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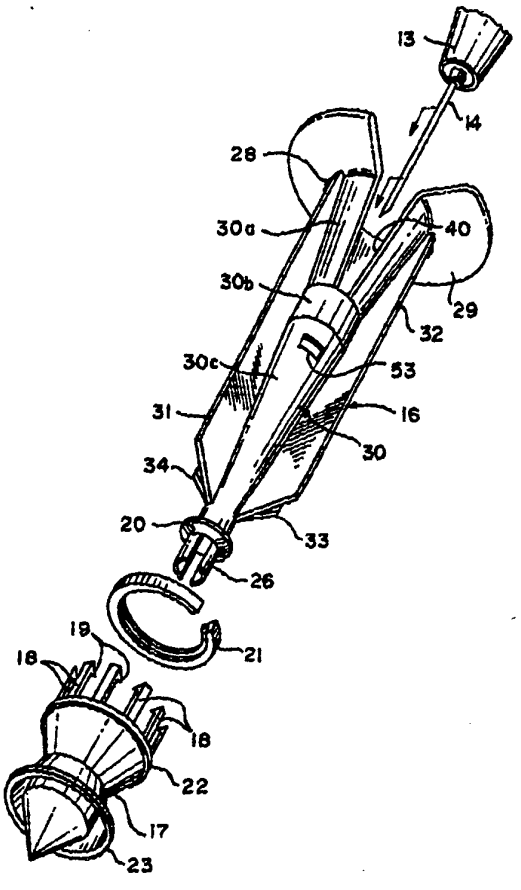
(54) Title: NON-REUSABLE SYRINGE WITH NEEDLE GUARD

(57) Abstract

A disposable hypodermic syringe having a barrel (11) with an adapter (13) on one end for attachment of a needle, and a piston (17) and plunger (16) reciprocable in the barrel. The plunger has a longitudinally extending hollow bore (40) therein and is removable from the barrel and lockable on the adapter in enclosing relationship to the needle to serve as a needle guard. A quantity of adhesive (51) in the plunger is pierced by the needle when the plunger is placed over the needle to serve as a needle guard, thereby permanently fixing the plunger/guard to the needle. In one form of the invention, the piston and plunger are automatically separable upon use to prevent reuse of the syringe.



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-- NON-REUSABLE SYRINGE WITH NEEDLE GUARD --

Technical Field of the Invention:

This invention relates generally to hypodermic syringes, and more particularly, to a hypodermic syringe that is capable of use only once, and which has a part that is removable after use to serve as a needle guard.

Background of the Invention:

This application is a combination of prior U.S. application serial number 07/985,301, filed December 4, 1992, entitled Non-Reusable Syringe With Needle Guard, and U. S. application serial number 08/042,386, filed April 2, 1993, entitled Non-Reusable Syringe With Removable Plunger Usable As A Needle Guard.

It is frequently necessary to use hypodermic syringes for intravenous administration of fluids, or to withdraw fluids from the veins of a person during the course of treatment of an illness, or in routine diagnostic examinations. Hypodermic syringes used for this purpose are generally disposable, and are intended to be discarded after a single use by trained medical personnel.

Unless they are properly disposed of, these used syringes present a health hazard. One of the more serious concerns of health care workers is the danger of becoming accidentally infected with HIV-infected blood or other materials. Acquired Immune Deficiency Syndrome (AIDS) is now recognized as an epidemic of global proportion. In addition, there is an increasing recognition of a broad spectrum of severe HIV-associated diseases, including pneumonia, endocarditis, and pulmonary tuberculosis. Medical and rescue personnel are aware of these risks, and when possible, take precautions to avoid unnecessary exposure or contact with infectious materials.

However, if a used syringe has been left intact and not properly disposed of, medical and rescue personnel, custodial workers, and others, are exposed to the danger of being accidentally pricked with the contaminated

needle in spite of the precautions that they might normally take. Such a needle could be mingled with soiled linens, bandages or other materials, and when these materials are gathered for disposal, the needle has the distinct potential of penetrating the skin of anyone handling the materials.

The used syringe could also fall into the hands of a drug addict or other person who may be inclined to reuse the syringe. Such persons typically reuse a syringe many times and share it with other addicts. If the syringe has been used to make an injection or to withdraw body fluid from a person having an infectious disease, all of those persons subsequently using the contaminated needle are at risk of acquiring the infectious disease.

Intravenous drug use is believed to account for most AIDS-related diseases in heterosexual men and women. This disease may also be transmitted to the children of infected adults, and to the sex partners of the infected persons, or to others, such as medical workers and rescue personnel, who may be inadvertently exposed to the blood of the infected person.

As AIDS-related diseases continue to grow, it is becoming increasingly more important to control the means by which these diseases are transmitted. Medical personnel should have reasonable assurance that they can perform their procedures without unnecessary risk of exposure to such infectious diseases, and without requiring timeconsuming steps to render used syringes safe for subsequent handling.

To prevent such accidents from occurring, the needles should be broken from the used syringes, and/or encased in a protective sheath, and devices have been provided in the prior art for accomplishing this. For instance, needles have been joined to the syringe body through frangible connections so that the doctor, nurse or other medical personnel can easily break the needle from the syringe after it is used. Unfortunately, this is not always done during the urgency of medical treatment, or if it is, there still remains an exposed needle body.

Similar shortcomings exist with respect to guards or sheaths that have been provided to encase the used needle. Such guards generally comprise separate sleeves or cap members that enclose the needle before it is used and which must be removed and set aside during use of the syringe. It is intended

that after use of the needle, the guard will again be placed over the needle. However, the guard may become misplaced during the medical procedure being performed and therefore not available for reuse. Even if it is not misplaced, the person responsible for safe handling of the syringe may not have the time, or take the time, to retrieve the guard and place it over the needle. Further, even if such a conventional guard is placed on the needle, it is capable of being removed, whereby the syringe could again be rendered capable of use.

In addition to an effective needle guard for used syringes, a means is needed to prevent sharing and reuse of syringes by intravenous drug abusers, and thereby to prevent the spread of infectious diseases caused by use of contaminated syringes. Since the major cause of spread of HIV, Hepatitis and similar diseases is through the repeated and/or shared use of contaminated hypodermic syringes and needles, a significant preventive measure would be the elimination of the ability of intravenous drug abusers to acquire syringes that could be used more than one time.

Accordingly, it would be desirable to have a disposable hypodermic syringe that is reliable in operation, simple and economical in construction, and in which a part of the syringe assembly itself is adapted as a needle guard after the syringe has been used for its intended purpose. It would further be desirable to provide a disposable syringe that is not capable of being reused after a single use.

Summary of the Invention:

The disposable syringe of the invention comprises a cylindrical syringe barrel of substantially conventional construction, having an open end and a suitable conventional fitting on the other end, such as a Luer lock adapter, or other means, for attaching a needle. A plunger or stem is reciprocable in the barrel and carries a piston on its inner end for developing vacuum or pressure, depending upon the direction of reciprocation of the piston and plunger in the barrel.

A feature of the present invention is the use of the plunger, itself, as a guard for the needle after the syringe has been used. To this end, the plunger has a cavity formed in it, shaped to receive the needle and to remain securely attached to the syringe after it has been placed over the needle. In use, the plunger is simply removed from the barrel after the syringe has been used, and placed over the needle. There is no separate member which must be retrieved and used for this purpose.

Moreover, in a preferred embodiment, an entry slot is formed through the side of the plunger at the open end, through which the needle may be initially laterally placed prior to being axially fully inserted into the plunger, to thereby minimize the risk of pricking the finger of the person placing the guard over the needle.

Additionally, a small quantity of adhesive is positioned in the plunger/guard to permanently adhesively secure the plunger/guard to the needle after it is placed in operative position on the needle, thereby rendering the needle incapable of reuse.

In addition to the above features, variations of the invention cause the syringe to be automatically rendered inoperable after a single use, so that it cannot be used again.

In one of these variations, the piston is releasably attached to the end of the plunger by movable latch arms and a collar. The collar moves into a position to release the latch arms when the plunger and piston are reciprocated through one cycle rearwardly and then forwardly in the barrel. A subsequent reciprocal movement of the plunger rearwardly in the barrel results in the piston becoming separated from the plunger so that it cannot be reattached to the plunger without the use of a special tool used during its manufacture, thus rendering the syringe incapable of further use.

In another variation, the collar is omitted and the latch arms have over-center positions moving from latching engagement with the piston to an unlatched position freeing the piston from the plunger. A variety of piston designs are also disclosed, whereby the piston may be made from rubber or plastic, although the piston of the invention is preferably made of a synthetic plastic material. To prevent set or "cold creep" of the seals of the plastic

piston, a relief area is formed in the inner surface of the syringe barrel in the position occupied by the piston when it is in its at-rest, stored position fully inserted into the syringe barrel.

Brief Description of the Drawings:

The foregoing and other objects and advantages of the invention will become apparent from the following detailed description when considered in conjunction with the accompanying drawings, wherein like reference characters refer to like parts throughout the several views, and wherein:

Fig. 1 is an exploded perspective view of a first form of plunger and piston assembly incorporating the features of the invention, and wherein a separate collar is used to hold the piston latched to the plunger;

Fig. 2 is a top plan view of the collar used to hold the latch arms engaged with the plunger, showing the collar in its "as molded" condition;

Fig. 3 is a top plan view similar to figure 2, showing the collar in its compressed condition after assembly in the barrel to hold the latch arms engaged with the plunger;

Fig. 4 is an enlarged longitudinal sectional view of a syringe incorporating the plunger and piston assembly of figure 1, showing the components in their normal, at-rest condition at the bottom of the barrel;

Fig. 5 is a view similar to figure 4, showing the plunger and piston being withdrawn or moved rearwardly in the barrel;

Fig. 6 is a view similar to figure 5, showing the plunger and piston being moved forwardly in the barrel;

Fig. 7 is a view similar to figure 6, showing the plunger again being moved rearwardly in the barrel, and depicting how the collar and latch arms have become disengaged to release the piston from the plunger;

Fig. 8 is an enlarged perspective view of a modified syringe incorporating the features of the invention, with parts broken away and parts shown in section;

Fig. 9 is a longitudinal sectional view on a reduced scale, with portions broken away and portions shown in section, of the syringe assembly of figure 8;

Fig. 10 is an end view of the syringe of figure 9;

Fig. 11 is a somewhat schematic, fragmentary, exploded perspective view of the syringe of the invention, showing how the needle is initially laterally positioned in the slot in the plunger so that the point of the needle is shielded before it is moved axially into a fully seated position in the plunger;

Fig. 12 is a fragmentary view, with portions broken away, depicting the relationship of the plunger and needle when the needle is fully seated in the plunger/guard;

Fig. 13 is a greatly enlarged perspective view, with portions shown in section and portions broken away, of a modified syringe assembly, wherein the collar is omitted and the latch arms have over-center positions;

Fig. 14 is an enlarged, exploded, fragmentary perspective view of the automatically detachable piston and associated end of the plunger in the form of the invention shown in figure 13;

Fig. 15 is a greatly enlarged vertical sectional view of the piston and forward end of the plunger in the form of the invention shown in figure 13;

Fig. 16 is an enlarged, longitudinal sectional view of the plunger in a further modified form of the invention, wherein a small envelope or ampoule containing an adhesive is placed in the bore of the plunger to adhesively secure the plunger/guard to the needle after the syringe has been used for its intended purpose;

Fig. 17 is a view similar to figure 16, showing how the adhesive-containing envelope is pierced by the needle when the plunger is placed in operative relationship over the needle;

Fig. 18 is a transverse sectional view, taken along line 18-18 in figure 17, showing how the adhesive forms a mechanical lock with the needle in the plunger bore after the envelope is pierced with the needle;

Fig. 19 is an enlarged perspective view of a syringe incorporating the built-in needle guard feature of the invention, but in which the piston is not separable from the plunger;

Fig. 20 is a view in elevation of the syringe of figure 19;

Fig. 21 is an exploded view, with parts broken away, of the syringe of figure 19, showing the plunger removed from the barrel and depicting how the plunger may be placed over the exposed needle to serve as a needle guard;

Fig. 22 is an enlarged view in elevation of the syringe of figure 19, showing the plunger removed from the barrel and applied to the end of the barrel to form a sheath for the needle;

Figs. 23 and 24 are transverse sectional views taken along lines 23-23 and 24-24, respectively, in figure 20;

Fig. 25 is an enlarged, fragmentary sectional view of a further modified plunger and piston assembly, shown on the right hand side of the figure in operative, engaged position, and shown on the left hand side of the figure in disengaged, inoperative position; and

Fig. 26 is a view similar to figure 25 of another modified plunger and piston assembly.

Best Mode for Carrying Out the Invention:

Referring more specifically to the drawings, a syringe in accordance with the invention is indicated generally at **10** in figures 1-7, 11 and 12. In this form of the invention, a cylindrical syringe barrel **11** has a forward end **12** with a suitable means, such as a Luer lock adapter **13**, for attachment of a needle **14**, and an open rearward end **15**. A plunger **16** is reciprocable in the barrel, and carries a piston **17** at its forward end for drawing material into the plunger and discharging it through the needle.

The piston **17** is releasably connected to the plunger so that it is rendered inoperable after a single use. To this end, the piston has a plurality of rearwardly projecting latch arms **18** that are molded with a radially outwardly oriented bias, so that they assume the position shown in figures 6 and 7 when they are unrestrained.

The free end of each latch arm has a radially inwardly directed detent **19** that is adapted to engage behind a retaining ring **20** on the forward end of the plunger to hold the piston to the plunger when the latch arms are urged inwardly to the position shown in figures 4 and 5. The latch arms are held in this position by a retaining collar **21** engaged in encircling relationship over the free outer ends of the latch arms.

As seen best in figures 2 and 3, the collar **21** comprises a split ring, and, as shown in figure 2, is molded with an outwardly biased configuration.

When compressed and inserted into the syringe barrel, however, the collar assumes the position shown in figure 3.

The piston **17** may be made of any suitable material, but in the form shown is made of plastic, and has two oppositely oriented, outwardly flared sealing rings **22** and **23** for sliding engagement against the inner surface of the syringe barrel.

The inner surface of the barrel adjacent the end **12** is slightly diametrically enlarged at **25** to provide a relief area for the piston **17** when it is inserted fully into the barrel. This relief area prevents set of the piston seals **22** and **23** which might otherwise occur when the piston is made of plastic material and is stored in this position.

The plunger **16** is reciprocable in the barrel between a forward position inserted fully into the barrel, and a rearward position retracted or withdrawn in the barrel, and has a forward end **26** that telescopically engages with a central post **27** on the rearward side of the piston **17**.

The rearward end **28** of the plunger has a radially enlarged operating flange **29** which may be gripped with the fingers and used to reciprocate the plunger in the barrel.

In this form of the invention, the plunger may have a generally X-shaped transverse cross-section, with a central body **30** and oppositely extending flanges **31**, **32**, **33** and **34** along diametrically opposite sides of the body to slidably support the plunger in the barrel.

The plunger body **30** has a hollow, stepped configuration, including a larger tapered entry portion **30a** adapted to receive the tapered portion **13** of the Luer adapter on the syringe barrel, an intermediate cylindrical portion **30b** adapted to lock onto the cylindrical portion of the Luer Lock fitting of the syringe barrel, and a reduced diameter tapered portion **30c** adapted to closely receive the needle **14**.

After the syringe **10** has been used, it is a simple matter for the doctor, nurse or other medical personnel to simply withdraw the plunger **16** from the barrel **11** and place the plunger over the needle, with the portions **30a** and **30b** locking onto the Luer Lock adapter **13** of the syringe barrel, as shown in figures 11 and 12. There is no need for the doctor, nurse or other person

using the syringe to search for and retrieve a separate needle guard, as is presently necessary in the prior art.

To facilitate placement of the plunger over the needle and to reduce the danger of accidentally pricking oneself with the needle while accomplishing this, an elongate slot **40** is formed through the side of the plunger body, leading from the end **28** and terminating at the end of the tapered portion **30a**. Thus, the needle may be laid sideways into the slot and then slid lengthwise to fully seat the needle in the plunger/guard. This eliminates the danger of missing the relatively small opening in the end of the plunger when attempting to insert the needle lengthwise into the guard.

A small envelope **50** containing an adhesive **51** is located in the hollow bore portion **30c** of the plunger in a position to be pierced by the needle **14** as the plunger is placed over the needle. The envelope **50** is roughly the size of a BB and is located at a point in the bore where small openings **52** and **53** are formed during the molding process. When the needle pierces the envelope, the adhesive **51** escapes and flows into the space surrounding the needle and into the two small openings **52** and **53**, thereby forming a mechanical lock between the needle and the plunger and preventing removal of the plunger after the adhesive has cured. It should also be noted that it is anticipated that a small quantity of the adhesive will enter the end of the needle as it passes through the envelope of adhesive, plugging the needle and preventing its use even if access to it should be gained.

A second form of the invention is indicated generally at **60** in figures 8-10. The plunger **61** in this form of the invention also has a hollow central body **30**, as in the previous form of the invention, with stepped diameter portions **30a**, **30b** and **30c** for the same purposes as described in connection with the previous embodiment. However, rather than the X-shaped cross-section as previously described, the plunger in this form of the invention has a pair of laterally projecting webs **62** and **63** with oppositely directed circumferentially extending flanges **64** and **65** on their outer edges. In all other respects, this form of the invention functions the same and has all the advantages of the previous form of the invention.

A third form of the invention is indicated generally at **70** in figures 13-18. In this form of the invention, a detachable piston **71** is carried on the

forward end of plunger **72** by an automatically releasable latching mechanism **73**.

The forward end of the plunger has a reduced transverse dimension and defines an elongate, forwardly extending attaching post **74** with a plurality of radially outwardly projecting latching arms **75** integrally pivotally connected to the post at hinge areas **76**. Four such latching arms are shown in the specific example described herein, but it is contemplated that a different number of arms could be used, if desired.

Each arm includes a thickened outer end portion defining detents **77** that are arranged in outwardly spaced, confronting relationship to a radially outwardly projecting retaining ring **78** formed on the post forwardly of the point of attachment of the arms to the post.

The piston **71** is carried on the post **74** at the forward end of the plunger, and as shown in figures 13-18, is made of a synthetic plastic material. This plastic piston has a pair of oppositely axially projecting sealing flanges **79a** and **79b**, each flared radially outwardly and having a radially enlarged sealing bead **80** thereon for effecting a sliding seal with the inner surface of the barrel. Thus, during forward motion of the piston in the barrel, pressure of fluid in the barrel acting under the sealing flange **79a** causes that flange to expand radially outwardly, making a tight sliding seal with the inner surface of the barrel. Conversely, rearward movement of the piston in the barrel causes lowered pressure in the forward end of the barrel to pull the sealing flange **79b** outwardly to effect a tight sliding seal with the inner surface of the barrel.

The piston is held on the forward end of the plunger by a plurality of detents **81** on the end of the piston adjacent the plunger, spaced radially inwardly from the sealing flange **79a**, and clamped between the latching arms **75** and retaining ring **78**. These detents are molded with a natural, unbiased position as shown in dashed lines in figure 15, spaced radially outwardly out of contact with the retaining ring **78**, and in the operative position of the invention are held inwardly behind the retaining ring by the latching arms **75**.

As seen best in figure 15, the outer ends of the arms **75**, the retaining ring **78** and the detents **81** are uniquely shaped to cooperate with one another and with the inner surface of the barrel during reciprocal movement of the

plunger in the barrel to either maintain the piston latched to the plunger, or to disengage the piston from the plunger.

With particular reference to figure 15, a first of these surfaces **82** defines a relatively narrow annular cylindrical band around the outer perimeter of the latching arms, which is parallel to the inner surface of the barrel and is adapted to slide along the inner barrel surface when the arms are in their normal, operatively latched position with respect to the detents on the piston. Thus, with the piston beginning in its forwardmost position at the forward end of the syringe, as seen in figure 13, this surface **82** is in parallel, sliding contact with the inner surface of the barrel.

At the same time, a second, latching surface **83** on a radially inner portion of each latching arm is in parallel, mating contact with a complemental latching surface **84** on an upper outer end portion of the detents **81** on the piston to hold the detents inwardly behind the retaining ring **78** and therefore latch the piston to the plunger, as shown in figures 13 and 15.

After the piston and plunger have been withdrawn in the barrel, and forward motion thereof is then initiated, the frictional drag between the outer ends of the latching arms and the inner surface of the barrel causes the arms to pivot rearwardly, as depicted in dashed lines in figure 15, through an over-center position to a rearwardly flexed inoperative position. The over center action results from the difference in diameter of the latching arms in comparison with the diameter of the inner surface of the barrel. Thus, when the arms are in their latched, operative position as shown in full lines in figure 15, the first surface **82** is on essentially thesame diameter as the inner diameter of the barrel, and this surface is in close, sliding contact with the inner surface of the barrel. However, when the arms pivot rearwardly upon forward movement of the piston in the barrel, the outer ends thereof swing through an arc that places the outer ends of the arms on a greater diameter than the diameter of the inner surface of the barrel. Continued forward movement of the piston in the barrel results in the arms pivoting to their unlatched position shown in dashed lines at the left hand side of figure 15. In this position, a third surface **85** on the outer end of the latching arms is in parallel, sliding contact with the inner surface of the barrel. This surface **85** has substantial width in relationship to the first surface **82**, and maintains the

latching arms in this unlatched position, regardless of the direction of motion of the piston in the cylinder.

The operating relationship between a fourth surface **86** on the underside of the latching arm and the upper end of the detents **81** will become apparent. The upper end of the detents has a slightly tapered surface **87** that extends between a heel **88** at the radially outermost end thereof, to a nose **89** at the innermost end. Thus, when the plunger and piston have been retracted in the barrel, and forward motion thereof is then initiated, the heel **88** begins pushing upwardly against surface **86** on the latching arm, and, combined with the frictional drag of the outer end of the arm against the inner surface of the barrel, begins upward flexing movement of the arm. Continued movement in this direction causes the nose **89** to begin sliding upwardly along a fifth surface **90** on the post immediately below the point of attachment of the arms, resulting in radially outward pivoting movement of the detents and continued upward pushing action of the heel against the surface **86**. The latching arms are thus pivoted completely through this "over-center" motion to their fully unlatched position shown in dashed lines on the left side of figure **15**, where the end surface **87** on the detents is in parallel contact with the undersurface **86** of the latching arms, securely holding the latching arms in their unlatched position during downward movement of the plunger and piston in the barrel and providing a large contact area between the plunger and piston for pushing the piston forwardly in the barrel.

When the plunger is again retracted in the barrel, the surfaces **85** on the outer ends of the latching arms easily slide along the inner surface of the barrel, whereby the latching arms are maintained in their unlatched position, regardless of the direction of reciprocation of the plunger in the barrel.

Upon subsequent withdrawal of the plunger in the barrel, the unlatched piston remains in its forwardmost, previously pushed position in the barrel.

During assembly of the syringe of the invention, the piston is first inserted into the barrel through the open rearward end thereof, and the plunger is next inserted to bring the post and latching arms into juxtaposition with the piston. A special tool (not shown) is then inserted through the open end of the barrel and into contact with the latching arms, and is used to force

the latching arms through their over-center position into the latched position shown in figure 15.

The plunger **72** in this form of the invention also has a hollow central body **30**, as in the previous form of the invention, with stepped diameter portions **30a**, **30b** and **30c** for the same purposes as described in connection with the previous embodiment. However, rather than the X-shaped cross-section of figure 1, the plunger in this form of the invention has a pair of laterally projecting webs **95** and **96** with oppositely directed circumferentially extending flanges **97** and **98** on their outer edges. In all other respects, and with the two exceptions noted above, this form of the invention functions the same and has all the advantages of the previous form of the invention.

As shown in figures 16-18, a small envelope or ampoule **100** containing an adhesive **101** is located in the hollow bore portion **30c** of the syringe in a position to be pierced by the needle **14** as the plunger is placed over the needle. The envelope **100** is roughly the size of a BB and is located at a point in the bore where small openings **102** and **103** are formed during the molding process. When the needle pierces the envelope, the adhesive **101** escapes and flows into the space surrounding the needle and into the two small openings **102** and **103**, thereby forming a mechanical lock between the needle and the plunger and preventing removal of the plunger after the adhesive has cured. It should also be noted that it is anticipated that a small quantity of the adhesive will enter the end of the needle as it passes through the envelope of adhesive, plugging the needle and preventing its use even if access to it should be gained.

A modified syringe is indicated at generally at **110** in figures 19-24. This form of the invention includes a conventional syringe barrel **11** with a forward end **12** having a suitable means, such as a Luer lock adapter **13** for attachment of a needle **14**, and an open rearward end **15**, as in that form of the invention illustrated in figure 1. However, rather than a separable piston and plunger assembly as shown in figure 1, the piston **112** is permanently fixed to the forward end **16a** of the plunger **16** in this form of the invention. Outwardly projecting actuating flanges **111** are formed on the rearward end **16b** of the plunger for manipulating the plunger in the barrel. The plunger has a hollow body **30** for receiving the needle **14**, and a side opening **40** to

facilitate insertion or placement of the needle in the plunger, just as in the previously described embodiments. Moreover, a small ampoule of adhesive, not shown, is provided in the hollow interior of the plunger to permanently fix the plunger/guard to the needle following use of the syringe.

A further modified plunger and piston assembly is indicated generally at **120** in figure 25. In this form of the invention, the piston **121** is much shorter and disc-like than in figure 1, for example, and includes a pair of relatively closely axially spaced sealing beads or rings **122** and **123**, a shallow, conically shaped nose portion **124**, and a flat rear surface **125**. A plurality of latch arms **126** on the rear surface of the piston are constructed and function the same as the latch arms described in connection with the first form of the invention.

The plunger **127**, in turn, has an annular retaining flange **128** for cooperation with the latch arms, and a flat tip **129** on its forward end that engages the surface **125** on the piston.

A split retaining collar **21** identical to that previously described is adapted to normally encircle the free ends of the latching arms to retain them in engaged position behind the flange **128**, as shown on the right hand side of figure 25, and is movable to an unlatched position, as shown on the left hand side of figure 11, when the plunger and piston are manipulated as described in connection with the previous form of the invention.

A further modified plunger and piston assembly is indicated generally at **130** in figure 26. In this form of the invention, the piston **131** is essentially disc shaped, with a flat rear surface **132** for cooperation with the flat tip **133** of the plunger **134**. A plurality of latching arms **135** are carried by the piston for cooperation with a retaining flange **136** on the forward end of the plunger to hold the piston assembled to the plunger when the split retaining collar **21** is in encircling relationship around the free ends of the latching arms. The collar and latch arms are releasable when the plunger and piston are manipulated as described previously.

During assembly of those forms of the invention incorporating a separable piston and plunger and a split collar to retain the latch arms engaged, the syringe barrel, plunger, piston and collar are positioned in relation to one another as shown in the left hand side of figures 25 and 26,

for example, the collar is compressed around the free ends of the latch arms, and the assembly is then inserted into the barrel through the open rearward end thereof.

While the piston has been described herein as made of plastic, it should be understood that it may equally as well be made of rubber, as described in applicant's prior U.S. patent 5,181,912. In such event, the piston itself may be constructed differently in the area where it seals with the barrel, but the latching mechanism is substantially identical to that previously described, and the hollow body for encasing the needle is the same as before.

The syringe of the invention is simple and economical in construction, and yet it provides an entirely different structure and function as compared with a conventional syringe, i.e., the plunger doubles as a needle guard after the syringe has been used, and the piston is connected to the plunger through a latched construction that automatically disables the syringe after a single use.

While the invention has been illustrated and described in detail herein, it is to be understood that various modifications may be made therein without departing from the spirit and scope of the invention, as defined by the appended claims.

What is claimed is:

CLAIMS

1. A non-reusable syringe having a built-in needle guard, comprising:

an elongate cylindrical barrel having adapter means on one end for attachment of a needle, and an open other end;

a needle secured to said adapter means on said one end of the barrel;

an elongate plunger reciprocable in the barrel between a forward position in the barrel and a retracted position, said plunger having a forward end in the barrel and a rearward end accessible exteriorly of the barrel for operating the plunger;

a piston carried on the forward end of the plunger for effecting a sliding seal with the barrel to draw material into the barrel and discharge it therefrom through said one end upon reciprocating motion of the plunger and piston in the barrel, said piston being detachably connected to the plunger by releasable latch means that automatically disengages when the piston and plunger are reciprocated through one complete cycle of operation rearwardly and forwardly in the barrel; and

said plunger having a hollow bore formed longitudinally through a central portion thereof, said bore including a first portion for cooperative locking engagement with the adapter means on the barrel and a second portion for receipt of the needle, whereby the plunger may be withdrawn from the barrel and placed in shielding relationship over the needle after the syringe has been used for its intended purpose.

2. A syringe as claimed in claim 1, wherein:

said plunger has an elongate slot formed in a side wall thereof, communicating with said bore and extending from said plunger open end toward the forward end, so that the plunger may be initially positioned laterally over said needle and then moved axially with respect thereto to fully seat the needle in the plunger.

3. A syringe as claimed in claim 1, wherein:

the bore is formed in the plunger from the rearward end thereof, and terminates in a distal, closed end of the second portion.

4. A syringe as claimed in claim 1, wherein:

a quantity of adhesive is contained within the bore in a position to be pierced by the needle when the plunger is placed over the needle, said adhesive serving to fix said plunger on said barrel in shielding relationship to said needle.

5. A syringe as claimed in claim 2, wherein:

a quantity of adhesive is contained within the bore in a position to be pierced by the needle when the plunger is placed over the needle, said adhesive serving to fix said plunger on said barrel in shielding relationship to said needle.

6. A syringe as claimed in claim 1, wherein:

the releasable latch means comprises a plurality of latching arms carried by the piston, said latching arms having free ends with detents thereon for engagement behind a retaining ring on the plunger to hold the piston to the plunger, said arms being molded with a normal, at-rest position spaced away from the retaining ring; and

a split retaining collar normally engaged around the free ends of the latching arms, in encircling relationship thereto, to urge the latching arms inwardly toward the retaining ring on the plunger so that the detents on the latching arms normally engage behind the retaining ring on the plunger.

7. A syringe as claimed in claim 1, wherein:

the piston is made of plastic and has outwardly biased yieldable seals thereon for sealing, sliding engagement with an inner surface of the syringe barrel; and

the syringe barrel has an enlarged diameter inner surface portion at its forward end, defining a relief area for the piston when it is in a stored position to prevent set or creep of the seals, whereby an effective seal is maintained between the piston and barrel.

8. A non-reusable syringe, comprising:

an elongate cylindrical barrel having adapter means on one end for attachment of a needle, and an open other end;

an elongate plunger reciprocable in the barrel between a forward position in the barrel and a retracted position, said plunger having a forward end in the barrel and a rearward end accessible exteriorly of the barrel for operating the plunger; a piston carried on the forward end of the plunger for effecting a sliding seal with the barrel to draw material into the barrel and discharge it therefrom through said one end upon reciprocating motion of the plunger and piston in the barrel;

said piston being releasably connected to the plunger by releasable latch means comprising a plurality of latching arms carried by the piston, said latching arms having free ends with detents thereon for engagement behind a retaining ring on the plunger to hold the piston to the plunger, said arms being molded with a normal, at-rest position spaced away from the retaining ring; and

a split retaining collar normally engaged around the free ends of the latching arms in encircling relationship thereto to urge the latching arms inwardly toward the retaining ring on the plunger so that the detents on the latching arms normally engage behind the retaining ring on the plunger to hold the piston to the plunger, but said collar becomes disengaged from the free ends of the latching arms upon forward motion of the plunger and piston in the barrel, whereby said latching arms move away from the retaining ring and the piston becomes disengaged from the plunger upon subsequent rearward movement of the plunger in the barrel.

9. A syringe as claimed in claim 1, wherein:

the releasable latch means latch the piston to the plunger during initial retraction of the plunger and piston in the barrel, and unlatch the piston from the plunger during forward movement thereof, so that the piston becomes disengaged from the plunger during subsequent retraction of the plunger in the barrel, said latch means including latching arms carried on the forward end of the plunger and extending radially outwardly into sliding contact with an inner surface of the barrel, said latching arms having a first position in latching engagement with detent means on the piston to retain the piston on the plunger, and being movable to a second, over-center, unlatched position releasing the piston from the plunger.

10. A syringe as claimed in claim 9, wherein:

the latching arms have latching surfaces thereon normally engaged with detents on the piston to urge the detents into latching engagement with a retaining ring on the plunger, whereby the detents on the piston are normally gripped between the latching arms and the retaining ring to retain the piston on the plunger.

11. A syringe as claimed in claim 10, wherein:

the latching arms are adapted to slide along the inner surface of the barrel in their latched position during rearward movement of the plunger in the barrel, but sliding friction between the latching arms and the barrel during forward movement of the plunger in the barrel causes the arms to move to their over-center, unlatched position.

FIG. 1

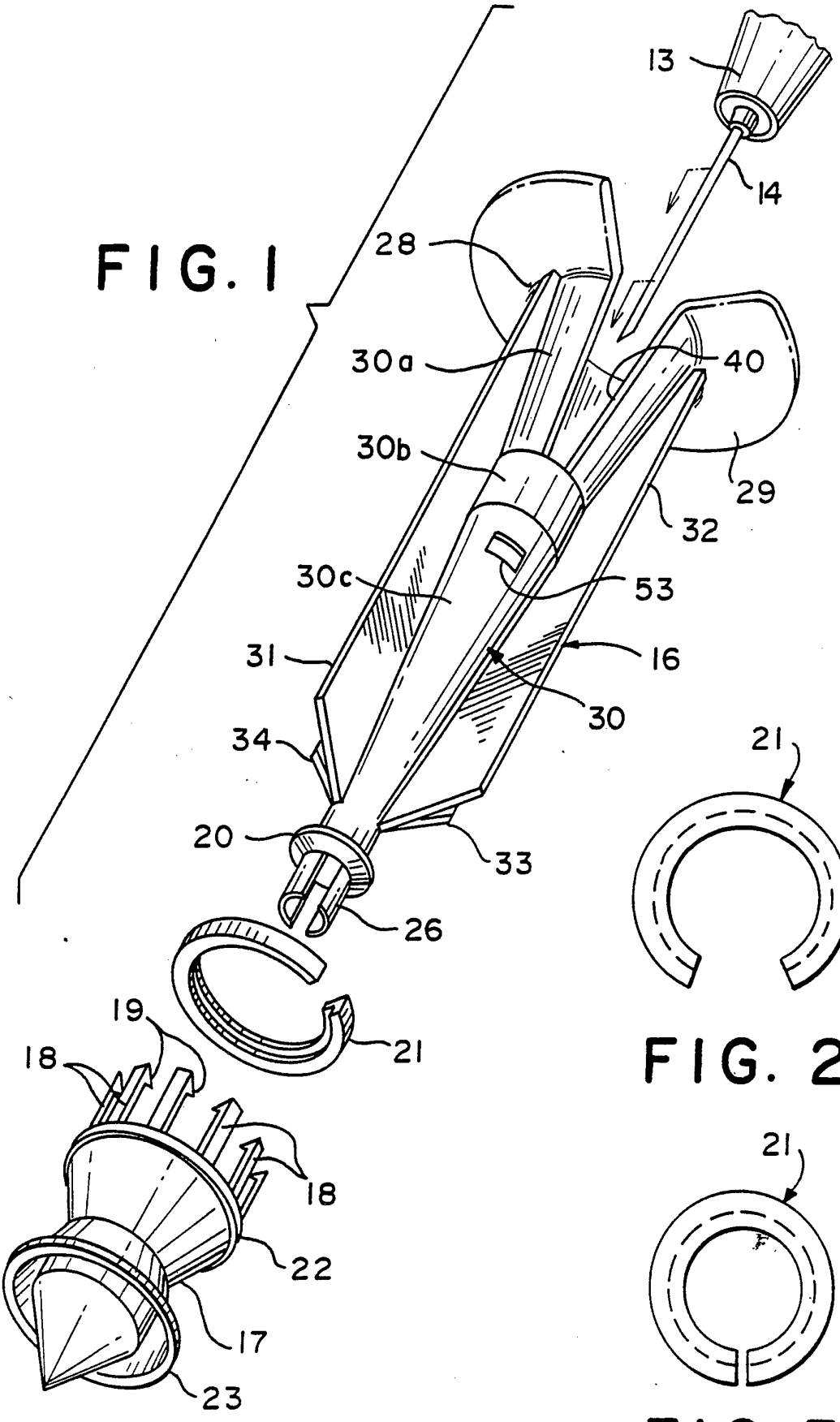

FIG. 2

FIG. 3

FIG. 4

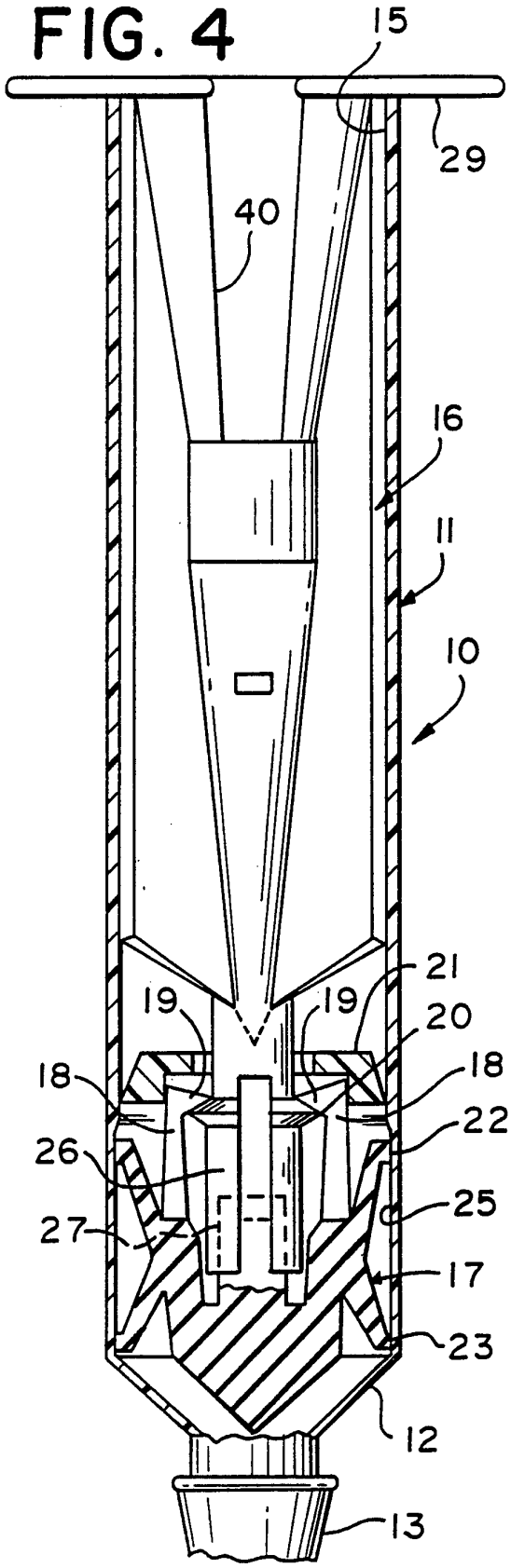
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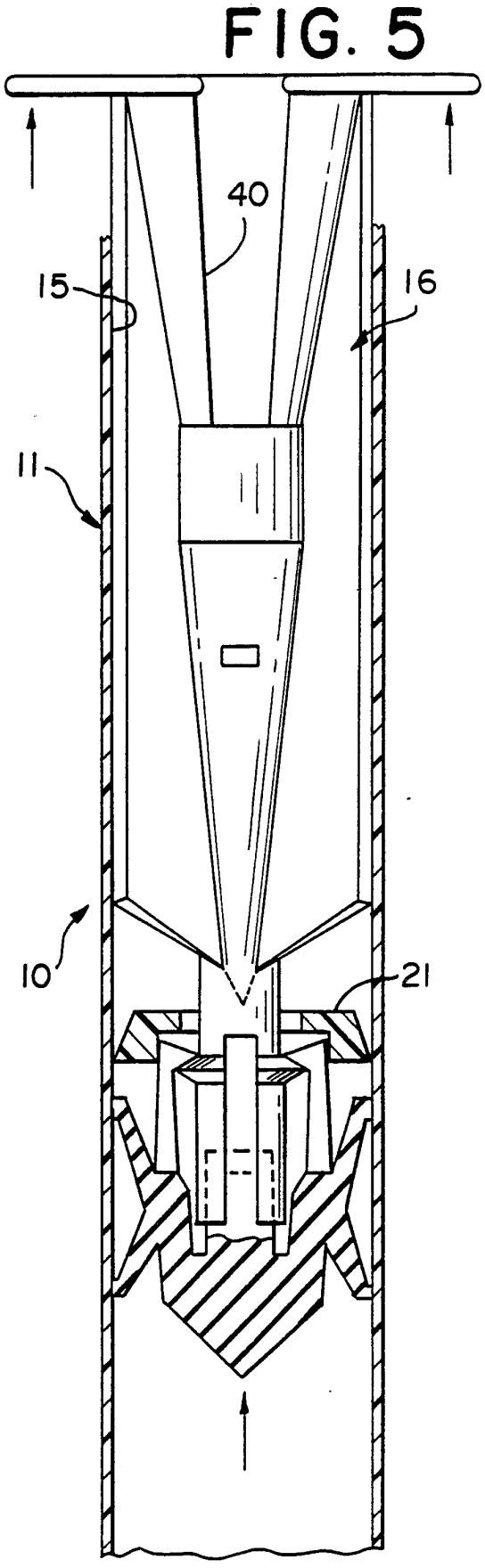
FIG. 5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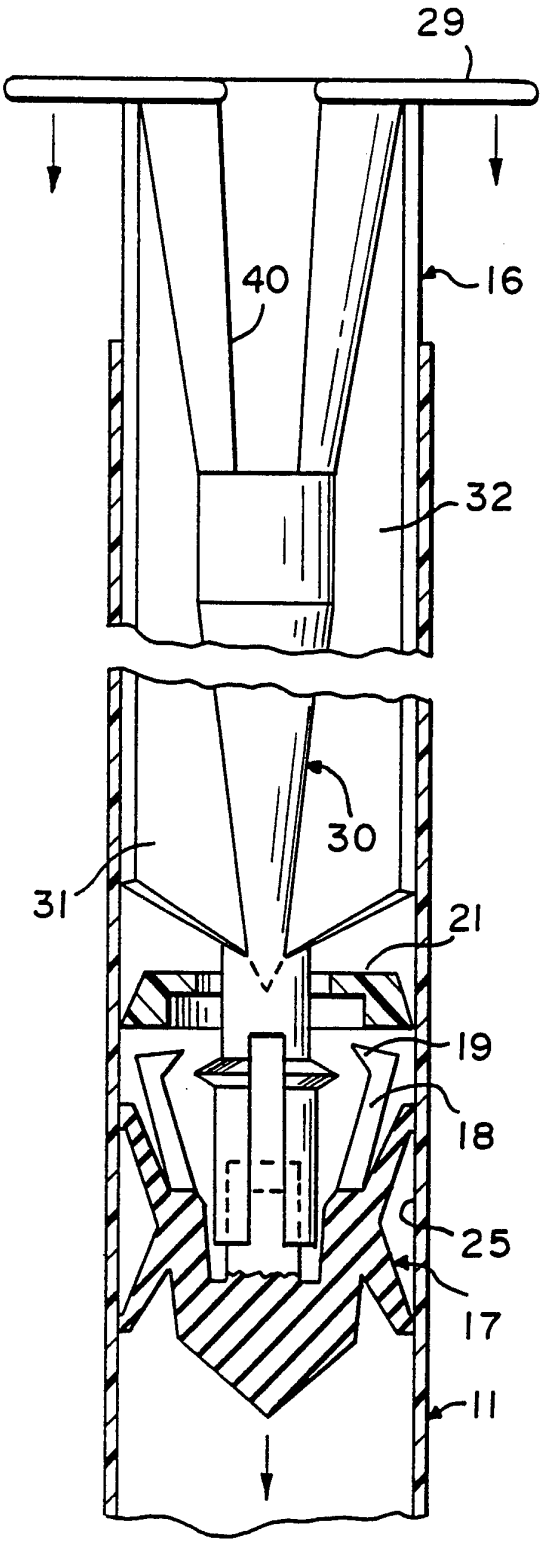
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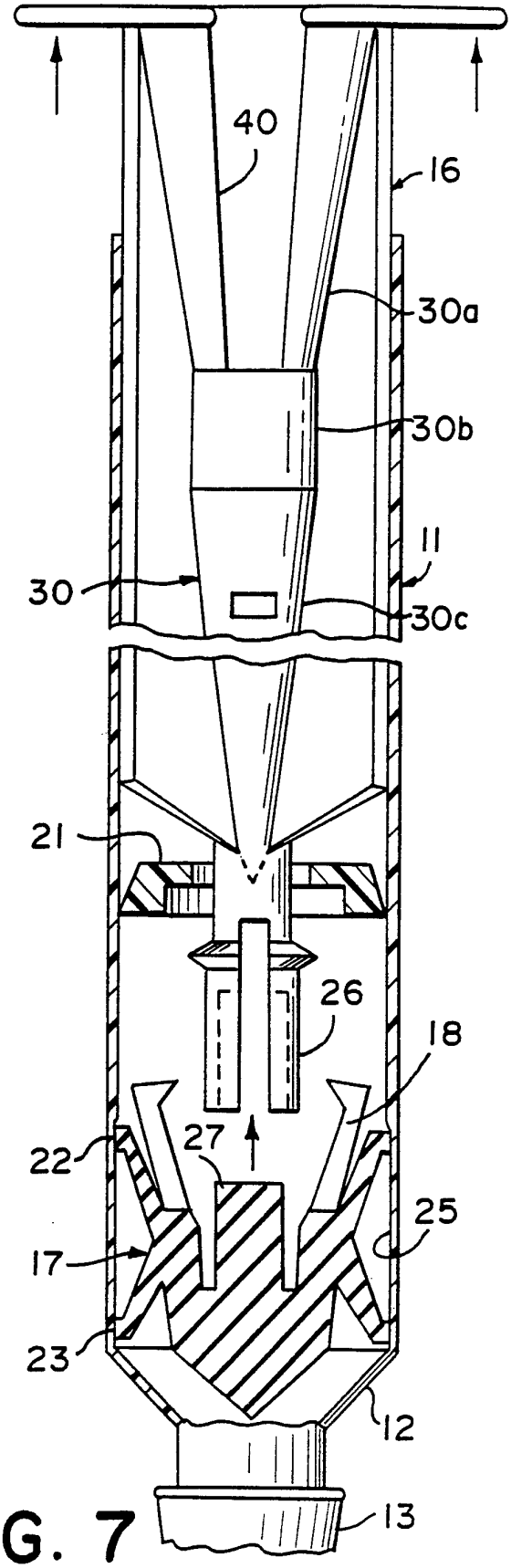
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FIG. 7

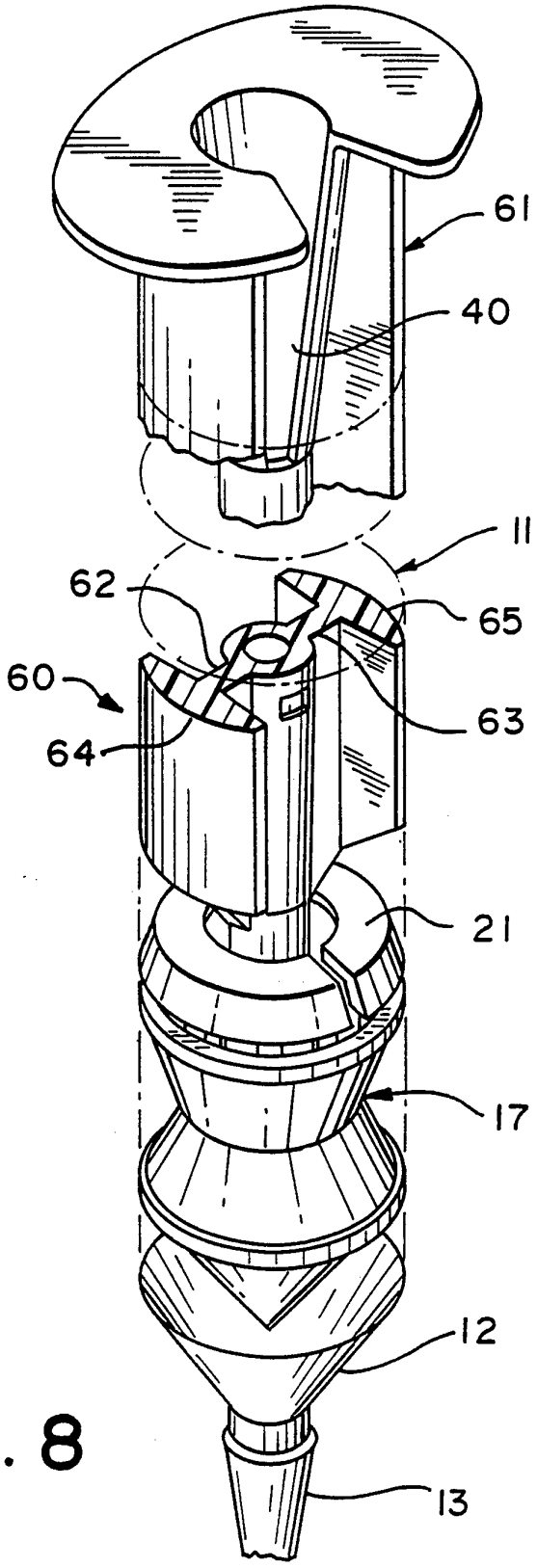
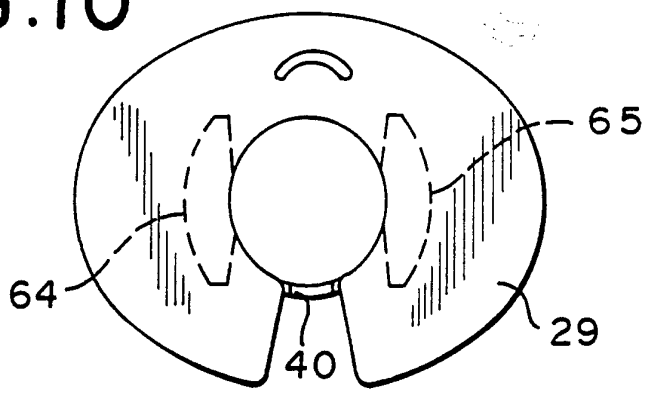
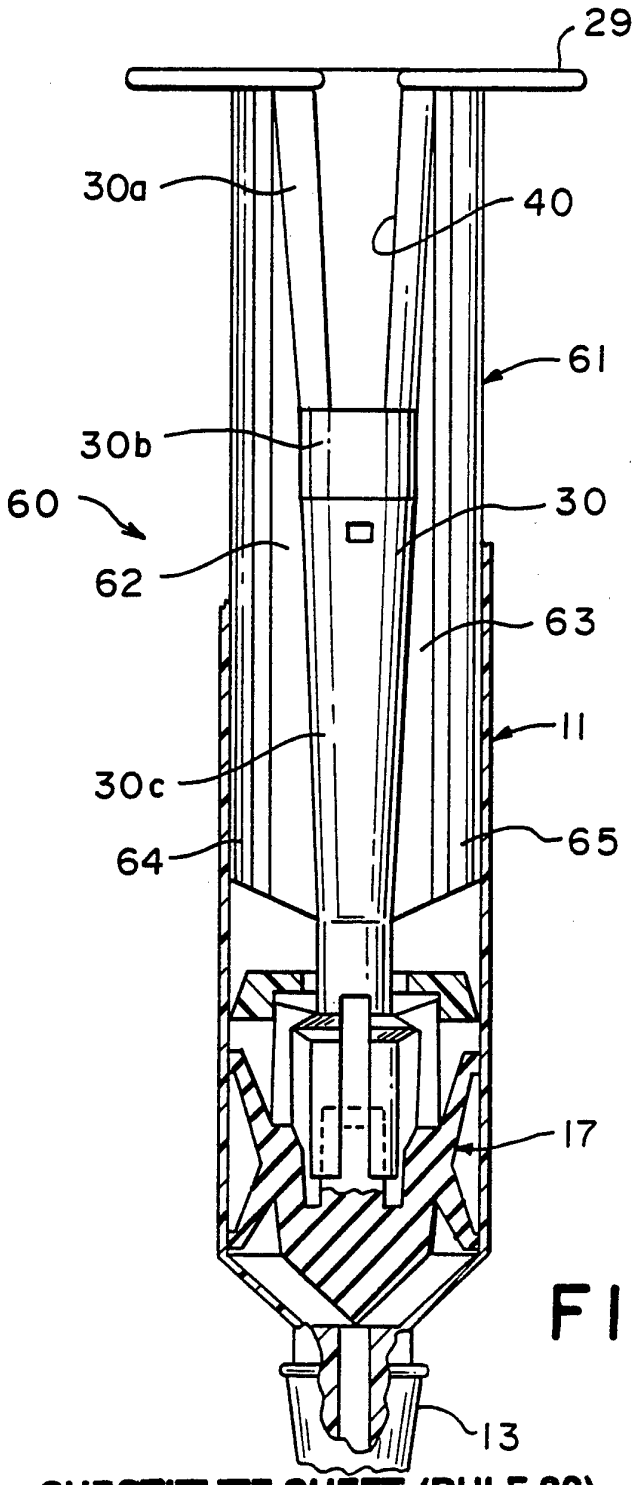


FIG. 8

FIG.10





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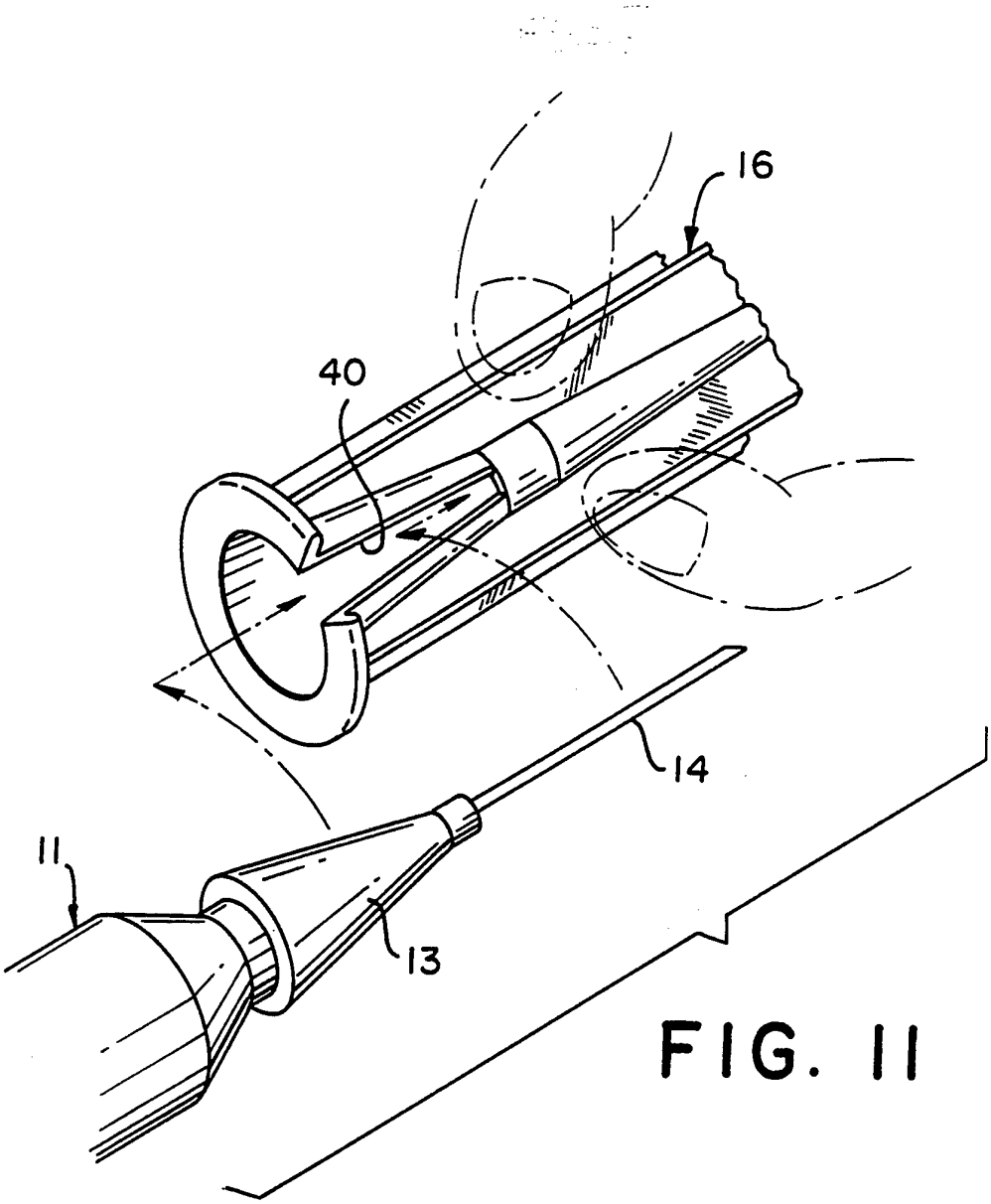

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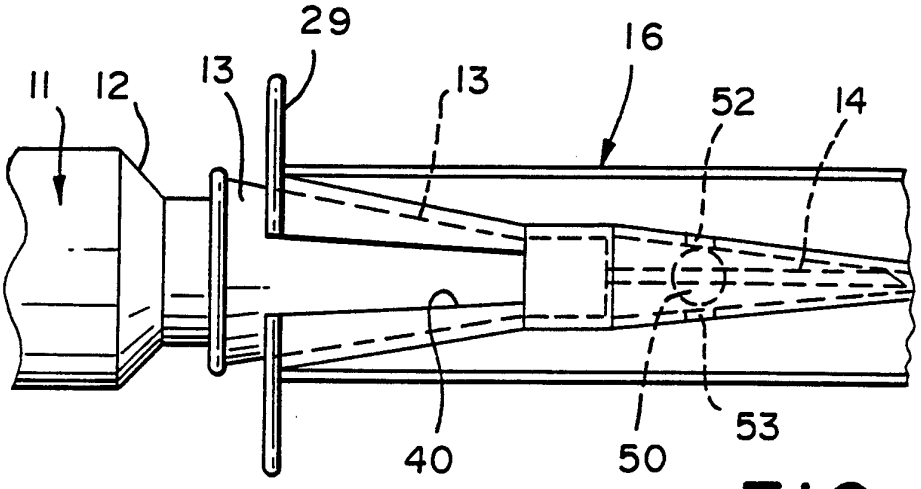
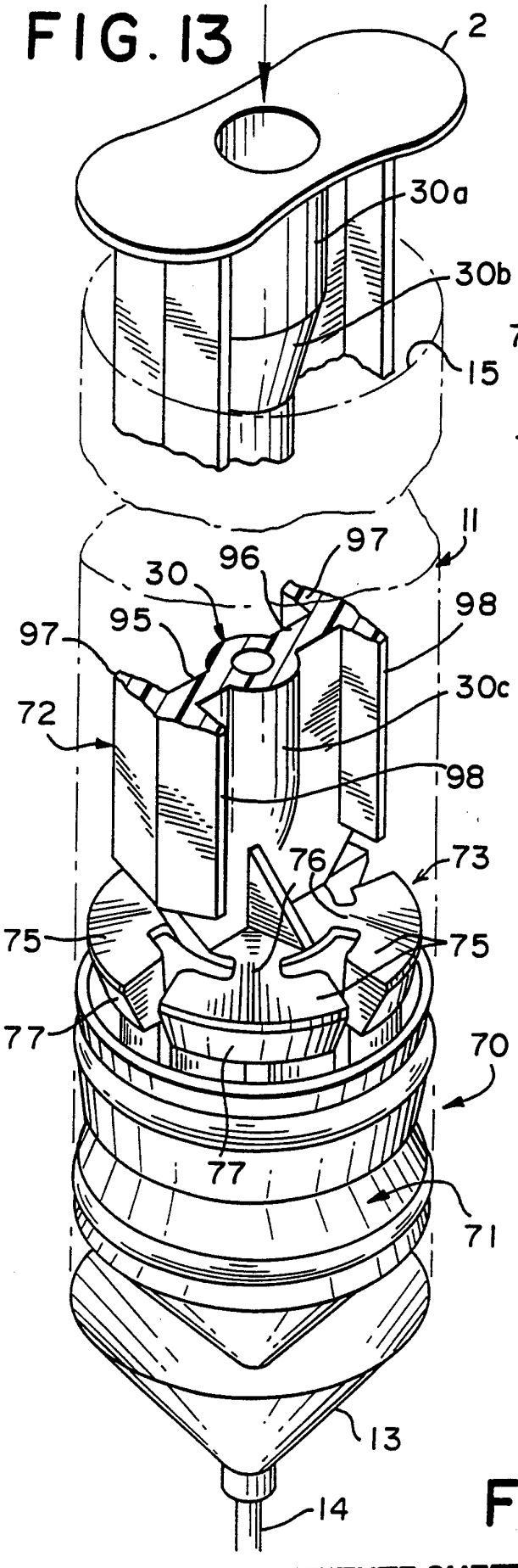


FIG. 12

FIG. 13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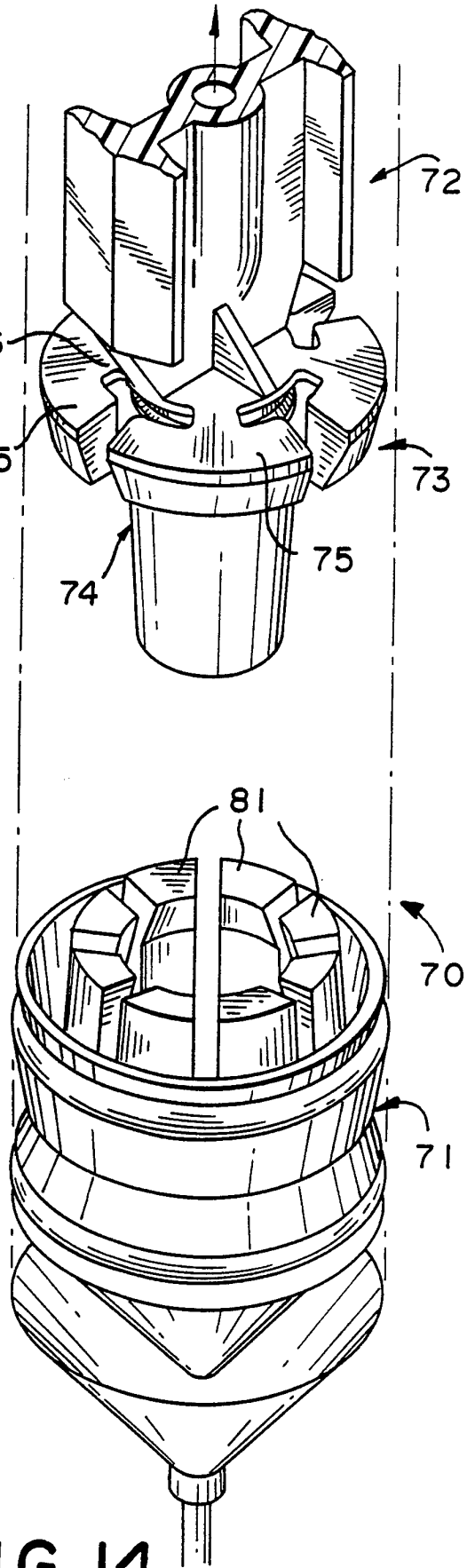
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FIG. 14

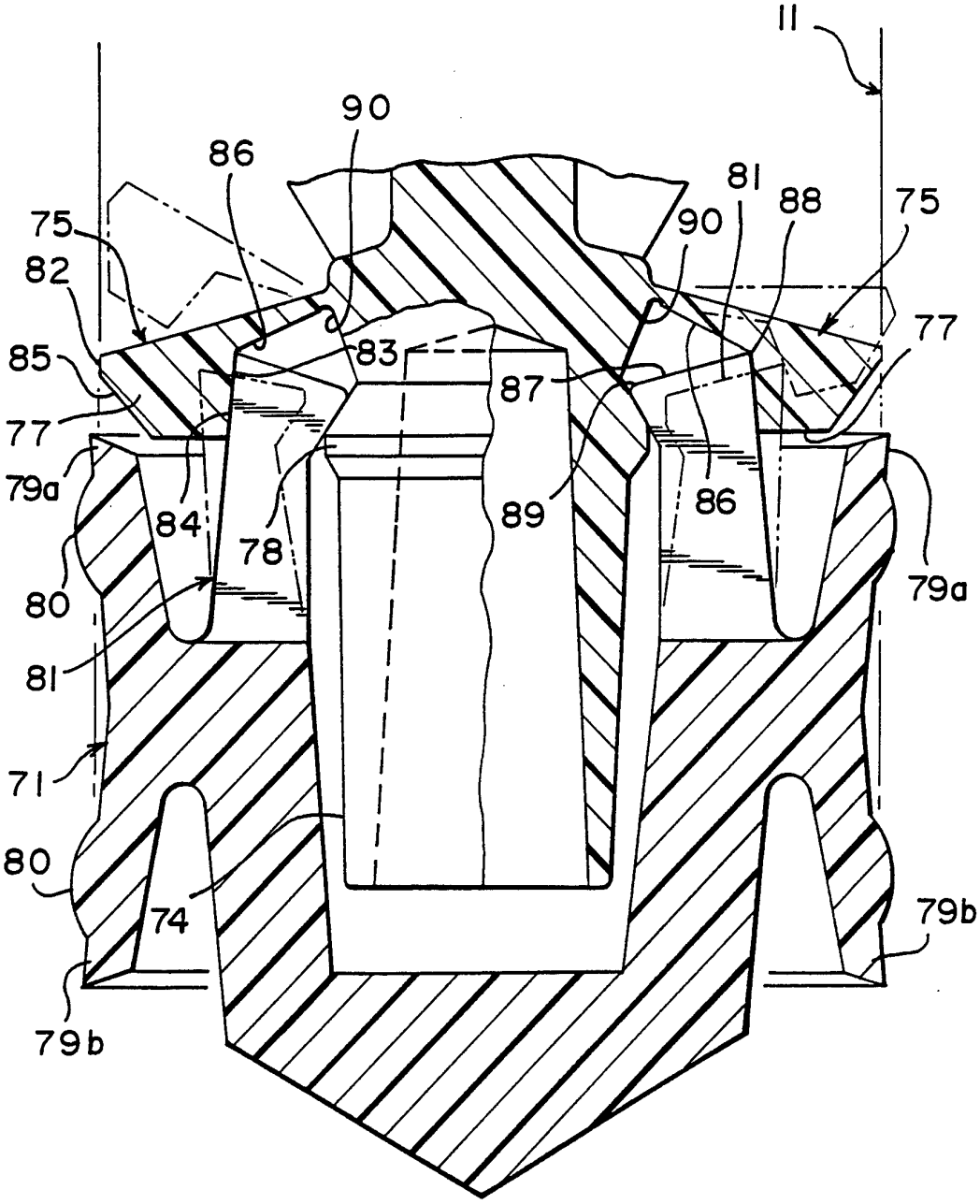
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FIG. 15

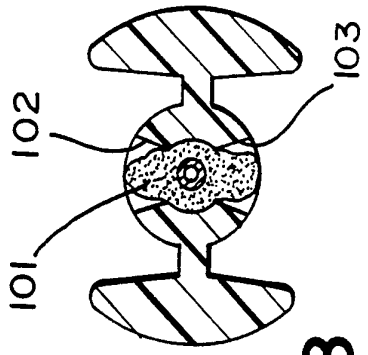
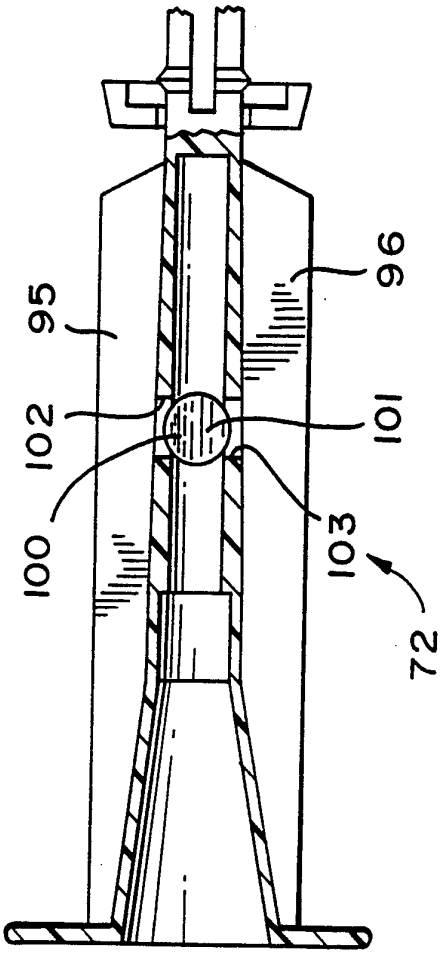


FIG. 18



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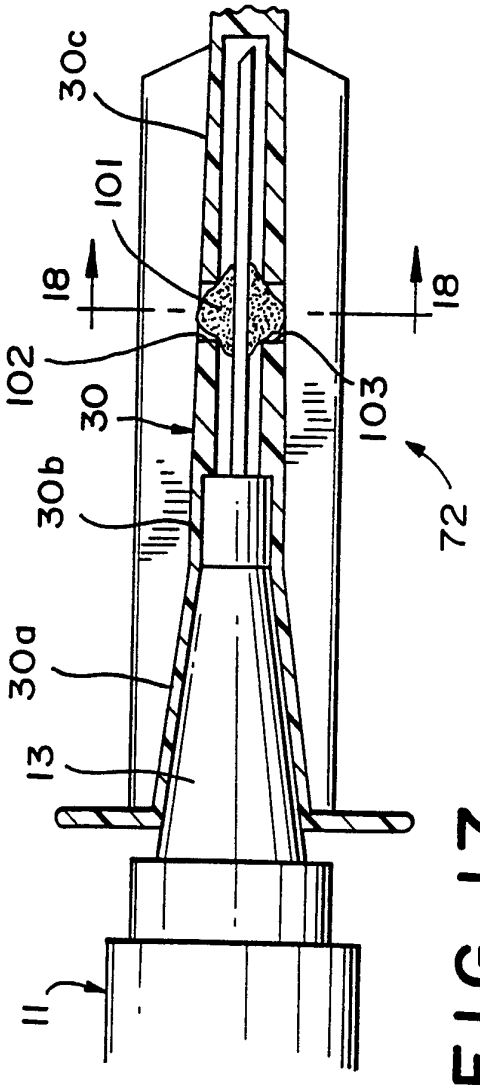
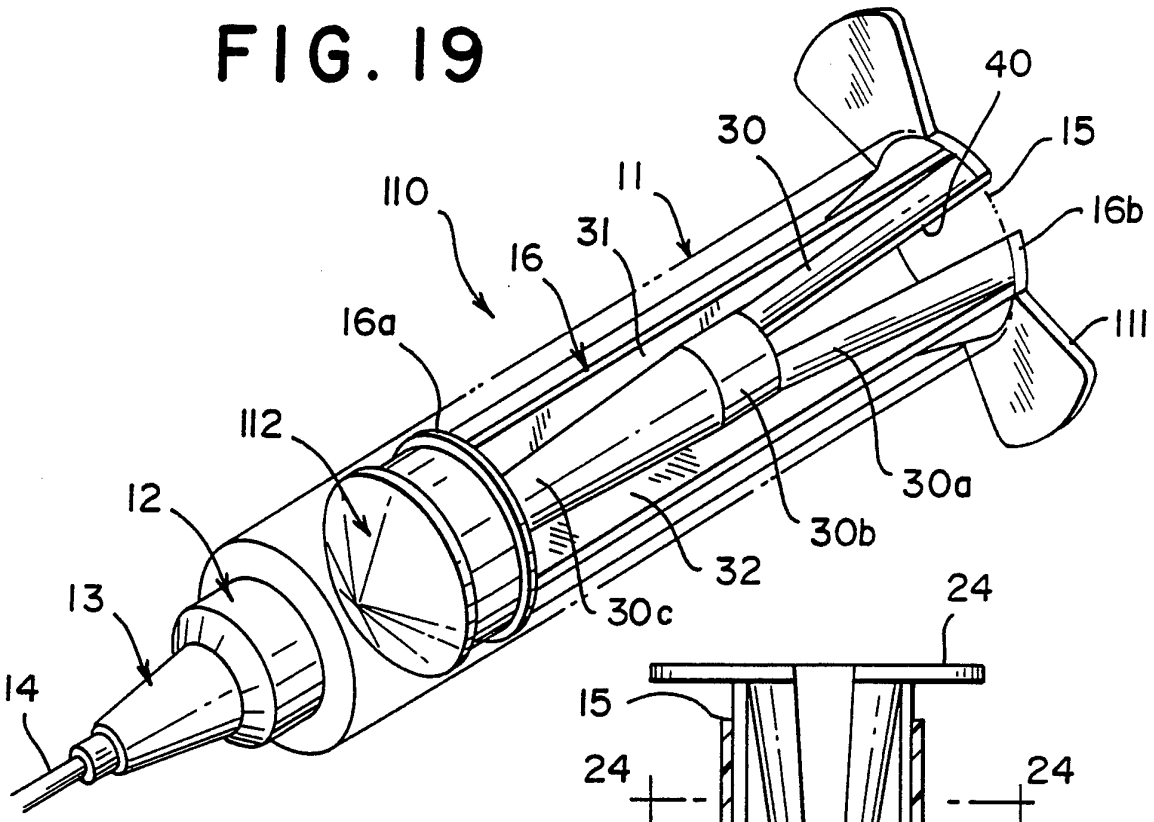


FIG. 17

FIG. 19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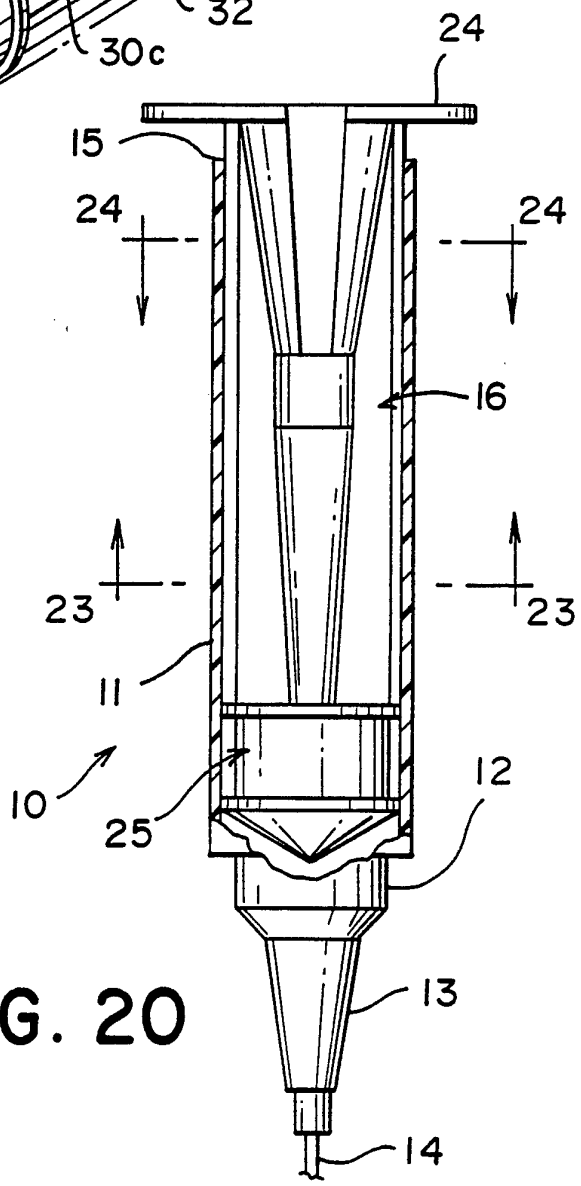
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FIG. 20

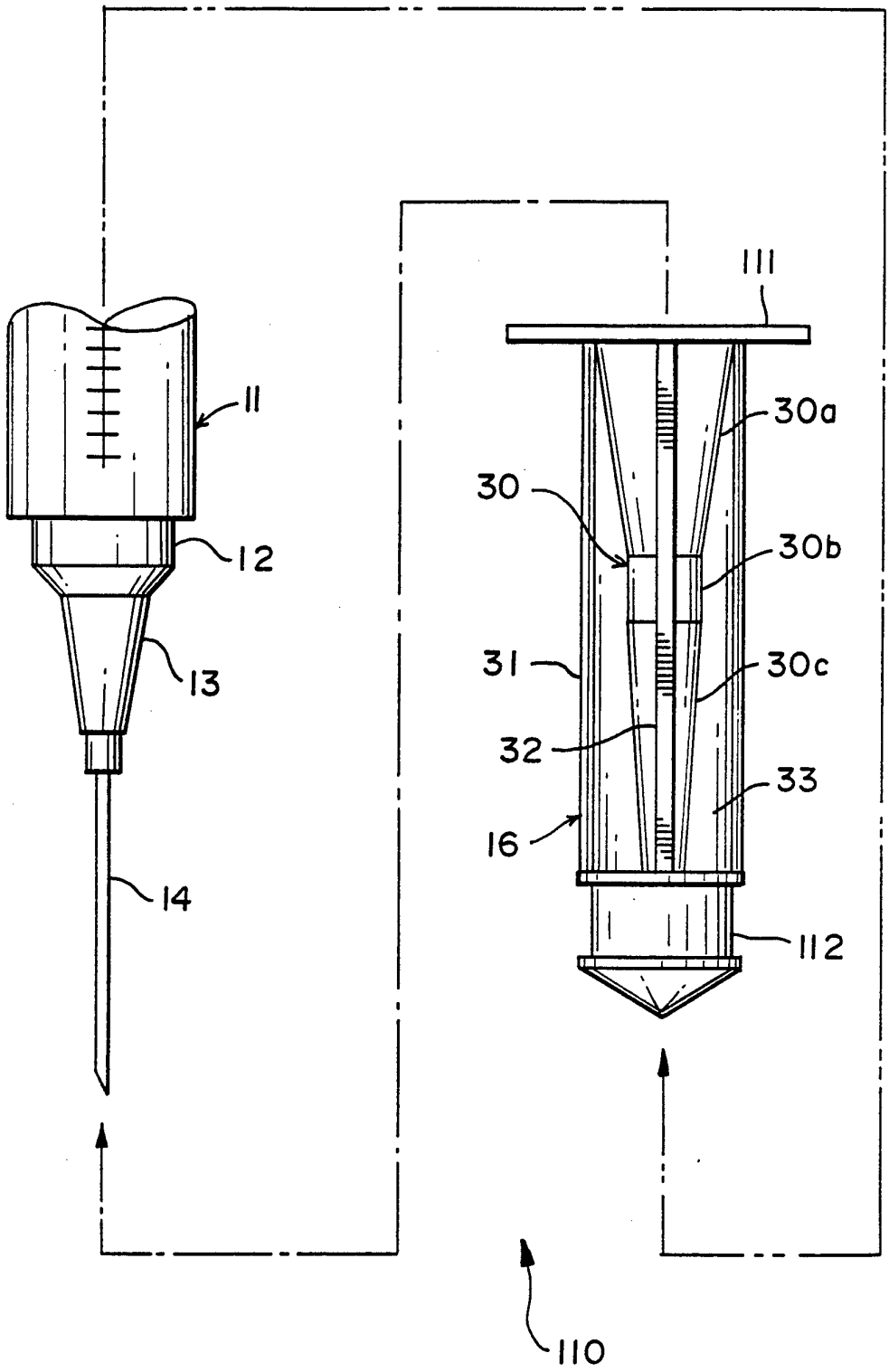


FIG. 21

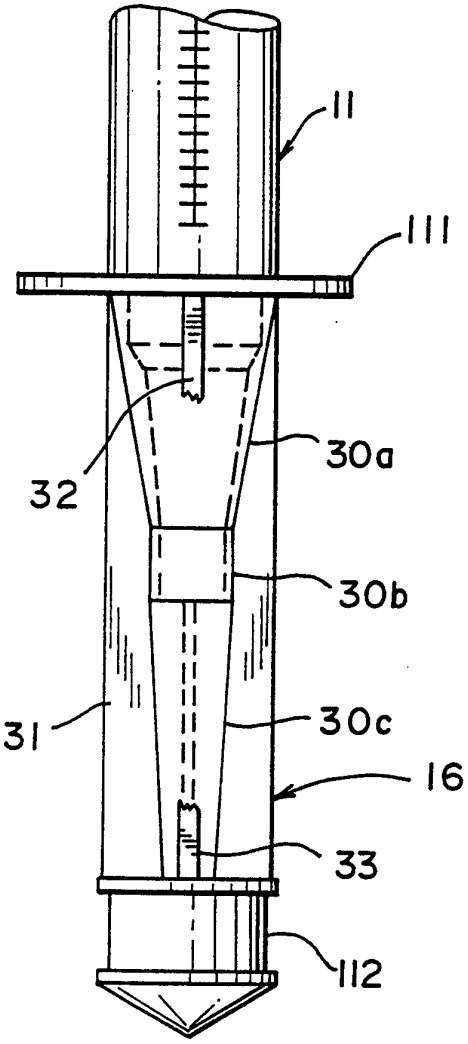
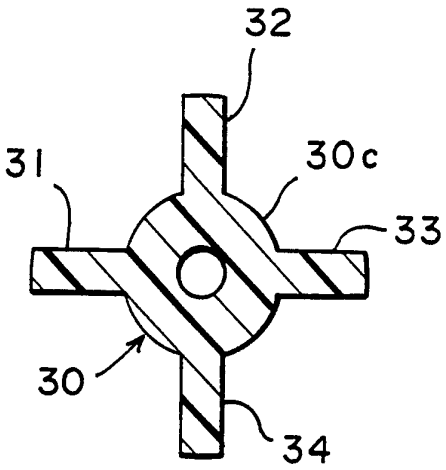


FIG. 22



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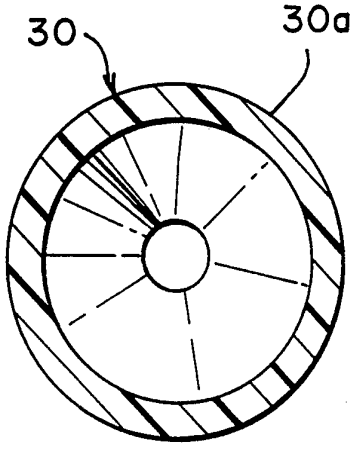

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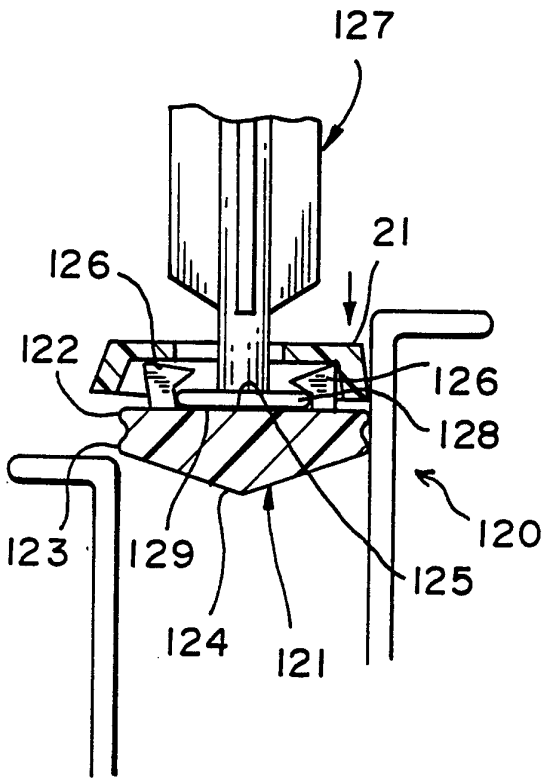
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FIG. 25

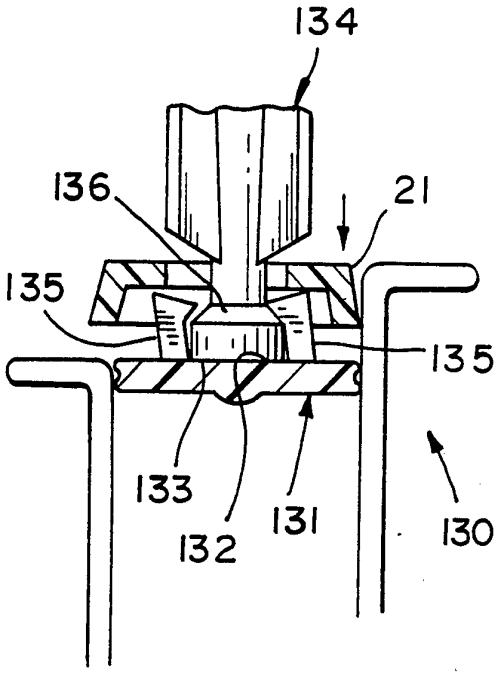
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FIG. 26

INTERNATIONAL SEARCH REPORT

Int tional application No.
PCT/US93/11716

A. CLASSIFICATION OF SUBJECT MATTER

IPC(5) :A61M 5/00
US CL :604/110

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)

U.S. : 604/110, 187, 192, 218, 228, 263

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 practicable, 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.
A	US, A, 2,578,394 (Blackman) 11 December 1951. See entire document.	1-11
A	US, A, 2,725,057 (Lockhart) 29 November 1955. See entire document.	1-11
A, P	US, A, 5,171,303 (DeCamp) 15 December 1992. See entire document.	1-11
A	US, A, 5,084,027 (Bernard) 28 January 1992. See entire document.	1-11
A	US, A, 5,149,323 (Colonna) 22 September 1992. See entire document.	1-11

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be part of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search 25 JANUARY 1994	Date of mailing of the international search report 14 MAR 1994
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer John D. Yasko Telephone No. (703) 308-2986

Form PCT/ISA/210 (second sheet)(July 1992)★