Injection syringe

The subject-matter of the present invention is an injection syringe according to the preamble of patent claim 1.

Injection syringes are known in many embodiments. They comprise a syringe cylinder with a coupling device for an injection needle and a plunger with a plunger head and a plunger shank as well as a thumb rest for actuating the plunger. Such injection syringes are not exclusively used by qualified personnel, but are increasingly used for injecting intoxicants and on account of this get into the hands of non-trained people who do not pay attention to the sterility.

For this reason there are already known injection syringes with which the first usage is to be indicated or which are only to be usable once. The possibility of using the syringe only a single time, apart from protecting drug addicts, also protects other sick people above all in developing countries from getting into contact with contaminated blood on already used syringes.

From EP-A-0,438,453 there is known an injection syringe whose plunger head comprises an axial bore which on the side of the plunger base is closed by a disk with a circumferential break-off location. Alternatively to a disk with a break-off location from the same document it is known to place in the base of the plunger a ring with a central break-off location. On the rear side of the syringe cone onto which the injection needle may be placed there is formed a cutter which projects into the plunger-swept volume and which with a complete emptying of the syringe, that is to say with the complete advance of the plunger head, separates the disk from the plunger base along the break-off location. The redrawing of a medicament is then prevented since on account of the breaking-through of the base of the plunger a vacuum may no longer be built up within the injection syringe. This known injection syringe has the disadvantage that for breaking through the base of the plunger a feelable resistance must be overcome. Skillful addicts or skillful medical personnel in hospitals in developing countries are therefore without further ado in the position of emptying the contents only to the extent that a destruction or perforation of the plunger base is not effected. The syringe as a result may be re-used as often as possible.

From US-A-5,000,735 there is further known an injection syringe whose plunger head is manufactured of rubber and is placed on a plunger extension. The connection of the plunger head to the plunger extension is effected via a separate carrier ring with radialy inwardly directed stoppers which may be broken off. The carrier ring on account of a slot-shaped opening may be spread apart and pressed together. This known injection syringe has the disadvantage that the plunger is composed of several individual parts. By way of this the manufacturing as well as assembly costs are unnecessarily high. Furthermore it is difficult to place together the carrier ring, plunger head and plunger extension without at the same time bending off the stoppers.

US-A-4,950,240 likewise discloses an injection syringe whose plunger is preferably manufactured of rubber and comprises a hollow space open at the top. An annular planar beam plate with two radialy inwardly directed beams connected to this beam plate via joint locations is placed on the plunger head such that the beams partly cover the opening of the hollow space. On the inner side of the opening there is located a flat, cylindrical reactor head which by way of a long cylindrical reactor shank is inserted into the opening of a breaking ring attached on the underside of the drive shank. At the same time the reactor shank is led through a central opening between the beams of the beam plate. A disadvantage of this known injection syringe is to be seen in that again several parts must be manufactured and put together. The manufacturing and assembly costs of such a syringe are relatively high. Above all there exists the danger that on putting together the individual parts the beams on the beam plate bend or break off. It is even questionable whether the at least four required parts in practice may also actually be put together.

In US-A-5,163,908 there is known a further injection syringe. On the upper side of the plunger head there is attached a cone on whose tip there is seated a receiver with a ball-shaped end. The front end of the shank is by way of radially outwardly running incisions divided up into several segements bearing tightly on one another. In the middle of the front end there is admitted a central opening which accommodates the receiver with the ball-shaped end. On injecting, the front end of the shank is pressed against the cone and at the same time disintegrates into a multitude of individual segments. A disadvantage of this injection nozzle lies in the fact that for the manufacture of the plunger there are required several parts and the manufacturing costs are

correspondingly high. Furthermore the shank described in the application is not manufacturable with the injection moulding method.

It is the object of the present invention to develop an injection syringe such that after the use for the first time a renewed drawing-in of fluid is impossible.

This object is achieved by an injection syringe with the features of patent claim 1. Advantageous formations of the invention are defined in the dependent claims.

The plunger head designed according to the invention during the injection or at the latest at the end of the injection procedure breaks from the plunger rod and may no longer be retracted. It remains stuck in the syringe cylinder.

In the embodiment of the syringe according to the invention with webs which lie in a surface area of a truncated cone, the breaking load may be designed differently large depending on the displacement direction of the syringe plunger. This permits the drawing up of the fluid without running the danger that the webs break. With the subsequent injection on the other hand the webs break already with a small pushing force, for example 7 - 10 Newtons. This does not compromise the function of the syringe since the syringe contents may still be ejected. The shank end displaces the plunger in any case to the front. The shank end then bears on the sealing cap which covers the bore.

The manufacture of the syringe, i.e. of the cylinder and of the plunger and, if the plunger comprises a rubber seal, also of the rubber cap is inexpensive since only two or three parts need to be manufactured and assembled.

By way of illustrated embodiment examples the invention is described in more detail. There are shown in

Figure 1 a perspective representation of a disposable syringe with a partly inserted plunger head,

Figure 2 a longitudinal section through a syringe with a plunger head located in the start position,

Figure 3 a longitudinal section through the syringe with a completely advanced plunger head which is separated from the shank,

Figure 4 a cross section through the plunger head and the shank end along line IV-IV in Fig. 5,

Figure 5 a longitudinal section through the plunger head and the shank end,

Figure 6 a longitudinal section through the plunger head in a further formation of the invention,

Figure 7 a longitudinal section through the plunger head in a further formation of the invention,

Figure 8 a longitudinal section through a syringe with a plunger head located in the starting position, without an additional sealing cap,

Figure 9 a plan view of a plunger of a further embodiment form of the invention.

In the perspective overview representation according to Figure 1 there is indicated a disposable syringe with the reference numeral 1. This comprises a syringe cylinder 3 with a coupling device for an injection needle (not placed on), e.g. a needle cone 5, as well as two radially protruding grip plates 7. In the syringe cylinder 3 there is shown a syringe plunger 9 which is partly advanced and on whose front shank end there is placed on a plunger head 11 and on whose rear shank end there is formed a thumb rest 13. Beween the plunger head 11 and the thumb rest 13 there lies a shank 15 which has for example a cross-shaped cross section. The two main parts, the syringe cylinder 3 and the syringe plunger 9 are manufactured of plastic by injection. In the piston head 11 there is admitted an axially running bore 17 which passes through the plunger head 11 completely (cf. Figs. 2 to 7) or only partly (Figs. 8 and 9). A preferably cap-shaped seal 19 surrounds in the first embodiment form the plunger head 11 peripherally and its end-face base surface. The cap-shaped seal 19 extends over at least one part of the periphery 20 of the sealing plunger 11 and here lies embedded within a circumferetial shoulder (cf. Figure 5).

The cross-shaped shank 15 at least in the front section has a diameter which is smaller than the diameter of the bore 17.

In one formation of the invention on the end of the shank 15 there is seated a disk 25 whose diameter is equal or larger than the diameter of the beam 23 of the shank 15, but smaller than the diameter of the bore 17.

Between the periphery of the disk 25 or the front shank section 27 preferably having a smaller thickness and the bore 17 there results a gap 28.

The connection between the shank section 27 or the disk 25 and the plunger head 11 is effected by fine, thread-like, rodlet-like or film-like webs 29 which extend radially from the beam 23 on the shank section 27 or from the periphery of the disk 25 radially onto the walling of the bore and are conneted to this. The connection of the webs 29 which in cross section are round or polygonal may be effected at the end of the bore 17 or axially displaced in the inside of this bore. The strength of the webs 29 is dimensioned in a manner such that on exceeding a predeterminable axial force, e.g. 10N they are sheared off from the shank 15 or the disk 25. A more detailed explanation of this procedure is made with the desription of the function.

In the plunger-swept space of the syringe plunger 3 at a distance to the syringe cylinder base, which is larger than the axial extension of the plunger head 11, there may be formed a circumferential bulge 33 which projects into the plunger-swept space of the cylinder 3 and thus into the displacement path of the plunger head 11 and which reduces its cross section. The radial extension of the bulge 33 is very slight and depends on the diameter of the syringe cylinder 3.

In the formation of the invention according to the Figures 6 and 7 the webs 29 have a rectangular cross section wherein the first edge 37, of the webs, which is proximal to the plunger head base runs inclined. The second edge 39 distant to the plunger head base may run parallel to the plunger head base or parallel to the first edge 37. The connecting regions of the webs 29 on the plunger head 11 and on the shank section 27 or on the disk 25 seated on the shank section 27 may run parallel or - as is represented in the examples in the Figures 6 and 7 - the bore 17 in the region of the webs 29 may have a conically running section 39. Analogously also the periphery of the disk 25 may be designed running conically, i.e. the disk 25 has the shape of a truncated cone (Fig. 6).

In the formation of the invention according to Figure 8, on the plunger head 11 there is attached no additional elastic seal, but the plunger head 11 bears with its periphery directly on the walling of the syringe cylinder 3. The shank section 27 is in turn connected to the plunger head 11 by way of fine webs 29, wherein in the plunger head 11 there is formed a pocket bore 17 into which the shank section 27 after breaking the webs 29 may move and abut on the base 28.

In the formation of the invention according to Figure 9 at the shank end again there is shown a plunger head 11 which directly with its periphery sealingly bears on the walling of the syringe cylinder. The connection between the plunger head 11 which here is designed disk-shaped, and the shank section 27 is effected by way of for example three feet 30 which on the one side are rigidly connected to the disk-shaped part of the sealing head 11 and on the other side in each case by way of a web 39 to the front end of the shank section 27 or to the disk 25. Preferably the length of the feet 23 corresponds to the distance of the disk 25 from the lower end of the upper part of the shank 15.

In the following the manner of functioning of the disposable syringe 1 is explained in more detail.

At the manufacturer's the syringe 1 after the injection moulding of the individual parts with the three-part design the seal 19 is placed over the plunger head 11 and subsequently the syringe plunger 9 is inserted into the syringe cylinder 3, and specifically only so far so that the seal 19 does not yet project into the bulge 33, i.e. the two parts do not contact. The insertion of the syringe plunger 9 into the syringe cylinder 3 is effected usually by way of an assembly and handling apparatus so that the position of the syringe plunger may be exactly adjusted. In the formation of the invention according to Figures 8 and 9 which make do without the sealing cap 19, after the manufacture of the syringe plunger 9 this is directly inserted into the syringe cylinder 3. The insertion however is effected only until the front end of the plunger head has reached the start of the conical region A (see Figure 8), inasmuch as the syringe cylinder 3 is equipped with a region A having a cone angle alpha. With a continuous cylindrical syringe cylinder 3 the plunger 9 may be advanced up to the plunger base 4.

The user of the syringe fills this in a conventional manner in that he retracts the syringe plunger 7. After the bleeding by blowing out the air in the front part of the syringe cylinder 3, the

injection is effected, wherein the plunger head 11 for the complete emptying is advanced up to the abutment at the base 4 on the needle-side end of the syringe cylinder 3. With the last millimetres of the advance with the traversing of the bulge 33, if one is provided, or with the traversing into the conical region A and/or with the pressing out of the last remains of the fluid on account of the increased resistance, the webs 29 break and the shank 15 slides in the bore 17 or between the feet 30 (Fig. 9) forwards and abuts on the base 28 of the bore 17 or the feet 30 at the end of the shank.

The plunger head 11 may thus be securely advanced up to the end of the plunger-swept space at the base 4 of the syringe cylinder 3 although the webs 29 are broken.

A renewed drawing of fluid is ruled out. The disposable syringe 1 is thus made unusable.

Patent claims

1. An injection syringe (1) with a syringe cylinder (3) with a coupling device (5) formed at the front cylinder end, for placing on an injection needle, with a grip plate pair (7) formed on the rear end of the cylinder, with a syringe plunger (9) longitudinally guidable in the plunger-swept space of the syringe cylinder (3), comprising a shank (15, 27) with a plunger head (11) with a peripherally circumferential sealing surface (19) and with a thumb rest (13), characterised in

- that the plunger head (11) is connected on the shank (15) with thread-like, rod-like or film-like webs (29) and
- that on the plunger head (11) there are formed means (30, 28, 19) for supporting the shank end.

2. An injection syringe according to claim 1, characterised in

- that in the plunger head (11) there is formed an axially running bore (17),
- that the shank section (27) on the end on the side of the plunger head has cross section which is smaller than the cross section of the bore (17) on the shank-side end and
- that the end, of the shank (15), on the side of the plunger head, is connected to the plunger head (11) by the webs (29).

3. An injection syringe according to claim 1, characterised in that on the plunger head (11) there are formed support feet (30) on whose ends the webs (29) are connected, which create the connection to the shank (15).

4. An injection syringe according to one of the claims 1 to 3, characterised in that the webs (29) are arranged essentially running radially between the shank (15) and the plunger head (11).

5. An injection syringe according to claim 4, characterised in that the webs (29) are fastened on a disk (25) formed or placed on at the end of the shank (15).

6. An injection syringe according to claim 5, characterised in that the edges (37, 39) of the webs (29) converge with an increasing radial distance to the shank (15) or the disk (25), and the contact surface with the plunger head (11) is smaller than with the disk (25) or that the webs (29) are formed running in a trucated-cone-shaped surface.

7. An injection syringe according to one of the claims 2, 4 to 6, characterised in that the webs (29) are connected to the plunger head (11) at the shank-side end of the bore (17) or axially distanced from the shank-side end in the inside of the bore (17).

8. An injection syringe according to one of the claims 6 to 7, characterised in that the bore (17) and/or the periphery of the disk (25) at the connection location of the webs (29) is formed running conically.

9. An injection syringe according to one of the claims 2, 4 to 6, characterised in that the seal (19) axially runs at least over a part of the periphery of the sealing plunger (11) and that the seal (19) is formed cap-shaped.

10. An injection syringe according to one of the claims 1 to 9, characterised in that at a distance to the front and/or rear end of the plunger-swept space in the syringe cylinder (3) in each case there is formed a fully or partly circumferential bulge (33) narrowing the cross section and/or at the front end there is formed a conically narrowing section (A).