

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
22 November 2007 (22.11.2007)

PCT

(10) International Publication Number
WO 2007/133096 A2

(51) International Patent Classification: **Not classified**

(21) International Application Number:
PCT/NZ2007/000114

(22) International Filing Date: 15 May 2007 (15.05.2007)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
547237 16 May 2006 (16.05.2006) NZ

(71) Applicant and

(72) Inventor: WALLS, Murray Francis [NZ/NZ]; 221 Middle Road, Rd 3, c/o Post Shop, KAIAPOI, Akaroa, 7583 (NZ).

(74) Agent: LYTH, Richard John; 735 Old Tai Tapu Road, RD 2, Christchurch, PO Box 61, Tai Tapu, Christchurch, Tai Tapu, 7645 (NZ).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH,

CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

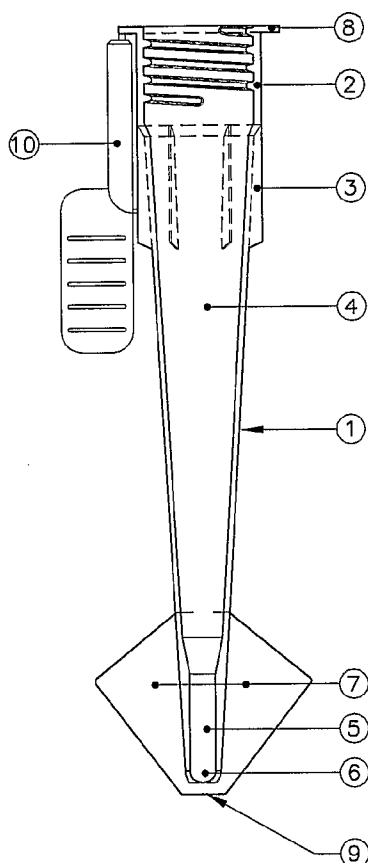
(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— without international search report and to be republished upon receipt of that report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: A SEALING NOZZLE AND FILLETING TOOL



(57) Abstract: A sealing nozzle and filleting tool which is adapted for attachment to an outlet of a sealant cartridge. The nozzle has a hollow tapered body section one end of which is shaped to enable attachment of the body section to the outlet of the sealant cartridge which in use is held at an angle of approximately 45 degrees to the sealant joint. The other end has an outlet with a delta shaped pair of wings or flaps. The hollow body section adjacent the outlet has a bore therein of constant cross section.

A SEALING NOZZLE AND FILLETING TOOL

5 FIELD OF THE INVENTION

The invention relates to a sealing nozzle and filleting tool for use by both skilled trade's men and women and home handy persons for applying product dispensed from a sealant or the like cartridge to tool a joint between two
10 surfaces as the sealant or the like is dispensed.

BACKGROUND TO THE INVENTION

At present sealant, whether for sealing or caulking a joint between two
15 surfaces or articles, is generally supplied in a cartridge. A useful discussion on the available prior art in this field is contained in United States patent specification no. 4570834. This specification describes what is called an apparatus for extruding a fillet and outlines in some detail the various situations where such an apparatus may be used.

20

Another useful discussion on the available prior art in this field is contained in United States patent specification no. 5017113. This specification describes what is called a filleting attachment for a caulking gun and also outlines in some detail the various situations where such an apparatus may be used.

25

A disadvantage of both of these apparatus is that the applicator nozzle is a tapered tube in which the narrow end forms the extrusion orifice and its wider end a socket for engagement with what is called an extrusion device. In the context of the present invention an extrusion device is a caulking gun or the
30 like. The tapered tube (shown in detailed cross section in Figure 17 of US patent 4570834 and Figure 2 of US patent 5017113) suffers from the disadvantage that in practice the contents tend to harden in the tapered tube when not being used with the result that it becomes blocked and unusable. It

is very difficult, if not impossible, to unblock such a tapered tube with the result that the applicator nozzle cannot be reused.

Another disadvantage of the apparatus described in US patent 4570834 is that in use the wiping surface or wing is at a more acute angle to the finished joint than that proposed for the present invention. Thus it tends to wipe the extruded material over the surface on either side of the joint rather than scraping it off as does the present invention which has in use the wing on the opposite side of the nozzle and at a more acute angle to the joint surface.

10

Another disadvantage of the tool described in US patent 5017113 is that the two edges 4 & 5 of the squeegee are at 90 degrees (right angles) to each other. In most jointing situations the surfaces that the sealant fillet is being applied between are also at right angles to each other, as are the surfaces shown in Figure 4. With the squeegee edges and the surfaces being filleted both at right angles, this will not allow the tool to be tilted to the 45 degree angle, to the joint, as is required for all sealing applications, and as shown in Figure 4.

20 Another disadvantage of the tool described in US patent 5017113 is that the outlet orifice 7 is of insufficient size to allow enough sealant to pass through it to effectively fill a joint between two surfaces.

25 An object of the invention is to overcome these disadvantages and to provide a sealing nozzle and filleting tool which at least offers a useful alternative choice.

SUMMARY OF THE INVENTION

30 According to a first aspect of the invention there is provided a sealing nozzle and filleting tool adapted for attachment to an outlet of a sealant cartridge, the nozzle has a hollow tapered body section one end of which is shaped to enable attachment of the body section to the outlet of the sealant cartridge and the other end of which is an outlet with a delta shaped pair of wings or

flaps, the hollow body section adjacent the outlet having a bore therein of constant cross section.

5 The nozzle and sealant cartridge are, in use, held at an angle of approximately 45 degrees to the sealant joint.

10 The bore of constant cross section allows a plug to be inserted therein to prevent sealant in the tapered body section from hardening. The plug can be moulded integrally with the tool and connected thereto by a frangible tab.

The said one end of the body section can be shaped for attachment to the screw thread on a sealant cartridge or for sliding engagement over a purpose made nozzle for a sealant cartridge.

15 The said one end of the body section can have external ribs which assist in facilitating its engagement to the outlet of the sealant cartridge.

20 The delta shaped pair of wings or flaps extend over the outlet and in use act to tool the sealant extruded from the outlet. The wings or flaps can be formed in a variety of different shapes and sizes and set at various angles to allow different angles of joint to be sealed and the sealant to be tooled to different shapes.

25 Preferably the edges of the winged flaps are at an angle of about 75 degrees to each other.

The delta shaped pair of wings or flaps can also be formed on a separate nozzle tip that engages over an outlet end of a purpose made sealant nozzle. The engagement of the nozzle tip to the outlet end of the sealant nozzle is by way of a clipping engagement.

30

Further aspects of the invention which should be considered in all its novel aspects will become apparent from the following descriptions which are given by way of example only.

DESCRIPTION OF THE DRAWINGS

Examples of the invention will now be described with reference to the
5 accompanying drawings in which:

Figures 1 and 2 are drawings of an example of screw on version of nozzle according to the invention in which Figure 1 is a side view and Figure 2 a sectional view;

10

Figures 3 to 5 are drawings of an example of slide on version of nozzle according to the invention in which Figure 3 is a side view of an inner nozzle section, Figure 4 is a side view of an outer nozzle section and Figure 5 is a sectional view of the outer nozzle section shown in Figure 4;

15

Figures 6 to 10 are drawings of an example of a clip on tip version of nozzle according to the invention in which Figure 6 is a side view of the nozzle, Figure 7 is a front view of the nozzle, Figure 8 is a front view of the nozzle with a clip on tip in position, Figure 9 is a side view of the clip on tip and Figure 10
20 is a front view of the clip on tip;

Figures 11 to 18 are drawings of a series of four different shapes of nozzle tip and tooled bead finishes for use in particular situations in which Figure 11 is a front view of a nozzle tip, Figure 12 is a sectional view of a sealant bead produced by the tip in Figure 11, Figure 13 is a front view of a nozzle tip,
25 Figure 14 is a sectional view of a sealant bead produced by the tip in Figure 13, Figure 15 is a front view of a nozzle tip, Figure 16 is a sectional view of a sealant bead produced by the tip in Figure 15, Figure 17 is a front view of a nozzle tip and Figure 18 is a sectional view of a sealant bead produced by the
30 tip in Figure 17;

Figures 19 to 22 are drawings of a shape of nozzle tip and tooled bead finish for use in a particular situation in which Figure 19 is a front view of a nozzle tip, Figure 20 is a side view of the nozzle top shown in Figure 19, Figure 21 is

an end view of the nozzle tip shown in Figure 19 and Figure 22 is a sectional view of the nozzle tip shown in Figure 19;

Figures 23 to 26 are drawings of a shape of nozzle tip and tooled bead finish for use in a particular situation when sealing a tile joint in which Figure 23 is a front view of a nozzle tip, Figure 24 is a side view of the nozzle tip shown in Figure 23, Figure 25 is an end view of the nozzle tip shown in Figure 23 and Figure 26 is a sectional view of the nozzle tip shown in Figure 23;

Figures 27 to 30 are drawings of a shape of nozzle tip and tooled bead finish for use in a particular situation in which Figure 27 is a front view of a nozzle tip, Figure 28 is a side view of the nozzle tip shown in Figure 27, Figure 29 is an end view of the nozzle tip shown in Figure 27 and Figure 30 is a sectional view of the nozzle tip shown in Figure 27;

Figures 31 and 32 are drawings of a different shape of nozzle tip for use in a particular situation and a wiping edge that can be formed as part of the edge of the winged tip in which Figure 31 is a front view of a nozzle tip and Figure 32 is a sectional view of the edge of the tip shown in Figure 31; and

Figure 33 is an isometric drawing showing the nozzle shown in Figure 1 fitted to a sealant cartridge and showing the way in which the unit is used.

DESCRIPTION OF THE EXAMPLES

Examples of the invention will now be described and in the accompanying drawings the same numerals will be used to refer to similar parts of the respective examples.

The nozzle tips drawn and described are for the most common joint angles widths and finishes however the tips are in no way limited to these shapes.

The first example shown in Figures 1 and 2 is a screw on version of nozzle generally indicated by arrow 1 and is for use by a professional user of such equipment whose sealant cartridges have a screw on sealant nozzle. Figure

2 which is a sectional view of the nozzle 1 has a hollow tapered body section 4 one end 2 of which is shaped to enable attachment of the body section to an outlet of the sealant cartridge (not shown) and the other end 6 of which has an outlet 5 with a delta shaped pair of wings or flaps 7. The outlet 5 has a bore therein of constant cross section into which a plug 10 can be inserted to prevent the sealant within the nozzle from curing. The said one end 2 of the body section 4 can have external ribs 3 which assist in facilitating its screw on engagement to the outlet of the sealant cartridge and a flange 8 to engage the sealant cartridge. A tip 9 of the nozzle is shaped in such a way, that when used as described below it tools a sealant bead at the same time as it is placed.

The second example shown in Figures 3 to 5 is designed for a home handy person and is a two part slide on version of the first example described above and has an inner and an outer nozzle section. Figure 3 shows dotted the inner of the nozzle 1 which has a hollow tapered body section 4, one end 2 of which is shaped to enable attachment of the body section to an outlet of the sealant cartridge (not shown) and the other end 6 of which has an outlet 5 having a bore therein of constant cross section into which a plug 10 can be inserted to prevent the sealant within the nozzle from curing. The body section 4 at the attachment end 2 has on its outer surface a locating lug 11 to facilitate the alignment of the slide on outer nozzle 1' and can have external ribs 3 which assist in facilitating its screw on engagement to the nozzle of the sealant cartridge. Figure 5 is a sectional view showing the outer nozzle 1' which has a tubular shaped body section 13 at one end and a hollow tapered body section 4' at the other end, to enable it to slide over the nozzle 1. The tubular section 13 has at one end 2' a flange 8 that is shaped to enable attachment of the body section to the outlet of a sealant cartridge (not shown) and be retained by the sealant gun, (not shown) and a locating chase 12. The tapered body section 4' has an outlet end 6' with a delta shaped pair of wings or flaps 7. A tip 9 of the outer nozzle is shaped in such a way, that when used as described below it tools a sealant bead at the same time as it is placed. Apart from being in two sections this example has all the features and uses that the screw on first example does.

The handyperson version is a two part sleeve type nozzle that has an inner nozzle 1 and an outer nozzle 1' that slides over the inner nozzle. This enables sealant to be extruded without the sealant contacting the inside of the outer nozzle 1' and for the outer nozzle 1' to be changed without removing the inner nozzle 1 from the sealant cartridge. The outer nozzle 1' where it contacts a sealant cartridge has a flange 8 which holds the nozzle in place, over the inner nozzle 1, while it is in use. This type of outer nozzle can be changed and reused periodically without having to clean the sealant out of the nozzle.

The third example shown in Figures 6 to 10 is a clip on version of nozzle tip generally indicated by 14 and is for use by any user of such equipment whose sealant cartridges have a screw on sealant nozzle. Figure 7 is an elevation of the nozzle 1 which has a hollow tapered body section 4, one end 2 of which is shaped to enable attachment of the body section to an outlet of the sealant cartridge (not shown) and the other end 6 of which has an outlet 5 having a bore therein of constant cross section into which the plug 10 can be inserted to prevent the sealant within the nozzle from curing. The body section 4 has on its outer surface a locating block 15 and a retaining ridge 17 for the attachment of the removable winged tip 14. The said one end 2 of the body section 4 can have external ribs 3 which assist in facilitating its screw on engagement to the nozzle of the sealant cartridge. Figure 10 is an elevation of the tip 14 which has a delta shaped pair of wings or flaps 7, that when used as described below tool a sealant bead at the same time as it is placed. The tip 14 has a recess 18 within the bore to lock it onto the nozzle 1 by locking over the ridge 17 on the nozzle 1, and a recess 16 to prevent it from turning (rotating) when attached to the nozzle 1. Apart from having a clip on tip, it has all the features and uses that the screw on first example does. Figure 8 is an elevation showing the clip on tip 14 attached to the nozzle 1.

Figures 11 to 26 show seven different shapes of nozzle wings and tips designed for use in particular circumstances. Beneath each nozzle tip is shown a section through a tooled sealant bead finish produced by the nozzle

tip. These sealant nozzles can be used to provide a professional finish to a sealant bead, at the same time as the bead is applied to the joint being sealed. This method leaves the sides of the joint clear of sealant, thus there is normally, no need to mask the joint or to clean up sealant after the sealant bead is tooled off.

The nozzle tips are shown in a variety of shapes to allow the tooling of 90° internal and external joints, and flat joints as well as concave, convex and flat bead finish shapes. Although these surface angles and finished shapes are shown and described, the tips can be manufactured to any joint angle, joint width or any bead shape required. The nozzles can also be manufactured in other sizes and shapes to fit different types of sealant cartridge.

The first version, Figure 11, shows a tip 9 with wings or flaps 7 with an angle A of 75° between the tooling edges designed to produce a flat bead and Figure 12 shows this sealant bead 19 between two 90° angled surfaces 20.

The second version, Figure 13, shows a tip 9 with wings or flaps 7 with an angle A of 75° between the tooling edges designed to produce a concave bead and Figure 14 shows this sealant bead 19 between two 90° angled surfaces 20.

The third version, Figure 15, shows a tip 9 with the wings or flaps 7 with an angle A of 75° between the tooling edges designed to produce a convex bead and Figure 16 shows this sealant bead 19 between two 90° angled surfaces 20.

The fourth version, Figure 17, shows a tip 9 with wings or flaps 7 with an angle A of 75° between the tooling edges designed to produce a flat, side sealant bead and Figure 18 shows this sealant bead 19 between two 90° angled surfaces 20.

The fifth version, Figure 19, is an elevation that shows a tip 9 with the wings

or flaps 7 designed to produce a concave sealant bead between two aligned or flat surfaces and Figure 22 shows this sealant bead 19 between two aligned surfaces 20. Figure 20 is a side view of Figure 19 showing the wings or flaps set at an angle B of 45° and Figure 21 is an end view of the wings or flaps showing the wings angled at an angle C of 90° to each other.

The sixth version, Figure 23, is an elevation that shows a tip 9 with the wings or flaps 7 designed to produce a concave sealant bead between two aligned or flat tiled surfaces and Figure 26 shows the sealant bead 19 between two aligned tile surfaces 20. Figure 24 is a side view of Figure 19 showing the wings or flaps set at an angle B of 45° and Figure 25 is an end view of the wings or flaps showing the wings angled at an angle C of 90° to each other.

The seventh version, Figure 27, is an elevation that shows a tip 9 with the wings or flaps 7 designed to produce a convex sealant bead to an external joint between two 90° angled faces and Figure 30 shows the sealant bead 19 between two external 90° angled faces 20. Figure 28 is a side view of Figure 27 and Figure 29 is an end view of the wings or flaps showing the wings angled at angle D of 60° to each other.

20

Figure 31 is an elevation of a sealant nozzle tip that shows the wings or flaps having a wiping blade 21 along the outer or wiping edge. Figure 32 shows an enlarged section X through the wiping blade 21. The purpose of the blade is to improve the wiping or cleaning effect of the wings or flaps in removing excess sealant from the sides of the joint being sealed. Although the blade 21 is shown of a particular shape, it is envisaged that it will be varied to best suit the type of sealant to be applied and the surface that the sealant is to be applied too.

30

It is envisaged that the user of the screw on nozzles shown in Figures 1 and 2 would leave the nozzle on the sealant cartridge, thus having a separate cartridge for each nozzle. To aid the ability to do this, these nozzles are sealable to prevent the sealant inside the nozzle hardening.

It is envisaged that the user of the screw on inner nozzle with the slide on outer nozzles and tips shown in Figures 3 to 5 would leave the screw on inner nozzle on the sealant cartridge, and have a separate slide on outer
5 nozzle for each different application. To aid the ability to do this, these inner nozzles are sealable to prevent the sealant inside the nozzle hardening.

It is envisaged that the user of the screw on nozzle with clip on tips shown in Figures 6 to 10 would leave the nozzle on the sealant cartridge and change
10 the tip as required. To aid the ability to do this, these nozzles are sealable to prevent the sealant inside the nozzle hardening.

The screw on nozzles shown in Figures 1 and 2 and Figures 6 to 10 can also be screwed onto a purpose designed handle (not shown), and be used as a
15 standalone filleting tool, to either tidy up a pre-tooled joint or to tool a fresh joint.

It is to be appreciated that some sealant tubes come with a fixed nozzle whilst others have a threaded section that the nozzle screws onto. When buying
20 sealant for use with these nozzles it is important that the appropriate tube is chosen.

In Figure 33 is shown the application of a sealant 24. The sealant cartridge 22 is held in a sealant or caulking gun (not shown) at an angle of
25 approximately 45°, parallel to the joint being filled, while orientating the nozzle 1 opening so that it forces sealant directly into the joint 23. The nozzle 1 is drawn along the joint in the direction of the arrow 25 with a slow even motion, applying just enough sealant to fill the gap 23 and form the bead 24, giving a smooth even finish to the bead while applying enough downward pressure on
30 the nozzle to stop the sealant oozing out from under the wings 7 of the tip 1.

Advantages of the second example shown in Figures 3 to 5 are that (a) the user does not have to clean out the inside of the nozzle for it to be reused, (b) it is quick to take off and on and to switch nozzles, (c) it is ideal for

handyperson, for periodic use and small jobs where only a part tube of sealant is to be used, and (d) these nozzles are sealable to prevent the sealant inside the nozzle hardening. Advantages of the third example shown in Figures 6 to 10 are that (a) the user does not have to remove the nozzle
5 from the cartridge to enable the tip to be changed, (b) it is quick to switch tips, (c) it is ideal for handyperson, for periodic use and small jobs where only a part tube of sealant is to be used, and (d) these nozzles are sealable to prevent the sealant inside the nozzle hardening.

10 Although a professional version and a handyperson version of these sealant nozzles are described, it does not exclude in any way either group using either type of sealant nozzle.

The nozzles can be manufactured from a variety of materials and preferably
15 from a plastics material which does not react with the sealant compositions to be applied.

The nozzle section could be made out of one particular material such as hard plastic and the winged tip made of another material such as soft plastic
20 or rubber, and attached to the nozzle.

The nozzle tips can be made to different widths to give a finished sealant bead width required for a particular situation and the nozzle section that attaches to the sealant cartridge can be made to any design to suit a
25 particular sealant cartridges and sealant guns, such as a sausage guns.

Particular examples of the invention have been described and it is envisaged that modifications and improvements can take place without departing from the scope of the attached claims.

Claims

1. A sealing nozzle and filleting tool adapted for attachment to an outlet of a sealant cartridge, the nozzle has a hollow tapered body section one end of which is shaped to enable attachment of the body section to the outlet of the sealant cartridge and the other end of which is an outlet with a delta shaped pair of wings or flaps, the hollow body section adjacent the outlet having a bore therein of constant cross section.
2. A sealing nozzle and filleting tool as claimed in claim 1 which in use is held at an angle of approximately 45 degrees to the sealant joint.
3. A sealing nozzle and filleting tool as claimed in claim 1 or claim 2 wherein the bore of constant cross section allows a plug to be inserted therein to prevent sealant in the tapered body from hardening.
4. A sealing nozzle and filleting tool as claimed in claim 3 wherein the plug is moulded integrally with the tool and connected thereto by a frangible tab.
5. A sealing nozzle and filleting tool as claimed in any one of claims 1 to 4 wherein the said one end of the body section is shaped either for attachment to the screw thread on a sealant cartridge or for sliding engagement over a purpose made nozzle for a sealant cartridge.
6. A sealing nozzle and filleting tool as claimed in claim 1 or claim 2 wherein the said one end of the body section has external ribs which assist in facilitating its engagement to the outlet of the sealant cartridge.
7. A sealing nozzle and filleting tool as claimed in any one of the preceding claims wherein the delta shaped pair of wings or flaps extend over the outlet and in use act to tool sealant extruded from the outlet.

- 5 8. A sealing nozzle and filleting tool as claimed in claim 7 wherein the wings or flaps are formed in a variety of different shapes and sizes and set at various angles to allow different angles of joint to be sealed and the sealant to be tooled to different shapes.
- 10 9. A sealing nozzle and filleting tool as claimed in claim 7 or claim 8 wherein the edges of the winged tip are at an angle of about 75 degrees to each other.
- 15 10. A sealing nozzle and filleting tool as claimed in any one of claims 7 to 9 wherein the delta shaped pair of wings or flaps are formed on a separate nozzle tip that engages over an outlet end of a purpose made sealant nozzle.
- 20 11. A sealing nozzle and filleting tool as claimed in claim 10 wherein the nozzle tip is clipped to the outlet end of the purpose made sealant nozzle.
- 25 12. A sealing nozzle and filleting tool as claimed in claim 1 or claim 2 and substantially as hereinbefore described with reference to the accompanying drawings.
13. A combination sealing nozzle and filleting tool and sealant cartridge incorporating a sealing nozzle and filleting tool as claimed in claim 1 or claim 2.
14. A method of using a sealing nozzle and filleting tool as claimed in claim 1 or claim 2 to produce a sealant bead.

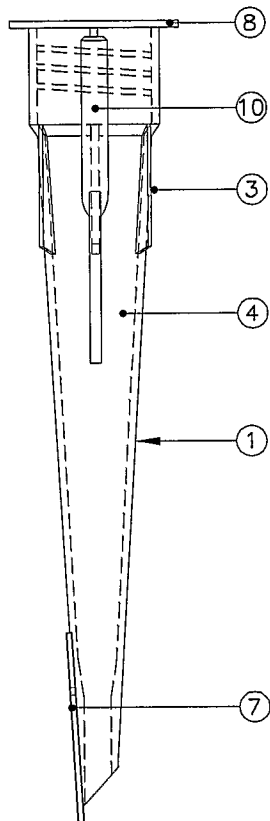


Fig 1

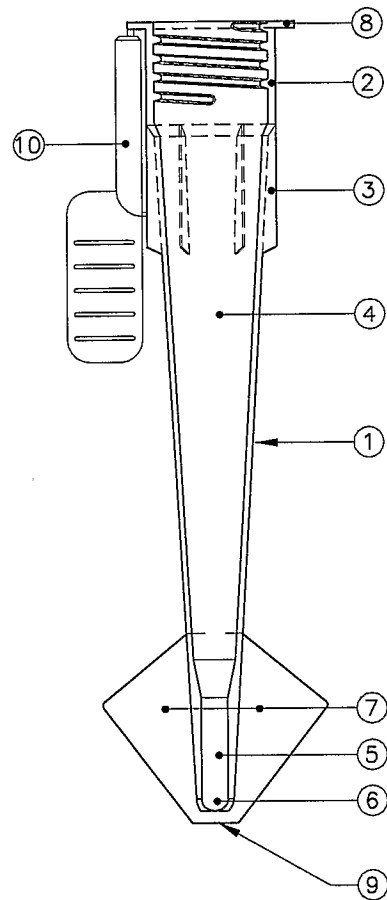


Fig 2

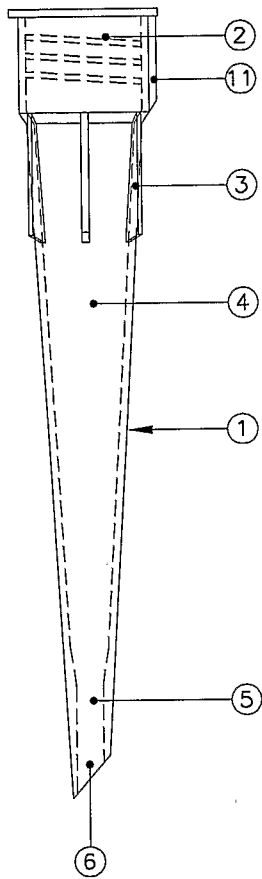


Fig 3

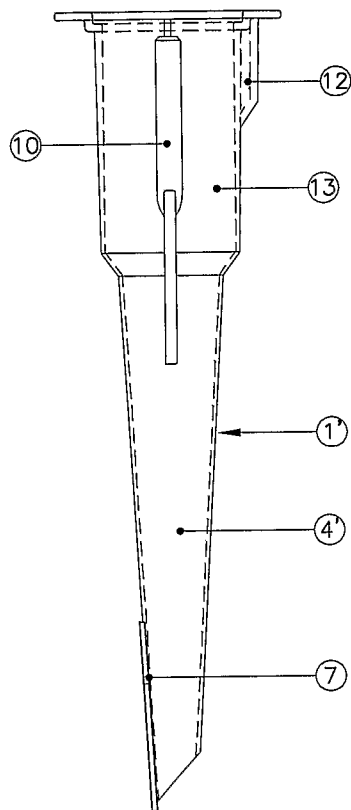


Fig 4

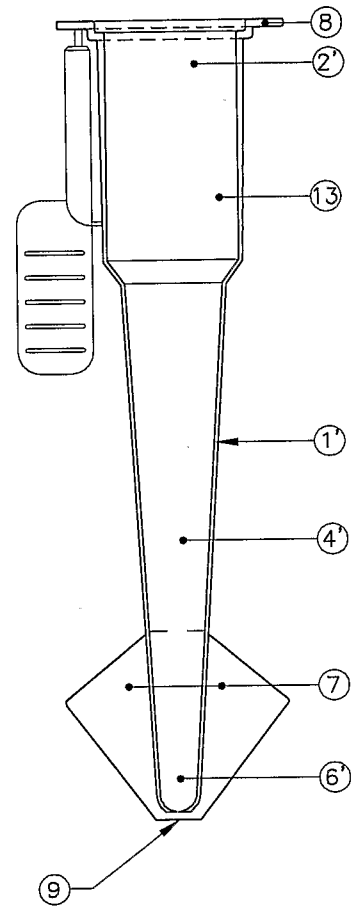


Fig 5

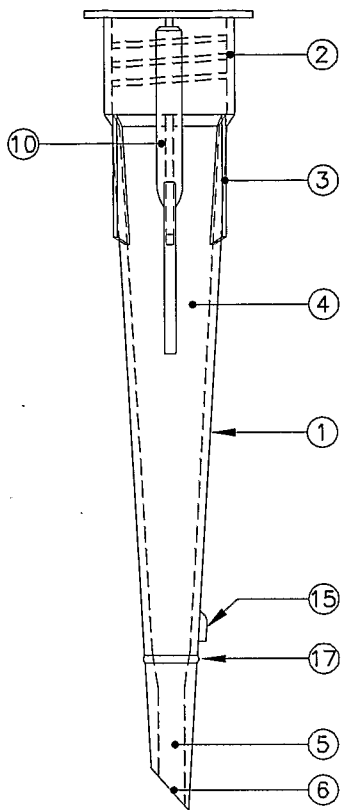


Fig 6

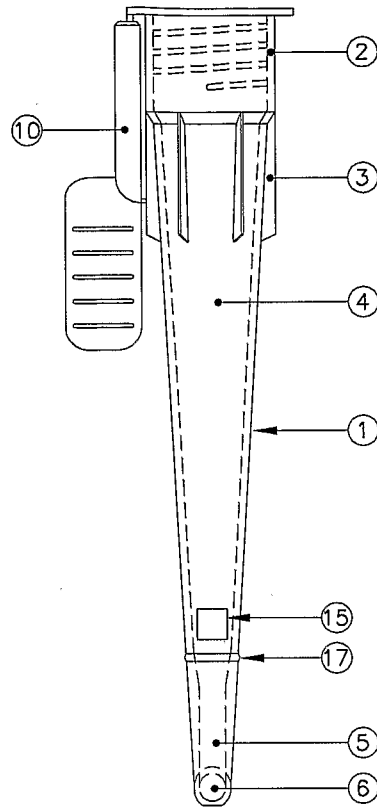


Fig 7

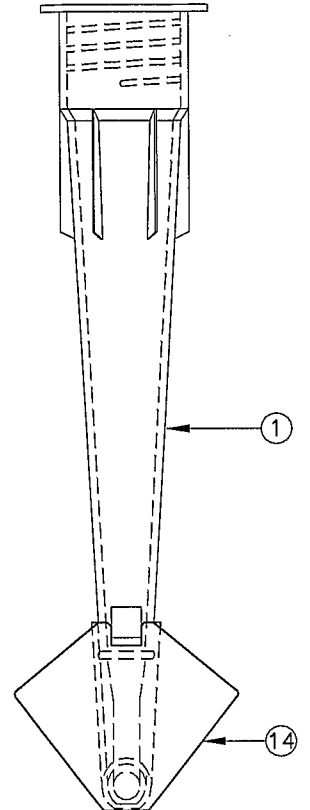


Fig 8

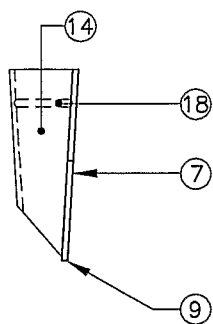


Fig 9

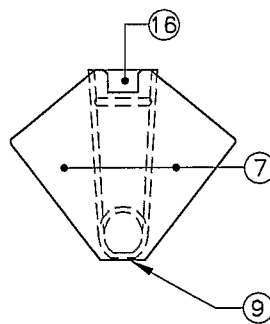


Fig 10

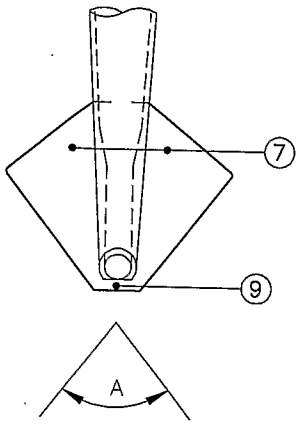


Fig 11

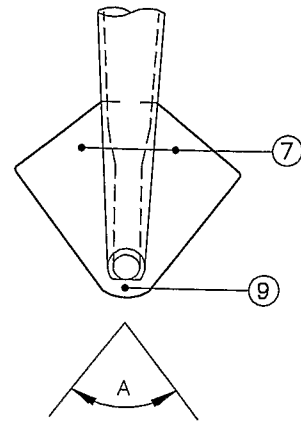


Fig 13

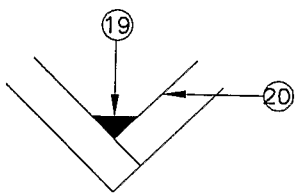


Fig 12

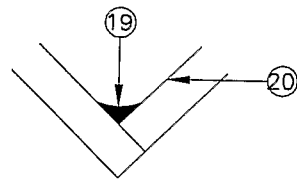


Fig 14

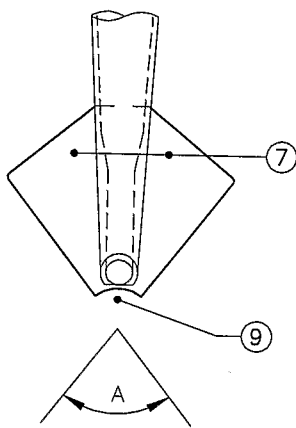


Fig 15

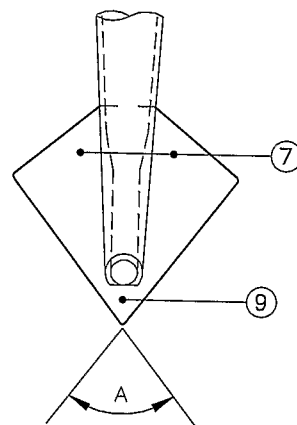


Fig 17

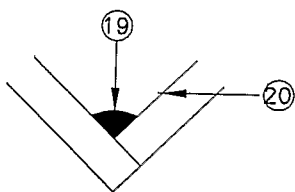


Fig 16

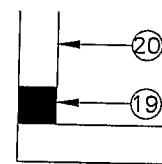


Fig 18

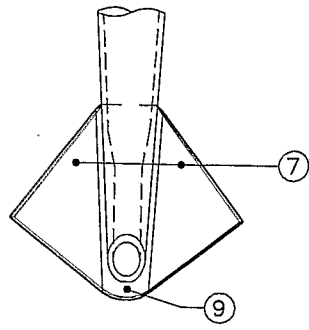


Fig 19

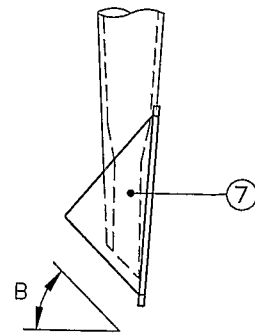


Fig 20

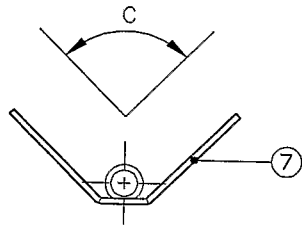


Fig 21

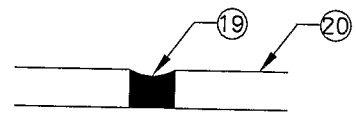


Fig 22

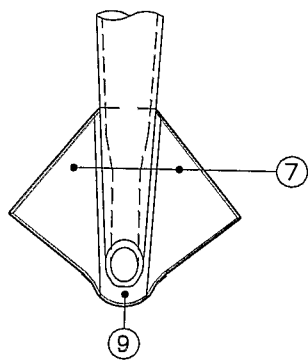


Fig 23

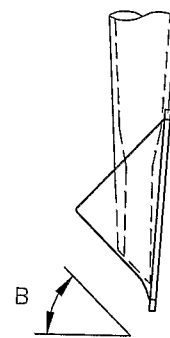


Fig 24

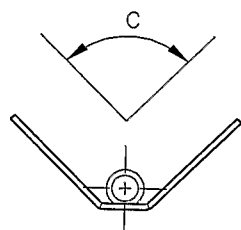


Fig 25

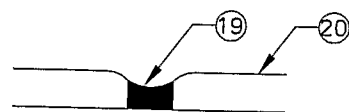


Fig 26

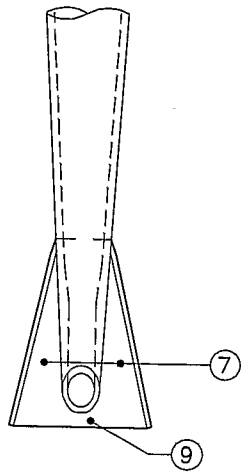


Fig 27

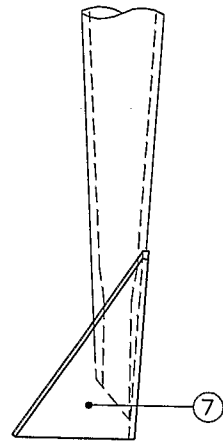


Fig 28

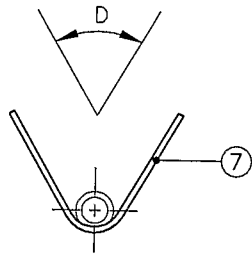


Fig 29

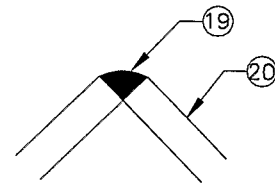


Fig 30

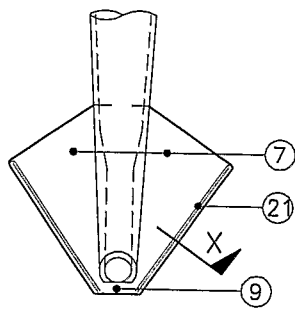


Fig 31



X

Fig 32

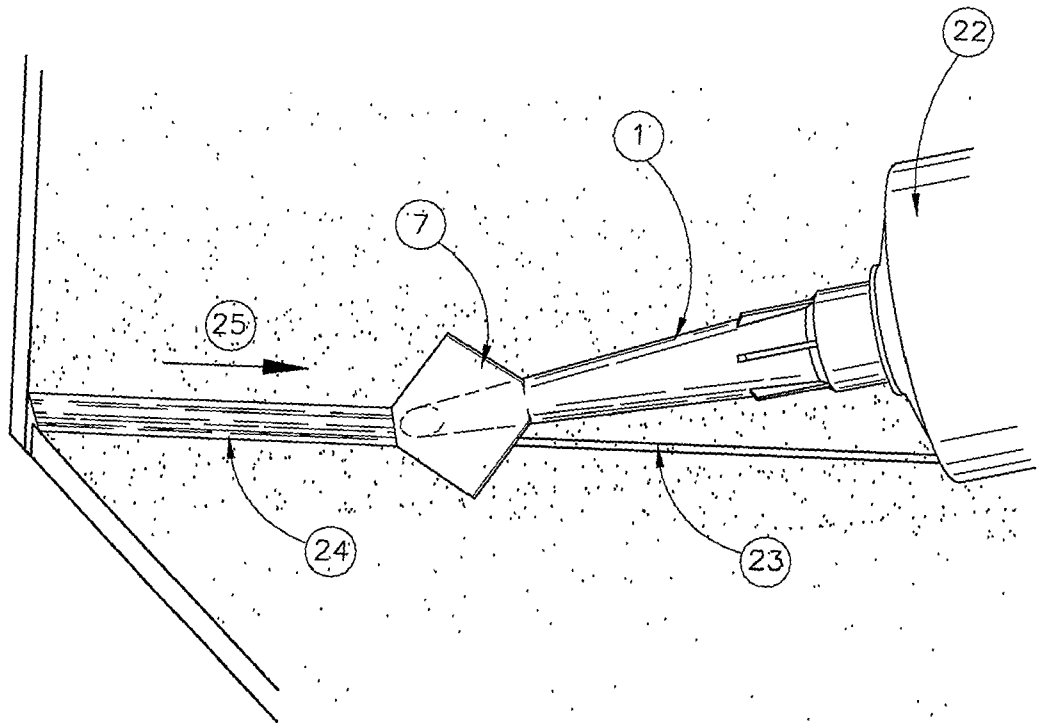


Fig 33