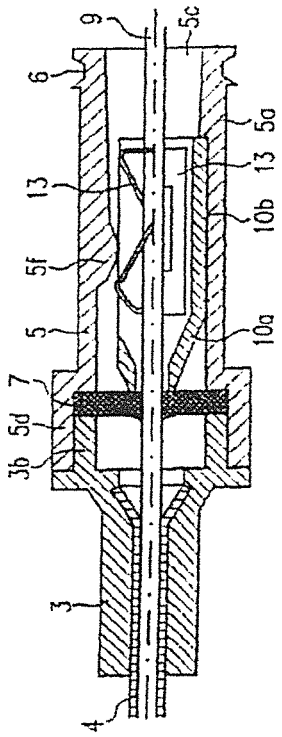


Fig. 5

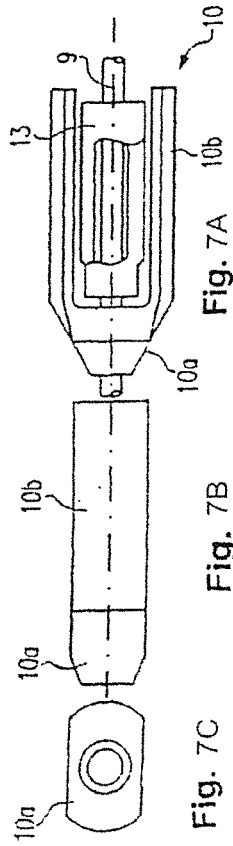


Fig. 7A

Fig. 7B

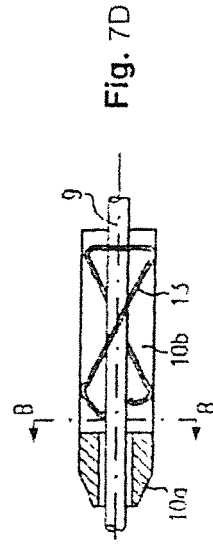


Fig. 7C

Fig. 7D

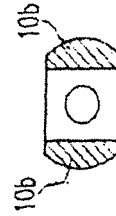


Fig. 7E

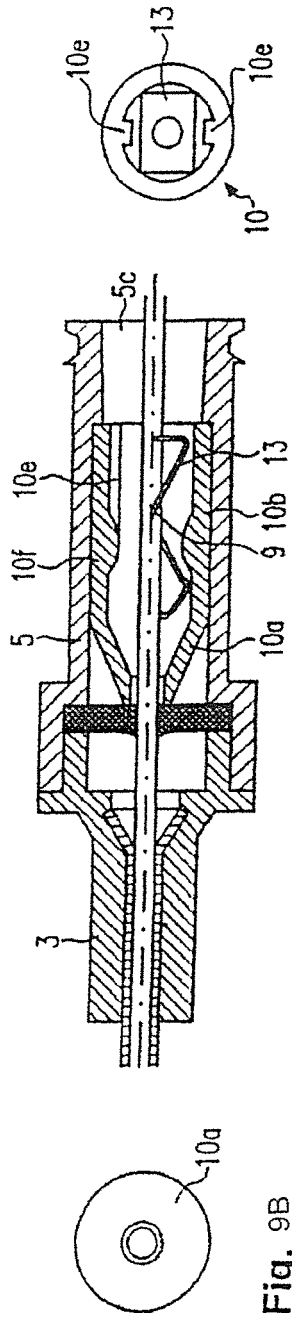


Fig. 9B

Fig. 9A

Fig. 8

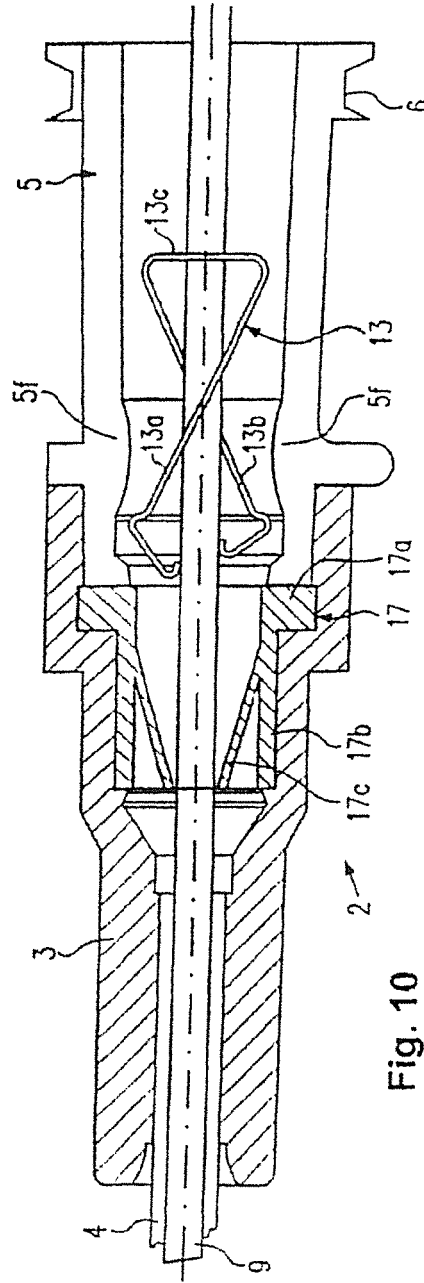


Fig. 10

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CATHETER INSERTION DEVICE

FIELD

Device, system, and method for a catheter insertion device are generally discussed herein with specific reference to catheter device having a valve opener and a valve.

BACKGROUND

A device of this kind is known from EP 352 928, wherein in a hollow catheter hub a needle guard element is arranged. On withdrawal of the hollow needle from the catheter over an engaging means near the tip of the hollow needle, the needle guard element engages with the engaging means and covers the tip when the hollow needle is separated from the catheter. In this design, after withdrawal of the hollow needle from the catheter, through this catheter blood can issue with which the operating personnel can come into contact.

The invention is based on the object of designing a catheter insertion device of the type described above such that an outflow of blood from the catheter is prevented after removal of the hollow needle with the needle guard element.

SUMMARY

This object is solved according to the invention by the features in the characterizing part of claim 1. In the ready position, a check valve is arranged in the catheter hub between the catheter and the needle guard element. Through this valve the hollow needle extends, so that after withdrawal of the hollow needle from the catheter the latter can be reliably closed such that an outflow of blood is prevented, while simultaneously the tip of the hollow needle is securely covered by the needle guard element so that the operating personnel cannot injure themselves on the needle tip.

BRIEF DESCRIPTION OF THE DRAWINGS

Exemplary embodiments of the invention are explained in more detail below with reference to the drawing, in which:

FIG. 1 shows a longitudinal section through a catheter insertion device in the ready position,

FIG. 2 shows the catheter insertion device with the hollow needle removed,

FIG. 3 shows the device with an attached syringe,

FIG. 4 shows a sectional view along the line A-A in FIG. 1,

FIG. 5 shows a longitudinal section through another embodiment,

FIG. 6 shows a view of the valve disc,

FIGS. 7A, 7B, 7C, 7D, and 7E show different views of a valve actuating element,

FIG. 8 shows a longitudinal section through a further embodiment,

FIGS. 9A and 9B show front views of the valve actuating element of FIG. 8, and

FIG. 10 shows a longitudinal section through a further embodiment.

DETAILED DESCRIPTION

FIG. 1 shows a catheter insertion device 1 having a catheter hub 2 which has a two-part form in the embodiment. A distal hub element 3 of the catheter hub has a holding section 3a in which a catheter 4 is press-fitted. The proximal end of the hub element 3 has an enlarged diameter with regard to the distal end and forms a connecting section with a hub element 5

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whose distal end overlaps the proximal end of the hub element 3 and which is provided at its proximal end with a Luer thread 6. Between the two hub elements 3 and 5, a check valve in the form of a valve disc 7 is inserted and is fixed in place by the two hub elements 3 and 5.

In the ready position according to FIG. 1, there is inserted in the catheter hub 2 a needle hub 8 to which a hollow needle 9 is fixed which extends through the valve disc 7 and the catheter 4 so that the needle tip 9a is exposed. Between needle hub 8 and valve disc 7 there is displaceably arranged in the proximal hub element 5 a valve actuating element 10 which has a truncated cone-shaped locating section 10a which serves to open the valve disc 7, as FIG. 3 shows. On the proximal side, a plunger section 10b adjoins the locating section 10a and has a hollow space for receiving a needle guard element 13. In the embodiment shown, the plunger section 10b is formed by two spaced plungers between which the needle guard element in the form of a spring clip 13 is inserted, as shown in the cross-sectional view in FIG. 4.

On withdrawal of the hollow needle 9 from the catheter hub 2, an engaging means 9b (FIG. 2), provided near the needle tip 9a and having the form of a radial projection on the hollow needle which can be formed by light crimping, engages with the outer circumference of a bore in the rear wall 13c of the spring clip 13, so that the spring clip 13 is removed from the catheter hub with the needle 9, while simultaneously the spring arms 13a and 13b of the spring clip cover the needle tip, completely protecting and blocking it. In this separated position shown in FIG. 2, the valve disc 7, due to its elasticity, closes the through-hole for the hollow needle 9 so that no blood can flow out through the catheter 4. As FIG. 6 shows, the valve disc is provided for example with three slits 7a starting from the middle and extending radially over a short section X, forming elastic flaps 7b therebetween which can be expanded by the hollow needle.

FIG. 3 shows the insertion of a syringe 14 in the catheter hub 2, wherein the neck portion 14a of the syringe comes to abut on the plunger section 10b of the valve actuating element 10 and presses it against the valve disc 7, so that the truncated cone-shaped locating section 10a outwardly displaces the flaps 7b of the valve disc and thereby opens the valve, so that a liquid can be inserted from the syringe 14 into the catheter 4.

The incline of the truncated cone on the locating section 10a and the displacement path of the actuating element 10 relative to the valve disc 7 are designed such that due to the elasticity of the material of the valve disc 7, the flaps 7b displace the locating section 10a to the right in FIG. 3 when the syringe 14 is removed from the catheter hub 2. Hereby, the valve disc 7 is automatically closed, as the position in FIG. 2 shows.

In the hub element 5, there is formed by a shoulder 5a a stop for the actuating element 10, to define the position of the actuating element in the separated position in FIG. 2. Hereby, the truncated cone-shaped locating section 10a lies near the stop 5a, while its distal end abuts on the valve disc 7 as shown in FIG. 2. The radial slits 7a of the valve disc 7 are designed such that in the ready position in FIG. 1, the flaps 7b are bent radially upwards less than in the open position by the locating section 10a in FIG. 3.

As the cross-sectional view in FIG. 4 shows, the two plungers lob of the valve actuating element 10 are guided in longitudinal grooves 5e of the hub element 5 and they project radially inwards into the bore 5c of the hub element 5, so that they form an abutting surface for the neck portion 14a of the

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syringe 14. The bore 5c in the hub element 5 is formed slightly conically corresponding to the conical neck portion 14a of a syringe.

On the inner circumference of the bore 5c of the hub element 5, a further shoulder 5b having a smaller diameter is formed, on which the radially outer areas of the spring arms 13a and 13b abut in the ready position in FIG. 1. Hereby, the spring clip 13 is fixed in its position in the hub element 5. When the needle hub 8 with the hollow needle 9 is removed from the catheter hub 2, first the spring clip 13 is held on the shoulder 5b by abutting until the radial projection 9b comes to abut on the rear wall 13c of the spring clip. In this position, the two spring arms 13a, 13b can be released from the shoulder 5b and spring back inwards to cover the needle tip, as FIG. 2 shows, whereupon the spring clip 13 with the hollow needle 9 can be removed from the catheter hub.

In the embodiment according to FIGS. 1 to 3, the distal end section of the hub element 5 is shrunk, welded or bonded onto the proximal end section of the hub element 3 after the valve actuating element 10 and the valve disc 7 are inserted in the hub element 5. It is also possible to join the two hub elements 3 and 5 to one another, for example by a thread which is secured against loosening after assembly. The spring clip 13 is inserted together with the hollow needle 9 in the bore 5c of the hub element 5 during assembly, wherein the radially outer areas of the spring arms 13a, 13b snap in at the shoulder 5b under elastic deformation.

Preferably, in front of the shoulder 5b a projection 5b' can be formed in the bore 5c of the hub element, as shown in FIG. 2. Hereby the snap-in and holding effect of the spring clip 13 is increased.

FIG. 5 shows a modified embodiment of the connection of the two hub elements 3 and 5, in which two cylindrical sections 3b and 5d engage in one another. A thread can be provided between these two cylindrical sections. However, it is also possible to bond or weld these two sections.

In this embodiment, the valve actuating element 10 is also modified in relation to the embodiment of FIGS. 1 to 3. FIG. 7A shows a side view of the approximately U-shaped actuating element 10 with the spring clip 13 inserted therein. As the side view rotated by 90.degree. in FIG. 7B shows, the locating section 10a is partly flattened on opposite sides so that the width of the plunger sections 10b extends into the locating section 10a. FIG. 7C is a front view from the left in FIG. 7B and shows the flattened structure of the locating section 10a. FIG. 7D is a sectional view along the central line in FIG. 7B. FIG. 7E shows a section through the valve actuating element 10 along the line B-B in FIG. 7D.

FIG. 5 shows the lower half of the valve actuating element 10 corresponding to the view in FIG. 7A, and the upper half in a sectional view rotated by 90.degree. corresponding to FIG. 7B. The shoulder 5a for positioning the valve actuating element 10 in the hub element 5 is hereby formed on the ends of the diametrically opposite grooves 5e (FIG. 4), so that the proximal ends of the plunger sections 10b abut on the shoulders 5a. Corresponding to the shoulder 5b in FIGS. 1 to 3 in the embodiment in FIG. 5, there is formed on the hub element 5 a projection 5f which projects inwards at diametrically opposite positions on the bore 5c of the hub element 5 and fixes the spring clip 13 in the hub element 5 until the spring arms 13a, 13b spring inwards over the needle tip and the spring clip with the hollow needle 9 is removed from the catheter hub.

FIG. 8 shows a modified embodiment having a hollow cylindrical valve actuating element 10 on whose inner circumference a projection 10f is formed for positioning the spring clip 13 inside the valve actuating element 10. FIG. 9A

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shows a front view of the valve actuating element 10 from the right and FIG. 9B shows a front view from the left in FIG. 8, wherein for locating the neck portion 14a of a syringe 14, in this embodiment radially inwardly projecting ribs 10e are formed which protrude radially into the bore 5c of the hub element 5, as the upper half of the valve actuating element in FIG. 8 shows, in which the sectional view of the lower half of the valve actuating element 10 is shown rotated by 90.degree. in relation to the upper half.

FIG. 10 shows a modified embodiment wherein between the two hub elements 3 and 5 a check valve 17 is inserted, which has a hollow cylindrical section 17b starting from a flange section 17a and abutting on the inner circumference of the hub element 3. From the inner circumference near the flange section 17a there start two opposite flaps 17c, which abut on the outer circumference of the hollow needle 9 in the ready position in FIG. 10. When the needle 9 is removed from the catheter hub 2, the elastically deformed flaps 17c move inwards and close the valve. In this embodiment, an actuating element for opening the valve 17 is not necessary, because the pressure of the fluid from the syringe 14 displaces the flaps 17c radially outwards so that the liquid can flow out through the valve 17. In this embodiment of a check valve, a so-called duck-bill valve is concerned, whose construction is in itself known.

In FIG. 10, in order to allow the spring clip 13 to be held in the catheter hub during withdrawal of the hollow needle 9 from the catheter hub 2 until the radial projection 9b on the hollow needle engages with the rear wall 13c to cover the needle tip, in this embodiment there is formed on the inner circumference of the proximal hub element 5 a projection 5f which extends radially inwards and on which the radially outer areas of the spring arms 13a and 13b come to abut and hold the spring clip until the spring arms spring back radially inwards to cover the needle tip. The inner diameter of the projection 5f is designed only slightly smaller than the maximum radial dimension at the spring arms 13a and 13b, so that during assembly the spring clip 13 can be inserted by slight pressure into the position in the catheter hub as shown in FIG. 10.

In the embodiment of a catheter insertion device according to FIGS. 1 to 9, in the position of the valve actuating element 10 in FIG. 2 the valve disc 7 can be opened by low pressure produced by the syringe 4 for drawing off liquid from the catheter, wherein the elastic flaps 7b are bent upward by the low pressure. In the embodiment of FIG. 10, a drawing-off of liquid from the catheter is not possible, because the duck-bill valve does not open when there is low pressure on the proximal side.

It is convenient to fabricate the check valve in the form of a valve disc 7 or of the flap valve 17 from elastic silicon, while a correspondingly rigid plastic material is used for the hub elements 3 and 5 and for the valve actuating element 10.

What is claimed is:

1. A catheter insertion device comprising:

- a catheter hub comprising an interior cavity having an opening at a proximal end;
- a catheter tube having a distal end opening extending distally of the catheter hub;
- a needle having a needle shaft defining a needle axis projecting distally of an end of a needle hub, said needle projecting through the catheter tube and comprising a needle tip;
- a valve positioned inside the interior cavity of the catheter hub, said valve obstructing fluid flow and comprises a slit; said valve remaining inside the interior cavity of the

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- catheter hub when the needle is removed from the catheter tube and the catheter hub;
- a valve actuating element slidably disposed in the interior cavity of the catheter hub to actuate the valve in a distal direction, the valve actuating element comprising a tapered nose section with an opening structured to push the valve to open the slit, and at least one plunger element extending proximally of the nose section and having a cross-sectional dimension smaller than the nose section and a proximal end surface; wherein the at least one plunger element is slidable distally within the catheter hub when the proximal end surface is pressed distally to push the valve to open the slit; and
- a needle protective device positioned proximal of the valve and at least in part around the needle and distal of the proximal end of the needle hub in a ready position, the needle protective device is movable to prevent unintended needle sticks.
2. The catheter insertion device of claim 1, wherein the valve comprises three slits that converge at a single point.
3. The catheter insertion device of claim 1, wherein the catheter hub is made from two hub housing sections attached to one another.
4. The catheter insertion device of claim 1, wherein the valve has a radial outer perimeter abutting the interior cavity of the catheter hub.
5. The catheter insertion device of claim 1, further comprising a second plunger element spaced from the at least one plunger element.
6. The catheter insertion device of claim 5, wherein the needle projects between the second plunger element and the at least one plunger element in the ready position.
7. The catheter insertion device of claim 1, wherein the valve actuating element further comprises a projection located proximally of the tapered nose section and projects radially outwardly of the nose section and abutting a shoulder of the catheter hub.
8. The catheter insertion device of claim 1, wherein the needle protective device comprises an arm that is located, at least in part, in the catheter hub.
9. The catheter insertion of claim 1, further comprising a crimp on the needle near the needle tip.
10. The catheter insertion device of claim 1, wherein the catheter hub further comprises a shoulder in the interior cavity of the catheter hub, the shoulder being a stop for the valve actuating element.
11. A catheter insertion device comprising:
a catheter hub comprising an interior cavity, an opening at a proximal end, and a catheter tube attached to a distal end;

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- a needle having a needle shaft defining a needle axis projecting distally of an end of a needle hub, said needle projecting through the catheter tube in a ready position and comprises a needle tip;
- a valve positioned inside the interior cavity of the catheter hub and in contact with the interior cavity, said valve being sized and shaped to obstruct fluid flow and comprises a wall surface comprising a slit; said valve remaining inside the interior cavity when the needle is removed from the catheter tube and the catheter hub;
- a valve actuating element slidably disposed in the catheter hub to actuate the valve, the valve actuating element comprising a nose section having a tapered end for pushing the valve to open the slit and a plunger end extending proximally of the nose section; the plunger end transferring a distally directed force to the nose section to push the valve to open the slit when pressed upon; and
- a needle protective device spaced from the needle tip in the ready position and movable relative to the needle tip, at least in part distally of the needle tip to prevent unintended needle sticks.
12. The catheter insertion of claim 11, wherein the plunger end comprises at least two spaced apart plunger elements.
13. The catheter insertion device of claim 11, wherein the needle comprises a crimp on the needle near the needle tip.
14. The catheter insertion device of claim 11, wherein the valve comprises three slits that converge at a single point.
15. The catheter insertion device of claim 11, wherein the needle protective device comprises a proximal wall and two arms that converge at a single point when viewed along a side of the needle.
16. The catheter insertion device of claim 11, wherein the catheter hub is made from two hub housing sections that are attached to one another.
17. The catheter insertion device of claim 11, wherein the valve actuating element further comprises a projection located proximally of the tapered nose section and projects radially outwardly of the nose section and abutting a shoulder of the catheter hub.
18. The catheter insertion device of claim 17, wherein the projection is distal of the at least two plunger elements.
19. The catheter insertion device of claim 11, wherein the needle protective device comprises an arm that is located, at least in part, in the catheter hub.
20. The catheter insertion device of claim 11, wherein the catheter hub further comprises a shoulder in the interior cavity of the catheter hub, the shoulder being a stop for the valve actuating element.

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