Needle Safety Device

The present invention relates to a needle safety device for a medical device such as, for example, an intravenous catheter apparatus, which comprises a base portion having a bore extending in an axial direction therethrough for receiving a needle, and two opposing jaws extending from the base portion generally in the axial direction and each having a head portion in the region of its free end, wherein at least one of the head portions forms a locking shoulder for securing the needle safety device in a housing of the medical device.

A needle safety device of this kind is generally known and operative as a guard for the tip of a needle of the medical device by automatically covering the needle tip during withdrawal of the needle from a patient. The needle safety device thereby serves to prevent accidental pricking of, for example, a medical professional by the needle after removal of the needle from the medical device.

A needle safety device according to the preamble of claim 1 is known from US-A-2005/0277879.

US-A-4863434 discloses a hypodermic syringe and needle combination comprising a needle sheath having a generally cylindrical body. At its distal end the needle sheath includes three separated, resilient curved panels symmetrically secured to the cylindrical body and slightly separated from each other. The individual panels are configured to a slant inwardly toward the central axis of the cylindrical body when no deforming forces are applied thereto. Inwardly projecting pie-section shaped leaves are respectively secured to each of the panels. The leaves are formed to slightly overlap laterally with at least one adjacent leaf when no deforming forces are applied to the leaves and the panels. The panels further include respective circularly aligned recesses on their outside surfaces to accommodate a resilient O-ring, which ensures that the leaves overlap each other when no deforming forces are applied to the panels and the leaves.

It is an object of the invention to provide a needle safety device which provides a better protection against accidental pricking by the needle.

This object is satisfied by a needle safety device having the features of claim 1.

The needle safety device of the invention is characterized by an elastic element surrounding the jaws in a region between the base

portion and the locking shoulder formed by the at least one head portion and seen in the axial direction the elastic element covers a substantial part of the jaws, wherein the elastic element and the jaws are configured such that the jaws can be spread apart against a restoring force of the elastic element in order to allow the needle received in the bore to extend all the way through the needle safety device.

Due to the elastic element exerting its restoring force on the jaws in the spread apart state of the jaws, which is the state in which the medical device, for example, an intravenous catheter apparatus, is typically shelved prior to use, the elastic element ensures that the spread apart jaws will snap together and guard the needle tip upon withdrawal of the needle from the medical device even after a longer shelf time, thereby continuously ensuring a correct functioning of the needle safety device. In addition, the elastic element prevents the jaws from becoming loose when the needle safety device slides along the needle, thereby further aiding a correct functioning of the needle safety device.

As a result of the elastic element being arranged in a region between the base portion and the head portions of the jaws, the elastic element also helps prevent the needle tip from protruding sideways out of the needle safety device, thereby further increasing the protecting function of the needle safety device.

Furthermore, due to the arrangement of the elastic element between the base portion and the head portions of the jaws, a locking recess for receiving a locking protrusion formed inside the housing of the medical device is formed between the elastic element and the locking shoulder of the at least one head portion. When the locking protrusion engages with the recess formed by the shoulder of the at least one head portion and the elastic element, the needle safety device is safely secured inside the hous-

ing of the medical device and is, in particular, prevented from movement in the axial direction relative to the housing.

The elastic element may comprise a tension ring completely surrounding the jaws, and/or a clamp, bracket, "C" clip or the like surrounding the jaws only in part.

According to the invention, as seen in the axial direction, the elastic element covers a substantial part of the jaws. The elastic element forms a partial sidewall and together with the jaws defines a chamber inside the needle safety device, in which the needle tip is held after complete withdrawal of the needle from the medical device, thereby further increasing the guarding function of the needle safety device.

The axial dimension of the elastic element may range from about one fifth of the length of the jaws to about two thirds or three fourths of the length of the jaws, and preferably is in the range of about one third of the length of the jaws.

Preferably, the elastic element is made from a material having elastic properties, for example, an elastic material such as rubber, silicone or the like. Due to its elastic properties, the elastic element creates a restoring force on the jaws, when the needle fully extends through the needle safety device thereby spreading the jaws apart and expanding the elastic element. As soon as the needle tip passes the free ends of the jaws upon pulling the needle through the needle safety device, the jaws are positively collapsed by the elastic element due to its restoring force.

In accordance with a further embodiment, the jaws are connected to each other by at least one link in a region between the base portion and the

head portions. Preferably, the link is arranged in the region of the elastic element. The link may be provided on only one side of the jaws. Alternatively, first and second links may be provided on opposite sides of the jaws.

Preferably, the at least one link is formed to have spring-like properties such that the jaws can be spread apart against a restoring force of the link. For example, the link may have a curved shape, such as an S- or Z-like shape. Alternatively, the link may have a substantially straight shape.

The at least one link prevents the two jaws from spreading apart two far, thus preventing over-stretching of the elastic element which could result in a loss of elastic properties. Furthermore, the link supports the elastic element in exerting a force on the jaws in the collapsing direction, thereby aiding the elastic element in preventing the jaws from becoming loose when the needle safety device slides along the needle. In addition, the link causes the jaws to collapse even if the elastic element should fail in its function. The link is designed such that it retains its spring-like properties over the period of shelf live.

To allow for a simplified and cost-effective production of the needle safety device, the base portion, the jaws, and preferably also the at least one link may be integrally formed and preferably made from a plastic material, for example, by injection molding. Alternatively, the base portion, the jaws, and preferably also the at least one link may be made from a metal material. According to a further embodiment, the base portion, the jaws and/or the link each comprise a different material or combination of materials, such as a different plastic material, a different metal material or a different combination of plastic and/or metal materials. For example, the base may be made from a metal material and the jaws may be made from a

plastic material, or vice versa. It is also considered that the inner part of the jaws, which contacts the needle, is made from a thermoplastic material such as TPE, whereas the outer part of the jaws may be made from a different material, for example, a plastic, metal, composite or elastomer material, so that the needle safety device causes less friction when sliding along the needle thereby facilitating the withdrawal of the needle.

In order to prevent the needle tip guarded by the needle safety device from protruding beyond the free ends of the jaws, at least one of the jaws has an angled end section at its free end, which extends towards the other one of the jaws in a direction generally perpendicular to the axial direction.

Preferably, the length of the at least one angled end section is selected such that the angled end section is supported on the needle when the needle extends all the way through the needle safety device, thereby spreading the jaws apart far enough for the shoulder of the head portion of the jaw having the angled end section to be able to engage behind the locking protrusion provided in the housing of the medical device.

A preferred needle for a medical device such as, for example, an intravenous catheter apparatus, has an inner profile, i.e. cross-section area defined by the inner periphery or circumference of the needle, a principal outer profile, i.e. principal cross-section area defined by the outer periphery or circumference of the needle, and a needle tip, the needle further comprising at least one enlargement in the region of the needle tip, wherein the enlargement is formed from an increase of the outer profile, whereas the inner profile remains substantially unchanged.

Further subject matter of the invention is an intravenous catheter apparatus, comprising a needle of the aforementioned type and a needle safety device of the invention, which is slidably arranged on the needle for protecting the needle tip, wherein the needle safety device includes a base portion having a bore extending therethrough for receiving the needle, the bore being adapted to the principal outer profile of the needle.

The enlargement and thus increase in effective diameter in the region of the needle tip prevents the needle tip from being pulled through the base portion of the needle safety device during withdrawal of the needle from the medical device. In other words the enlargement prevents the needle safety device from sliding beyond the needle tip and thus ensures that the needle tip is continuously and reliably guarded by the needle safety device after removal of the needle from the medical device.

By forming the enlargement such that only the outer profile of the needle is increased, whereas the inner profile remains unchanged, in other words by maintaining a substantially constant inner cross-section area throughout the entire length of the needle, blood from a patient entering the needle can freely flow along the inside of the needle. In other words a flashback of blood, which occurs when the needle penetrates a vein, is not adversely affected by the enlargement.

The enlargement may be formed by subjecting the needle to concentrated heat at a localized area using, for example, a welding process such as a laser welding process, with or without addition of additional material.

Alternatively, the enlargement may be formed from additional material dispensed onto the outer surface of the needle. In order to locate the dis-

pensed material in a defined position, a recess or groove may be formed in the outer surface or circumference of the needle.

The additional material may, for example, be selected from at least one of a plastic material, an adhesive, a resin and a metal material.

In the case of the additional material being a metal material, the enlargement may, for example, be formed by build-up welding of the additional material onto the needle.

Preferred embodiments of the invention are described in the following description and in the accompanying drawings, wherein:

Fig. 1 shows a view partly in cross-section of a wing housing of an intravenous catheter apparatus, including a needle safety device of the invention inserted therein and a needle extending therethrough;

Fig. 2 shows a view partly in cross-section of the wing housing of Fig. 1, including the needle safety device, but not the needle;

Fig. 3A shows a side view of the needle safety device of Fig. 1 including a tension ring, with the needle safety device guarding the tip of the needle;

Fig. 3B shows a side view of the needle safety device of Fig. 3A without the needle or the tension ring;

Claims

1. A needle safety device (28) for a medical device, the needle safety device (28) comprising:

a base portion (30) having a bore extending in an axial direction therethrough for receiving a needle (24); and

two opposing jaws (34, 36) extending from the base portion (30) generally in the axial direction and each having a head portion (38, 40) in the region of its free end, wherein at least one of the head portions (38, 40) forms a locking shoulder (50) for securing the needle safety device (28) in a housing (10) of the medical device,

and

an elastic element (44) surrounding the jaws (34, 36), wherein the elastic element (44) and the jaws (34, 36) are configured such that the jaws (34, 36) can be spread apart against a restoring force of the elastic element (44) in order to allow the needle (24) re- ceived in the bore to extend all the way through the needle safety device (28),

characterized in that

the elastic element (44) surrounds the jaws (34, 36) in a region between the base portion (30) and the locking shoulder (50) formed by the at least one head portion (38, 40); and

seen in the axial direction the elastic element (44) covers a substantial part of the jaws (34, 36).

2. A needle safety device (28) in accordance with claim 1, characterized in that
an axial dimension of the elastic element (44) ranges from about one fifth of the length of the jaws (34, 36) to about two thirds or three quarters of the length of the jaws (34, 36), and preferably is in the range of about one third of the length of the jaws (34, 36).

3. A needle safety device (28) in accordance with claim 1 or 2, characterized in that
the elastic element comprises a tension ring (44) completely surrounding the jaws (34, 36), and/or a clamp or bracket partly surrounding the jaws (34, 36).

4. A needle safety device (28) in accordance with any one of the preceding claims,
characterized in that
the jaws (34, 36) are connected to each other by at least one link (46) in a region between the base portion (30) and the head portions (38, 40).

5. A needle safety device (28) in accordance with claim 4,
characterized in that
the link (46) is arranged in the region of the elastic element (44).

6. A needle safety device (28) in accordance with claim 4 or 5,
characterized in that
the link (46) is provided on only one side of the jaws (34, 36), or first and second links are provided on opposite sides of the jaws (34, 36).

7. A needle safety device (28) in accordance with any one of claims 4 to 6,
characterized in that
the or each link (46) is formed to have spring-like properties such that the jaws (34, 36) can be spread apart against a restoring force of the link (46).

8. A needle safety device (28) in accordance with any one of claims 4 to 7,
characterized in that

the or each link (46) has a curved shape, for example an S- or Z-like shape, or a substantially straight shape.

9. A needle safety device (28) in accordance with any one of the preceding claims,
characterized in that
the base portion (30), the jaws (34, 36), and preferably also a link (46) connecting the jaws (34, 36), are integrally formed.

10. A needle safety device (28) in accordance with any one of claims 1 to 8,
characterized in that
the base portion, the jaws and/or a link (46) connecting the jaws (34, 36) each comprise a different material or combination of materials.

11. A needle safety device (28) in accordance with any one of the preceding claims,
characterized in that
at least one of the jaws (34) has an angled end section (42) at its free end, which extends towards the other one of the jaws (36) in a direction generally perpendicular to the axial direction.

12. A needle safety device (28) in accordance with claim 11,
characterized in that
the length of the angled end section (42) is selected such that the angled end section (42) is supported on the needle (24) when the needle (24) extends all the way through the needle safety device (28), thereby spreading the jaws (34, 36) apart far enough for the shoulder (50) of the head portion (38) of the jaw (34) having the angled end section (42) to engage with the housing (10) of the medical device for securing the needle safety device (28) in the housing (10).

13. An intravenous catheter apparatus comprising:
a needle (24) having an inner profile, a principal outer profile and a needle tip (56), the needle (24) further having an enlargement (26) in the region of the needle tip (56), wherein the enlargement (26) is formed from an increase of the outer profile of the needle (24) in at least one direction, whereas the inner profile remains substantially unchanged; and

a needle safety device (28) in accordance with any one of claims 1 to 12 and slidably arranged on the needle (24) for protecting the needle tip (56), wherein the needle safety device (28) includes a base portion (30) having a bore extending therethrough for receiving the needle (24), the bore being adapted to the principal outer profile of the needle (24).

14. An intravenous catheter apparatus in accordance with claim 13, characterized in that
a, preferably annular, locking protrusion (54) for engaging with the needle safety device (28) is formed on an inner surface of a catheter hub (10) of the intravenous catheter apparatus.

15. An intravenous catheter apparatus in accordance with claim 14, characterized in that
the locking protrusion (54) has a substantially rectangular profile with rounded edges or a rounded profile similar to a Gaussian curve or a semi-sinusoidal curve.