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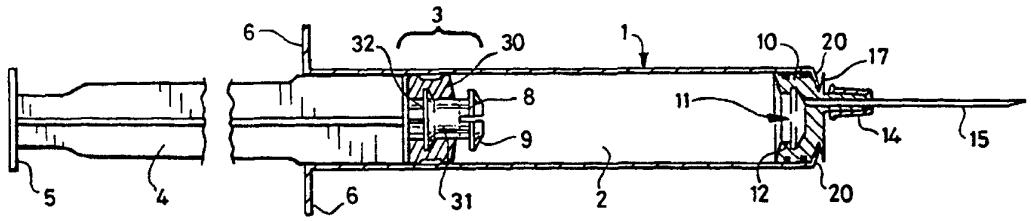
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(54) Title: SAFETY SYRINGE



(57) Abstract

The present invention relates to a syringe in which the needle can be retracted into the syringe body (1) directly from the body of the patient upon whom the syringe has been used. The syringe incorporates linearly acting coupling means between the piston (3) or plunger shaft (4) and the needle mounting means (10), which coupling means has at least one fluid vent passage to prevent fluid build up within the coupling means as it is engaged. The needle mounting means (10) is secured to the syringe body (1) by a linearly acting fastener (16, 21). Such a syringe avoids the need for excessive forces to engage the coupling means and to disengage the needle mounting means (10) and the need to rotate parts of the syringe to engage the coupling or disengage the needle mount and thus avoids excessive pain and discomfort to the patient. By retracting the needle (15) into the syringe body (1) directly from the body of the patient, exposure of the syringe user to the needle is minimised.

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TITLE: SAFETY SYRINGE

The present invention relates to a safety syringe, notably to a safety syringe having means for retracting the needle after use.

BACKGROUND TO THE INVENTION:

Many forms of syringe exist for administering a fluid, for example a medicament, to a patient by injecting the fluid through the skin of the patient or for withdrawing a fluid, for example a blood sample, from the patient.

Syringes typically comprise a tubular body within the axial bore of which a piston head is moved axially by means of a plunger so as to dispense the contents of the space within the body ahead of the piston as the plunger is depressed or to suck material into the syringe when the plunger is withdrawn, via a needle which is inserted into or under the skin of the patient. Many forms of syringe are known, but they all have these general features and the term syringe will be used hereinafter to denote generically devices of this type.

Once a syringe has been used problems arise in the disposal of the used syringe. Whilst the syringe can be constructed so that it can be dis-assembled and the individual components cleaned and sterilised for subsequent re-use, this is time consuming and costly. It is therefore the common practice to dispose of the used syringe to waste, for example into a strong plastic container which is disposed of by incineration or burial. However, in handling the used syringe there is the risk that the user may accidentally stab himself with the exposed tip of the needle prior to or during insertion into the disposal container. Furthermore,

the syringe is disposed of in an operative condition so that it can be retrieved from the disposal container for unauthorised use, for example to inject drugs or the like. Where the syringe has been used to draw blood from or to inject medicament into a patient with a blood carried disease, for example AIDS, there is a risk of cross-infection via the used needle.

In order to reduce the risk of accidental stabbing of the user with the used needle, it has been proposed to apply a sheath to the needle. However, this retains the axial length of the syringe and needle, which gives problems in the space the syringe occupies in the disposal container. It has therefore been proposed to break the needle off the syringe, for example using a cutter or the like. However, this leaves a sharp needle stump projecting from the end of the syringe which can snag or stab the skin of a user.

In order to reduce this problem, it has been proposed, for example in British Specification No 2 214 082, that the needle sheath should be used to break the needle away from the end of the syringe at its mounting so as to render the syringe inoperative by removal of the needle and to reduce the axial length of the syringe which has to be disposed of. However, in applying the sheath axially over the exposed needle, the user still runs the risk that he will jab himself with the needle. Furthermore, the syringe is still operative and the needle can be replaced.

In order to reduce these problems it has been proposed, for example in US Patent No 4,790,822, that the rear or proximal end of the needle mounting should be formed so that it can be coupled to the forward or distal end of the piston in the syringe bore. When the forward stroke of the syringe has been completed, the coupling is engaged so that the needle

can be detached from its mounting and withdrawn into the bore of the syringe as the plunger is withdrawn. The needle is thus housed within the bore and the user is protected against accidental stabbing by the tip of the needle. The syringe can then be disabled by snapping off the exposed portion of the plunger shaft.

However, the above proposals do not address the problem of accidental stabbing of the user before the needle is sheathed and ideally the needle should be sheathed as it is withdrawn from the patient's skin, whereby the needle tip is not exposed to the syringe user. However, in attempting to achieve this with conventional syringes incorporating one or more of the above safety features, we have encountered problems in ensuring smooth retraction of the needle from the patient's skin. If the needle is not retracted smoothly, unnecessary pain and distress is caused to the patient due to movement of the needle within the patient's skin or body.

Thus, we have found that where the needle mounting requires a rotary action to disconnect the needle from the syringe body, for example as in US Patents Nos 4,675,005 or 4,747,830 or European Patent Application No 0278493 A3, this causes excessive movement of the needle within the skin/body of the patient and is unacceptable. Similarly, where the coupling between the piston and the needle mount requires a rotary action to engage the coupling, for example as in US Patent No 4,675,005, this also causes excessive movement during its engagement and is unacceptable.

Where the needle mounting incorporates a linear snap fit engagement of parts, as described in US Patents Nos 4,790,822 or 4,692,130, we have found that current designs for such mountings do not allow smooth disengagement of the

needle from the syringe. Typically, we have found that problems arise due to the long travel required to release the needle mount from the mounting member by which the needle mounting is carried by the syringe body. As a result, it is necessary to apply a considerable and prolonged force to the plunger to withdraw the needle sufficiently far to release the needle mount. This causes wavering of the syringe in the grip of the user. Furthermore, the actual moment of release of the needle/needle mount cannot be accurately predicted and this results in a sudden jerk of the syringe as the needle/needle mount is released and before the user decreases the force which he is applying to the plunger. Both these factors cause excessive movement of the needle tip in the skin/body of the patient, which is unacceptable.

Furthermore, where the coupling between the piston and the needle mount involves a linear movement between the coupling component parts to engage the coupling, the axial forces required to engage the coupling are surprisingly high and the engagement is not always complete with the risk of erratic and sudden disengagement of the coupling when the user attempts to withdraw the coupled plunger and needle mount. Surprisingly, we have found that this is due to the entrapment of fluid between the engaging components of the coupling, and in some cases between the opposing faces of the piston and the end wall of the piston bore, and that vent means must be provided to allow this trapped fluid to escape.

We have now devised a form of needle mount and coupling which reduces the above problems and allows the needle of a syringe to be withdrawn into the bore of the syringe directly from the skin of the patient without causing undue paid or discomfort to the patient.

SUMMARY OF THE INVENTION:

Accordingly, the present invention provides a syringe comprising an axially extending body portion having an axial piston bore therein extending from a proximal open end to a closed distal end, a piston member journalled for axial movement in the piston bore, a plunger member whose distal end carries the piston member for axial movement of the piston member in the piston bore, said body portion having a needle through which fluid can flow to and/or from the piston bore and mounted upon the body portion by a demountable member whereby the needle can be detached from the body portion and transported axially into the piston bore, there being provided coupling means whereby the piston member or plunger member can be coupled to the demountable member for transporting the needle axially into the piston bore, characterised in that:

a. the coupling means between the piston member or the plunger member and the demountable member is a linearly acting coupling means and at least one of the members forming the coupling means is provided with at least one fluid vent passage whereby fluid entrapped between co-operating surfaces of the coupling members can escape to allow engagement of the coupling members;

b. the said demountable member is secured to the body portion by a linearly acting fastening means located at or adjacent the distal end of the piston bore and comprising at least two inter-engaging circumferentially disposed radially co-operating fastening members, one carried by the body portion of the syringe and the other carried by the demountable member, the external radial dimensions of the demountable member distally beyond the fastening member carried by it being less than the internal radial dimensions of the body portion at the location of the fastening member carried by it, whereby the demountable member can travel

axially within the piston bore when said fastening means have been disengaged from one another by relative axial movement of one with respect to the other and said coupling means have been engaged.

The invention also provides a method for rendering a syringe safe after use, which method is characterised in that it comprises retracting the needle of the syringe into the piston bore of the syringe whilst retaining the syringe in substantially the position at which the syringe was operated to inject fluid into or to remove fluid from the body of the patient.

The fastening members are of a form which is disengaged by axial movement of one member with respect to the other. Such fastening members can take a number of forms, for example triangular radial teeth or ribs which engage in an annular triangular recess. However, in order to assist smooth disengagement of the ribs from the recess, it is preferred that the engaging surfaces of the fastening members be rounded or otherwise sloped to assist sliding of the surfaces over one another as the demountable member is moved axially into the piston bore. However, other forms of axially disengagable fastening members may be used. Thus, one fastening member can be provided by radially deformable arms or the like which carry radial projections, for example barbs or ratchet teeth, which engage an annular flange or rib carried by the other fastening member. If desired, the fastening members can be formed from or be coated with a low friction material, for example a PTFE or silicone rubber.

In a preferred embodiment, the body portion of the syringe is in the form of a cylinder and the internal bore of the cylinder provides the axial piston bore. The bore is closed at its distal end by a transverse end wall which is provided

with an aperture. The demountable member carrying the needle is secured axially within the aperture by inter-engagement of the radially inwardly projecting lip of the aperture with a radially inwardly directed annular recess. This recess can be cut into the material of the demountable member or can be provided by a pair of axially spaced apart radially outwardly projecting annular ribs carried by the demountable member forming an annular recess therebetween. It is particularly preferred to form the annular lip of the aperture formed by suitable cutting away or machining of the end wall of the syringe body and to form the demountable member carrying the needle from a silicone or other pharmaceutically acceptable rubber having an annular groove formed adjacent its proximal end into which the lip of the aperture engages.

For convenience, the invention will be described hereinafter in terms of the use of a radial lip and co-operating annular recess as the fastening members since such a form of fastening members readily lends itself to accurate manufacture by injection or other moulding techniques using plastics and enables a smooth disengagement of the components to be achieved over a wide range of syringe sizes and operating conditions. Furthermore, as described below, such a form of fastening means can be readily modified to adjust the force required to disengage the fastening means during use and can be designed so as to incorporate means for aiding retention of the demountable member during charging of the syringe.

The relative dimensions of the ribs and recesses can be varied over a wide range having regard to the nature of the material from which they are made and the extent of engagement of the ribs in the recesses. The optimum form and dimensions for the ribs and recesses can readily be

determined by simple trial and error tests. Typically, it will be desired that the demountable member carrying the needle disengage from the syringe body under an axially applied force which is from 10 to 200% greater than the maximum internal suction force which it is expected to generate within the piston bore as material is sucked into the piston bore when charging the syringe. Typically, syringes are exposed to internal suction forces of from 100 to 450 mms Hg below ambient depending upon the bore of the needle through which the fluid is being drawn and the rate of withdrawal of the piston within the piston bore. It is therefore preferred that the fastening members should disengage when an axial retractive force equivalent to a suction of more than 250, preferably more than 500, mms Hg is applied to the proximal face of the demountable member exposed to the piston bore when the demountable member is mounted upon the syringe body.

Where a specific design of annular fastening members requires a disengagement suction force which is greater than is acceptable, the force required to achieve disengagement can be reduced by forming the fastening members as discontinuous members. Thus, for example, a continuous annular rib can be formed as a series of separate sector portions which will usually allow the rib portions to flex and thus disengage at a lower applied force than a continuous annular rib. In a particularly preferred embodiment, the lip of the aperture in the end wall of the piston bore is cut with radial slits to form a series of ribs which engage with a continuous annular groove in the demountable member.

In a particularly preferred embodiment, the lip of the aperture in the distal end wall of the piston bore is orientated in a distal direction and is deformable axially,

whereby the application of the axial force to the demountable member causes the lip of the aperture to move radially inwardly and subsequently radially outwardly as the lip is deformed axially. In this way, the application of a suction force to the proximal face of the demountable member as the piston is retracted in the piston bore causes the radial grip applied by the aperture lip to increase progressively as the axial suction is applied. However, the suction force does not exceed the force required to flex the lip beyond the radial orientation so that the demountable member is not released from the grip of the lip. When a greater force is applied axially when the coupling between the piston and the demountable member has been engaged, the lip flexes through a truly radial orientation to adopt a proximally directed orientation allowing the radial dimension of the aperture to increase, thus aiding smooth release of the demountable member from the body portion.

Many syringes are formed with a conical distal end in which the end wall cone has an included angle of from 120 to 170°. Such a form of lip can be achieved by cutting away the apex of the conical end wall at an angle to form a secondary conical end to the syringe which has an included angle which is from 5 to 30° greater than that of the original end wall. The cut removes the apex of the original end wall to form the aperture and forms a lip to that aperture having a radially tapering cross-section which provides the flexible property to the lip. It is particularly preferred to cut the lip with two or more radial slits or cuts outs which divide the lip into a series of radial sectors which assist flexing of the rim as described above. Typically the slits or cut outs are formed symmetrically about the rim, for example at 90, 120 or 180° intervals around the lip.

The distal portion of the demountable member extending beyond the end wall of the body portion has an external radial dimension which is smaller than the internal radial dimension of the fastening member, for example the lip of the aperture in the end wall of the syringe body, carried by the body portion. As a result, after the fastening members have been disengaged by the application of axial force, the demountable member is a non-engaging passage through the fastening member carried by the syringe body and requires the application of significant disengaging force only to disengage the fastening members and not for any significant subsequent axial travel of the demountable member. It is therefore preferred that any portion of the fastening member carried by the demountable member which extends distally of the fastening member carried by the syringe body portion, usually only the distal rim of the annular recess, be kept to a minimum commensurate with adequate securing of the demountable member against distal axial movement when the fastening members are engaged.

Similarly, the internal radial dimensions of the body member, usually the piston bore, proximally of the fastening member carried by the body member are at least a sliding fit greater than the maximum radial dimension of the demountable member, typically of that portion of the demountable member extending proximally of the fastening member. Whilst this portion of the demountable member can be a loose radial fit within piston bore, it is preferred that this portion of the demountable member be a sliding fit or up to 1 mms smaller external diameter than the internal diameter of the piston bore so that the internal walls of the piston bore provide a measure of support and guidance to the demountable member as it is retracted into the piston bore. If desired, the demountable member can carry one or more annular sealing ribs or O rings to prevent leakage of the contents of the

piston bore past the demountable member.

The demountable member carries an axially extending needle through which a fluid can be discharged from the piston bore. The needle can extend fully through the demountable member and form an integral part thereof. Alternatively, the demountable member can be provided with an axial bore therethrough which communicates with an axially extending spigot or luer upon which the needle is mounted using a conventional fixed or separable mounting, preferably a locked mounting to prevent accidental removal of the needle. The luer can be located substantially coincident with the longitudinal axis of the demountable member so that the needle extends along the longitudinal axis of the syringe. However, the luer can be located off centre so that the needle extends axially, but offset from the longitudinal axis of the syringe.

The distal end of the plunger member or the distal face of the piston member and the proximal face of the demountable member are provided with coupling members which engage by relative axial movement to provide the positive coupling between the piston/plunger and the demountable member which overcomes the inter-engagement of the fastening members to release the demountable member. The coupling members can take a number of forms, for example inter-engaging barbs carried by one of the piston/plunger or demountable member and a rim or groove carried by the other. However, it is preferred to form a radially extending button or flange on the piston/plunger or the demountable member and a corresponding recess in the other so that the button or flange is a snap fit into the recess. If desired, the rim of the recess can be formed from a flexible material to assist engagement of the button or flange into the recess. Thus, for example, the recess can be in the form of a blind

ended bore or the like and the rim can be provided by a washer or the like having a smaller diameter aperture therein secured over the open end of the bore and through which the button or flange is an interference fit. If desired, the recess or the button or flange can be formed with means whereby the engagement between them is one way, whereby the coupling cannot be disengaged once engaged. Thus, the button or flange can be under cut on its rearward face and the lip of the rim can have an axial annular rib or skirt which engages in the under cut once the button or flange is engaged fully into the recess. Preferably, the face of the button or flange which enters the recess is shaped to assist engagement of the flange or button into the recess. For example, the button or flange can present a tapered face to the recess, as when the button or flange has an arrowhead type of axial cross-section. For convenience, the invention will be described hereinafter in terms of a spherical button head which engages in a substantially congruent recess.

It will be appreciated that the coupling member need not be carried by the piston member but may be carried by or be formed integrally with the distal end of the plunger where the piston member is in the form of an annular member which is mounted upon the distal end of the plunger shaft with the coupling member protruding through the piston member.

The coupling members preferably engage with a minimal axial force applied to them, typically of from 1 to 15 lbs per square inch, to minimise discomfort to the patient. However, the coupling must require an axial disengagement force which exceeds the force required to disengage the fastening members securing the demountable member to the syringe body portion. Typically, the axial force required to disengage the coupling members will be at least 10%,

preferably at least 100%, greater than the force required to disengage the fastening members.

As stated above, we have found that the force required to engage the coupling members can be greatly increased due to the entrapment of fluid between the opposing faces of the coupling members. In order to reduce this, one and/or both of the coupling members are provided with fluid vent ducts or passages whereby fluid can escape from between such opposed faces. Thus, one or both of the coupling members can be made from a porous or foraminous material which allows the passage of fluid through the member. However, it is particularly preferred to cut an vent groove in either or both members so that fluid can escape from between the opposed faces to the bore of the needle. It is also preferred to form the distal end of the piston and the proximal end face of the demountable member substantially congruent so that the piston buts against the demountable member and expresses substantially all of any fluid in the piston bore as the coupling members engage. This reduces waste due to medicament remaining unused within the piston bore, and the retention of possibly contaminated blood in the syringe which might come into contact with the user or others. The fluid vent(s) provided in the coupling member(s) may also assist escape of any fluid trapped between the opposing faces of the piston and the demountable member.

The syringe of the invention thus enables a user to draw fluid into and to discharge fluid from the piston bore of the syringe as with a conventional syringe. However, at the end of the discharge stroke of the syringe, the user depresses the plunger to cause the coupling members to engage and thus secure the demountable member to the piston. Since the coupling members are formed so as to vent fluid

which might become entrapped between them, the axial pressure required to engage the coupling members can be reduced to a minimum and discomfort to the patient during engagement of the coupling members is reduced. Once the coupling members have been engaged, the form and construction of the fastening members securing the demountable member in position allow the demountable member and the needle to be disengaged with a minimum of discomfort to the patient and without the need to rotate the syringe or to apply prolonged and excessive force. The needle can thus be withdrawn into the piston bore whilst the syringe is held in position against the patient's body and without exposing the tip of the needle to the user or others. Once the needle has been withdrawn into the piston bore, the syringe can be disposed of safely and in an axially collapsed form.

Since the needle is within the piston bore, the syringe is not readily re-used by an unauthorised person. However, in order to render the syringe securely disabled, it is preferred to provide some form of locking means whereby the piston carrying the demountable member and the needle can be moved within the piston bore. Thus, for example, the piston bore can be provided with internal barbs or teeth which engage the piston of demountable member and are configured so that they allow retraction but not advance of the piston and/or demountable member. Such locking means can act on the plunger shaft and/or on the piston and/or the demountable member if desired.

It will also usually be desired to form the plunger shaft with a ring or zone of weakness at which the shaft can be broken to further render the syringe inoperative and also to reduce the axial length of the disabled syringe for disposal. Thus, the plunger shaft can be partially cut away to form a weak section which is brought into register with

the rim of the proximal end of the piston bore when the locking means described above are engaged. The shaft can then be flexed about the rim of the piston bore to snap the shaft. Preferably, such a weakened portion of the shaft is configured so that opposed ends are formed to the shaft residues upon breaking the shaft which nest into one another. This ensures that the shaft is axially foreshortened and cannot achieve a full forward travel of the demountable member in the event that the locking means securing the demountable member in the fully retracted position is not engaged or is overcome allowing the demountable member to move towards the distal end of the piston bore. A particularly preferred form of such weakened portion is to form the shaft at this portion as two parallel axial flat arms each having two opposed V sections cut away from the width of the arms. When the arms are broken, the residues of the shaft present the apexes of the triangular ends of the broken arms to each other. This provides an unstable connection between the residues of the arms which readily slide over one another or distort when axial pressure is applied when someone attempts to push the plunger into the piston bore.

The syringe of the invention can be readily manufactured using conventional materials and techniques, for example injection of plastics, and can be made by the modification of an existing syringe by adapting the distal end of the syringe body to accept the demountable member and by using a piston member carrying a coupling member in place of a conventional piston member.

DESCRIPTION OF THE DRAWINGS:

To aid understanding of the invention, a preferred embodiment of the invention will now be described by way of

illustration with respect to the accompanying drawings in which Figure 1 is an axial cross-sectional view of the syringe with the plunger fully retracted; Figure 2 shows the syringe of Figure 1 with the plunger in its fully advanced position and with the coupling members engaged; Figure 3 shows the syringe of Figure 2 with the plunger in its fully retracted position having retracted the demountable member with it; Figure 4 is a detailed view of the distal end of the syringe of Figure 1; Figure 5 is a detail end on view of the coupling member carried by the plunger of the syringe of Figure 1; and Figure 6 is an axial cross-sectional view of an alternative form of the syringe of Figure 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT:

The syringe of Figure 1 comprises a cylindrical body portion or barrel 1 having a piston bore 2 and journalled for axial movement therein a piston 3 which is carried upon the distal end of a plunger 4 having a broadened head 5 at its proximal end upon which a user acts to move the piston by depressing or withdrawing the plunger. The proximal, open end, of the barrel 1 has radially extending flanges 6 which can be gripped by a user during use of the syringe. The distal end of the piston bore 2 is closed by a needle mounting member 10 made from a silicone or other suitable rubber or plastic.

The piston 3 can be a conventional rubber or similar sliding, sealing fit plug within bore 2 and secured to plunger 4 by any suitable means. As shown in the drawings, it is preferred to form piston 3 as an annular member 30 which fits upon a shaft 31 extending from the distal end of the plunger 4 and is held in place by one or more flanges 32 which extend radially from the shaft 31 and which engage in an annular groove in the annulus of the piston 30.

The distal face of the piston 3 is shaped substantially congruent to the proximal face of member 10 so that the piston 3 butts closely against the member 10 and substantially all fluid in the piston bore 2 is discharged from the syringe. The distal end of the plunger shaft extends through the annular piston 30 and terminates in a radial flange 8 having a rounded or tapered distal end face 9. As shown in Figure 5, the distal end face of flange 8 is cut with a cruciform vent slit 33 which allows fluid trapped between the distal face of piston 3 and the proximal face of member 10 and under the end face 9 of the flange 8 to escape through member 10 as described below. The slit 33 extends axially through flange 8 and also allows the resultant four sections of the flange 8 to flex radially inwardly to assist passage of flange 8 into recess 11 in member 10 as described below.

Member 10 carries on its proximal face a recess 11 which is formed substantially congruently to flange 8 and into which flange 8 is a snap fit. Typically, due to the slope of the opposing faces of member 10 and the end face 9 of the flange 8, the flange snap fits into recess 11 under an applied pressure of about 5 to 10 psi. However, due to the radial or slightly under cut proximal radial face of flange 8 and the co-operating rim 12 of the recess 11, flange 8 requires a substantially higher force to disengage it from recess 11, typically equivalent to a withdrawal force equivalent to a withdrawal pressure of at least about 30 psi.

The member 10 comprises a sealing fit plug having the recess 11 formed in its proximal face and having an axial bore 13 extending through the member from the base of the recess 11. The bore 13 communicates with a needle mounting luer 14, which carries a conventional hypodermic needle 15. The needle 15 can be a simple push fit upon the luer 14, but is

preferably secured in place by a conventional luer lock mechanism (not shown). The recess 11 has a radially inwardly directed rim 12 at its proximal end through which the flange 8 is a snap fit passage. The rim 12 can be undercut on its distal side to co-operate with the under cut on the proximal face of flange 8 to retain flange 8 within recess 11 when the plunger is withdrawn. The bore 13 and luer 14 can be located off centre as shown or can be located on the longitudinal axial of the syringe if desired.

As shown in Figure 4, the member 10 is held in place at the distal end of the piston bore by passing through an aperture in the end wall 20 of the syringe barrel body 1. The lip 21 of the aperture engages with an annular groove or recess 16 formed in the member 10. The body of member 10 is cut away distally of the distal lip 17 of the recess 16 so that the distal portion of the member 10 has smaller radial dimensions than the diameter of the aperture in the end wall 20 of the syringe body. The lip 21 engages the recess 16 as a snap fit which requires a suction of about 500 mms Hg to disengage. However, when a typical suction of up to 450 mms Hg is applied during charging of the syringe with a fluid medicament or blood, the lip 21 does not disengage from recess 16 and the member 10 remains in place at the distal end of the piston bore.

In use, the syringe is initially filled with medicament and is in the configuration shown in Figure 1. A user inserts the tip of the needle 15 into the skin of a patient and depresses plunger 4 to discharge medicament through recess 11, bore 13, luer 14 and needle 15 as the piston 3 is moved axially towards the distal end of bore 2. At the distal extreme of its travel, plunger 4 brings flange 8 into engagement with recess 11 in member 10. Any fluid which remains between the opposed faces of member 10 and piston 3

escapes through the slit 33 cut in flange 8 to discharge through needle 15. Similarly, any fluid trapped between the engaging faces of flange 8 and recess 11 can escape via slit 33 to the space behind the proximal face of flange 8 and the rim 12 of the recess. If desired, registration means can be provided to ensure that one of the slits 33 in flange 8 is in register with bore 13 to allow fluid to escape from the space behind the flange to bore 13 and thus further prevent the build up of pressure within the coupling as it engages.

When plunger 4 reaches the extreme of its distal travel, the coupling between the flange 8 and recess 11 is completed and withdrawal of the plunger applies a greater axial force to lip 21 and recess 16 than they can resist. As a result they disengage and member 10 is carried rearwardly with plunger 4 to transport needle 15 into the piston bore. Since the force required to engage the coupling and to disengage the fastening means securing member 10 upon lip 21 act linearly and are comparatively small, the user can retract the needle into the piston bore smoothly and with little discomfort to the patient.

When the plunger 4 is fully retracted to the position shown in Figure 3, the needle 15 is fully sheathed within the piston bore and the syringe can now be removed from the patient in safety. If desired, an end cap 22 can be inserted into the aperture in the end wall 20. Alternatively, the plunger 4 can be formed with a zone of weakness as shown in Figure 6 at which it can be broken by flexing the plunger about the rim at the proximal end of the barrel 1. The zone of weakness is formed by cutting V portions 23 out of the plunger shaft to leave a narrow section 24 at which the shaft can be broken. Preferably, the V sections are cut out of two parallel flat arm extensions of the plunger shaft, of which only one is

visible in Figure 6.

Preferably, internal stops or barbs 25 are formed on the inside of the piston bore wall to prevent the plunger and piston from being withdrawn fully from the piston bore. The stops or barbs 25 also prevent the piston member carrying the needle and any residue of the plunger in the piston bore from being moved towards the distal end of the piston bore and thus expose the tip of the needle 15. The residue of the plunger shaft which is broken away from the piston can be inserted through the aperture in the end wall 20 to seal the aperture in place of the cap 22 and possibly also to crush the needle 15.

In a further alternative, the shaft of the plunger can be flexed to cause the flange 8 to deform due to the slit 33. This allows the flange 8 to disengage from recess 11 allowing the plunger to be withdrawn completely from the piston bore and to be disposed of separately.

As shown in the detailed view in Figure 4, the lip 21 can be formed with a tapered radial cross-section which allows the lip 21 to flex as shown dotted when a proximally directed force is applied to the member 10. This flexing will enhance the radial grip of lip 21 on member 10 until the lip flexes beyond a true radial position, at which point the lip will loosen its grip on member 10 and assist disengagement of the distal lip 17 of recess 16 from lip 21 to allow member 10 to pass through the aperture in the end wall 20. If desired, the distal lip of recess 16 can be formed (as shown) so that it also flexes to assist disengagement of member 10 from lip 21.

Whilst the flange 8 has been shown as being formed as an integral part of the shaft of the plunger 4, it will be

appreciated that the flange could be formed as part of the piston 3.

CLAIMS:

1. A syringe comprising an axially extending body portion having an axial piston bore therein extending from a proximal open end to a closed distal end, a piston member journalled for axial movement in the piston bore, a plunger member whose distal end carries the piston member for axial movement of the piston member in the piston bore, said body portion having a needle through which fluid can flow to and/or from the piston bore and mounted upon the body portion by a demountable member whereby the needle can be detached from the body portion and transported axially into the piston bore, there being provided coupling means whereby the piston member or plunger member can be coupled to the demountable member for transporting the needle axially into the piston bore, characterised in that:

a. the coupling means between the piston member or the plunger member and the demountable member is a linearly acting coupling means and at least one of the members forming the coupling means is provided with at least one fluid vent passage whereby fluid entrapped between co-operating surfaces of the coupling members can escape to allow engagement of the coupling members;

b. the said demountable member is secured to the body portion by a linearly acting fastening means located at or adjacent the distal end of the piston bore and comprising at least two inter-engaging circumferentially disposed radially co-operating fastening members, one carried by the body portion of the syringe and the other carried by the demountable member, the external radial dimensions of the demountable member distally beyond the fastening member carried by it being less than the internal radial dimensions of the body portion at the location of the fastening member carried by it, whereby the demountable member can travel axially within the piston bore when said fastening means

have been disengaged from one another by relative axial movement of one with respect to the other and said coupling means have been engaged.

2. A syringe as claimed in claim 1, characterised in that the said fastening means for securing the demountable member to the said body portion comprise an annular recess and a co-operating radially extending rib member or members.

3. A syringe as claimed in claim 2, characterised in that the demountable member extends axially through an aperture at the distal end of the piston bore and in that the lip of the aperture provides a radially inwardly directed rib member which engages a co-operating annular groove or recess in the demountable member.

4. A syringe as claimed in claim 3, characterised in that the lip of the aperture is adapted to flex axially from an initial distally orientated configuration to a proximally orientated configuration upon the application of a proximally directed force to the demountable member.

5. A syringe as claimed in any one of the preceding claims wherein the fastening means for securing the demountable member to the body portion are adapted to disengage when an axial suction of more 250 mms Hg is applied to the proximal face of the demountable member.

6. A syringe as claimed in any one of the preceding claims wherein the fastening means for securing the demountable member to the body portion are adapted to disengage when an axial suction of more 500 mms Hg is applied to the proximal face of the demountable member.

7. A syringe as claimed in any one of the preceding

claims, characterised in that the portion of the demountable member extending proximally beyond the fastening means by which it is secured to the body portion has a diameter which is a sliding fit within the piston bore.

8. A syringe as claimed in any one of the preceding claims, characterised in that the coupling means is between the distal end of the plunger shaft and the proximal end of the demountable member.

9. A syringe as claimed in any one of the preceding claims, characterised in that the coupling means comprises a button or flange member which is a snap fit into a recess.

10. A syringe as claimed in any one of the preceding claims, characterised in that the coupling members engage at an applied force of less than 15 pounds per square inch and require a force to disengage them which is at least 10% greater than the force required to disengage the fastening means securing the demountable member to the body portion.

11. A syringe as claimed in claim 9, characterised in that the fluid vent passage is provided by one or more grooves in the surface of the button or flange member of the coupling means.

12. A syringe as claimed in claim 11, characterised in that the grooves extend axially through the button or flange member so as to sub-divide that member into sectors which can be flexed radially to assist engagement of that member into the recess.

13. A syringe as claimed in any one of the preceding claims, characterised in that the distal face of the piston member and the proximal face of the demountable member are

substantially congruent and are adapted to engage in abutting relationship when the piston member reaches the distal extent of its travel.

14. A syringe as claimed in any one of the preceding claims, characterised in that the said vent passages also assist escape of fluid trapped between the co-operating faces of the piston member and the demountable member.

15. A syringe as claimed in any one of the preceding claims, characterised in that the coupling means resists disengagement once it is engaged.

16. A syringe according to claim 1 substantially as hereinbefore described with respect to and as shown in the accompanying drawings.

17. A method for rendering a syringe safe after use in injecting a fluid into or removing fluid from a patient, which method is characterised in that it comprises retracting the needle of the syringe into the piston bore of the syringe whilst retaining the syringe in substantially the position at which the syringe was operated to inject fluid into or to remove fluid from the body of the patient.

18. A method as claimed in claim 17, characterised in that the syringe is a syringe as claimed in any one of claims 1 to 16.

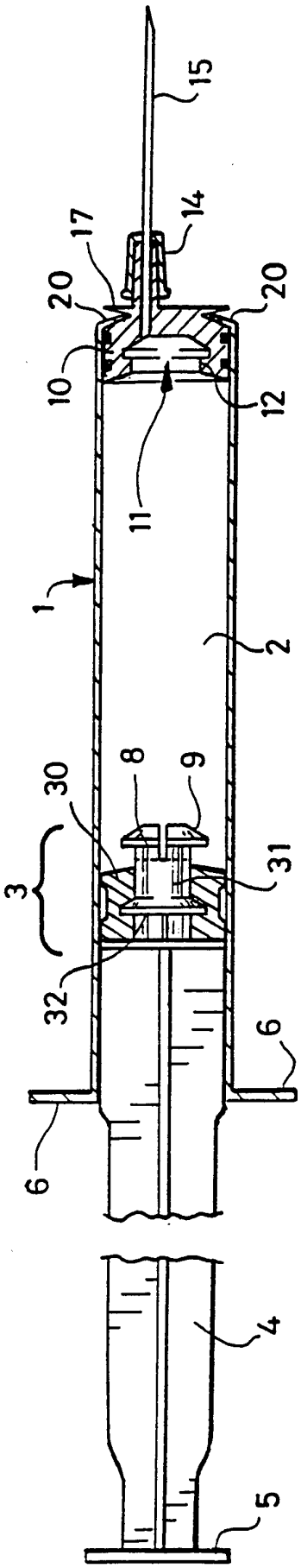


Fig. 1

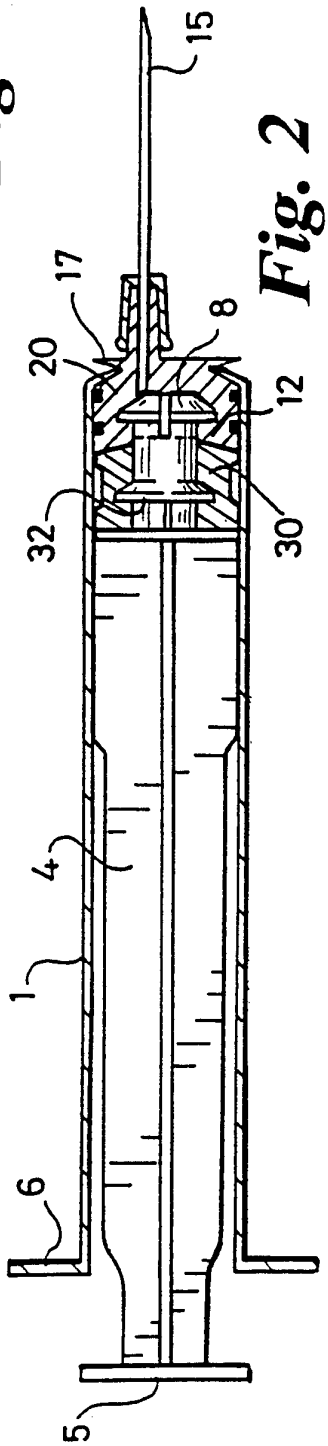


Fig. 2

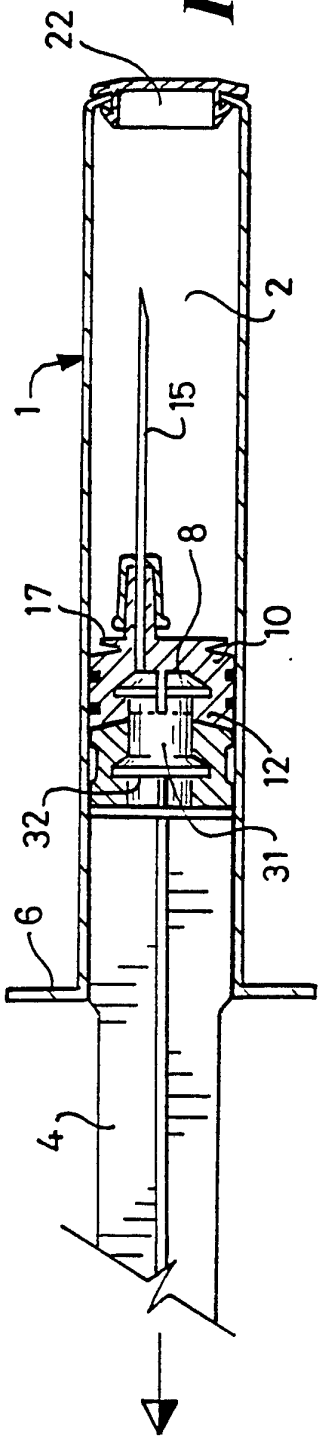


Fig. 3

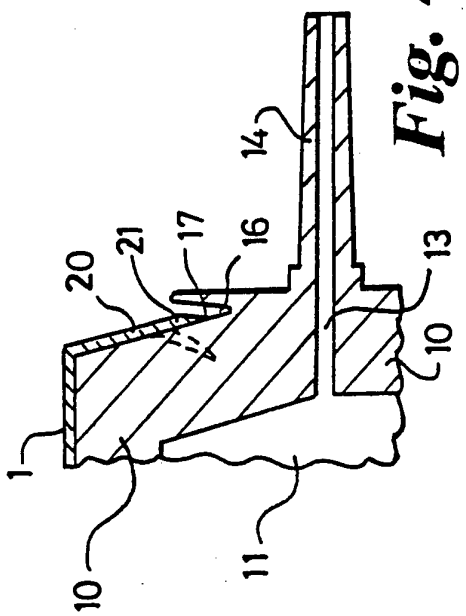


Fig. 4

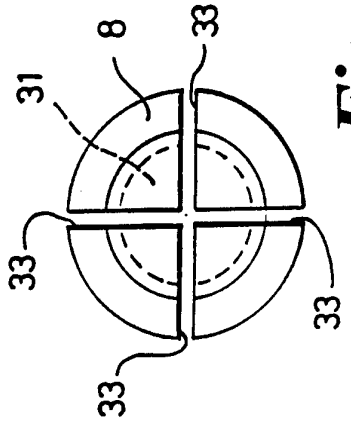


Fig. 5

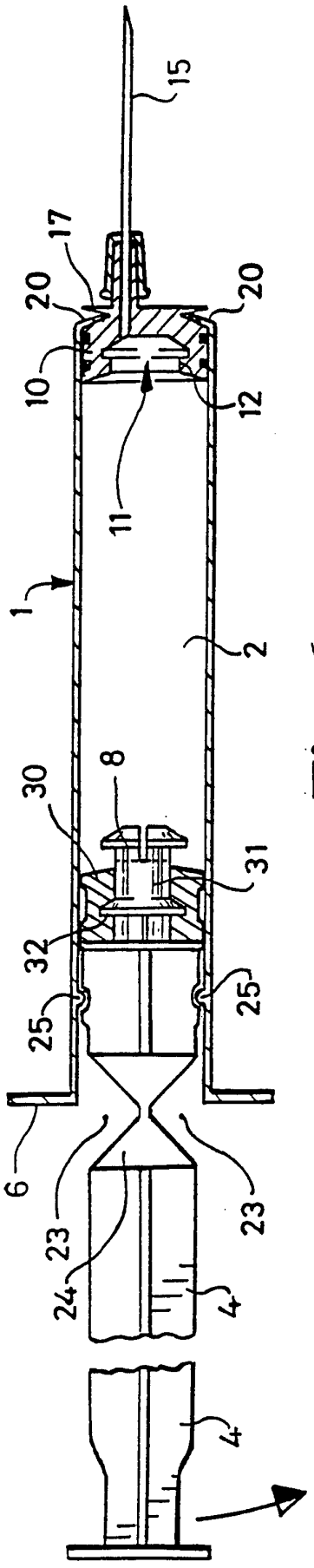


Fig. 6

INTERNATIONAL SEARCH REPORT

Inter nal Application No
PCT/GB 94/02013

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 A61M5/32 A61M5/50

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 A61M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US,A,5 000 738 (LAVALLO ET AL.) 19 March 1991 see column 4, line 54 - column 5, line 7 see figures 8-10	1-3, 5-15,17, 18
Y	WO,A,89 00432 (ASSISTANCE PUBLIQUE) 26 January 1989 see page 14, line 22 - line 25 see page 15, line 1 - line 11 see figures 10-12	1-3, 5-15,17, 18
A		4
A	US,A,4 790 822 (HAINING) 13 December 1988 cited in the application see column 3, line 35 - line 48 see figures 2-5	1,4

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
17 January 1995	27.01.95

Name and mailing address of the ISA	Authorized officer
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO,A,92 21389 (HAINING) 10 December 1992 see page 3, line 36 - line 38 see page 4, line 1 - line 4 see page 5, line 3 - line 4 see figures 3-7	4,7
A	EP,A,0 480 862 (IBANEZ) 15 April 1992 see column 2, line 12 - line 14 see column 3, line 34 - line 37 see figure 4	1

INTERNATIONAL SEARCH REPORT

Information on patent family members

Inter ional Application No
PCT/GB 94/02013

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A-5000738	19-03-91	NONE	
WO-A-8900432	26-01-89	FR-A- 2618075	20-01-89
US-A-4790822	13-12-88	NONE	
WO-A-9221389	10-12-92	US-A- 5152750	06-10-92
		AU-A- 1991192	08-01-93
		US-A- 5342323	30-08-94
EP-A-0480862	15-04-92	NONE	