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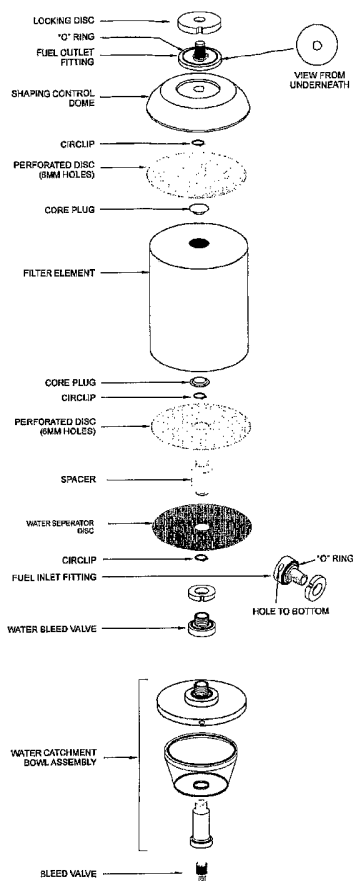
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[Continued on next page]

(54) Title: AXIAL DEPTH FILTER



(57) Abstract: An Axial Depth Filter device is a multipurpose process designed to separate water during the filtering process of oils and fuels as it removes contaminants and impurities.

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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.

AXIAL DEPTH FILTER

5 This invention relates to improvements to filtering devices designed to extend the vivacity of all types of liquids such as Diesel and other motor fuels, motor oils, hydraulic fluids, paint thinners, specialty oils; such as essential oils and emulsions, organically grown oils et cetera by removing harmful substances
10 from such liquids, including the removal of emulsified water commonly present in most oil based fluids.

The AXIAL DEPTH FILTER, puts forward an advanced method of filtering, removing a vast diversity from, to be filtered solutions. Despite its immense
15 proficiency it is uniquely positioned environmentally. It is entirely self sufficient and does not rely on any type of propulsion or power and all of its component metal parts are recyclable.

Hereto employed, similarly aimed, filtering devices and/or methods do
20 improve the quality of the here addressed liquids but do so at a much lower grade than the Axial Depth Filter by not totally eliminating these potentially damaging elements and substances; including emulsified water.

Motorized transport such as heavy duty trucks, busses, marine and
25 earthmoving machines, for instance, usually rely on the filters supplied, and usually recommended, by manufacturer of the equipment. Although considered to be satisfactory, many of these filtering devices fail their purpose for various reasons. Chiefly because most fail to remove solid particles under 10 microns, which correspond to ca. 95% of contamination as well as the
30 removal of moisture (free water) from oils, to acceptable levels.

Where heavy plant and machinery is required to work in extreme conditions i.e. long distance haulage and earthworks fine dust and other air-borne particles do enter otherwise sealed systems without being readily noticed.
35 Suspended water, typically found in fuels is not removed entirely.

Mining, marine, earthmoving and construction work, requires additional filtering devices. Some such secondary filters are commercially available, however, these are typically technically complex and therefore expensive with a question on their ability to perform as to their claim.

These problems are overcome with this invention.

The AXIAL DEPTH FILTER is a multi purpose filtering device that will remove water and other impurities, which adversely affect otherwise typical performance and life span of machinery, during normal filtering operation before contaminants are introduced or re-circulated in machinery and ancillary systems.

The AXIAL DEPTH FILTER is compact and the utilization of basic, relatively inexpensive components and, by employing a unique manufacturing method achieve unique function by design. The AXIAL DEPTH FILTER far exceeds the efficiency of presently available commercial devices, yet does this at very low initial price and at considerably reduced operating cost.

The AXIAL DEPTH FILTER can be manufactured for, and used on, any type of engine, motor or machine driven equipment that normally benefits from the use of oil and/or fuel filters by improving the varying functions of such equipment and, at the same time, increasing the overall operational efficiency.

Function and use.

The AXIAL DEPTH (Diesel Oil / fuel) FILTER, in practical use, will separate and remove free water from fuel and eliminate other impurities and contaminants. The filter is capable of separating water from fuel at ca. 40 PPM. The removal of other particle contaminants is lower than 1 micron.

Fuel economy, power output and general engine efficiency is noticeably increased and exhaust emissions are substantially reduced extending fuel injector's life.

Specific pressure and flow rates are dependant on the filter medium used in a particular filter but generally must not exceed 650KPA or equivalent to 18

liters of fuel flow per minute. Additional banking will be required if the
5 pressure exceeds these limitations. All fittings are standard fittings. The
period of useful operation of each filter is dependent on use and application
such as fuel quality (water and contaminants). The typical life expectancy of a
filter will be in the region of 30,000 liters.

10 The basic AXIAL DEPTH (oil) FILTER unit consists of a shaped 'cylindrical
seamless metal primary module' which can be manufactured to any given size
depending on its application and purpose. It features an outlet connection
fitting at the bottom of the unit and an inlet connection fitting at the top of the
unit.

15

AXIAL DEPTH (Hydraulic fluid) FILTER.

Used as a hydraulic oil filter, the AXIAL DEPTH FILTER works broadly in the
same manner as that described for a fuel filter with the difference that it
assists to keep fluid acid levels at acceptable levels. This promotes system
20 longevity by reducing equipment wear.

The AXIAL DEPTH FILTER has its own pressure reduction system and can
be fed from the most suitable pressure point of the hydraulic system. If the
pressure is higher than 1000KPA a pressure reduction valve must be used but
not lowered beyond 100KPA. Unlike the fuel filter, the outlet is returned to the
25 hydraulic fluid reservoir for recirculation. A typical filter change should take
place after ca. every 500 hours of system operation. Manufactures oil
analysis procedures must be adhere to and oil should be monitored and
changed when indicated by such analysis.

30 The AXIAL DEPTH (fuel) FILTER unit consists of a shaped 'cylindrical
seamless metal primary module' which can be manufactured to any given size
depending on its application and purpose. It features an inlet connection
fitting at the lower half side of the unit and an outlet connection fitting at the
top of the unit. A reusable-bleeding valve is positioned at the lowest point of
35 the filter .An inspection glass bowl is available.

The AXIAL DEPTH FILTER and its variants are maintenance free and are not re-usable. When a filter has reached its maximum operational life it must be disposed of and a new filter installed, however, the savings in fuel, machine operational performance, reduced emissions and other benefits far outweigh the basic cost of a filter.

10 Basic Configuration and Components of the fuel filter

The actual AXIAL DEPTH (fuel) FILTER component is encased in a METAL HOUSING (Page C). This outer casing is formed from aluminum (metal spun) to precise specifications and can be made from other suitably strong material e.g. new generation industrial polymers.

15 External service fittings are purpose positioned and vary dependent on the purpose to which a filter is put. The main fuel filter the INLET and locking disc (Page D fig. 10) and OUTLET (Page D fig.3) are positioned differently to these of an oil filter. A PERFORATED LOCATION DISC (Page D fig.6) is positioned below the fuel outlet fitting (Page D fig. 3) and LOCKING RING (Fig. 1)
20 encased in the SHAPING CONTROL DOME (Page D fig. 4) covering the top of the filter module.

The centre CORE (Page D fig.17) is held in the outer casing surrounded by the FILTER ELEMENT (Page D fig.8). The filter element and core assembly
25 are seated firmly on the lower rim inside the outer casing shored up by a PERFORATED LOCATION DISC (Page D fig.6). and DISC SPACER (Page D fig.9) assembly. Below, and separated by the DISC SPACER is a specifically perforated WATER SEPARATOR DISC (Page D fig. 6a). The center core features CORE PLUGS (Page D fig.7) on both ends of the filter core to
30 prevent fluid bypassing the filter. The WATER SEPARATOR ASSEMBLY (Page D fig.12) is positioned at the lowest point of the fuel filter casing ending with the Bleed VALVE (Fig. 13). Various smaller components such as O-rings, circlips and fittings complete the assembly. Although similar, OIL FILTERS (Page A fig. 2 & E) have fewer components and do not require the
35 Water Separator (illuminator) feature.

Basic Components of the Water Catchment Bowl

5 The WATER CATCHMENT BOWL assembly fits onto the bleed valve fitting at the lowest part of the fuel filter (Page D fig 11). The BOWL ASSEMBLY (Page F) shows the Bowl Location Plate (fig. 1) with a seal and threaded spigot . The Transparent Glass Inspection Bowl (fig. 3) is held in place by the Location Stem (fig. 4). The Location Stem has a number of orifices which
10 permits the collection and disposal of accumulated water when the Bleed Valve (fig.5) is opened.

Basic Configuration and Components of the oil filter

The actual AXIAL DEPTH (oil) FILTER component is encased in a METAL
15 HOUSING (Page E). This outer casing is also formed from aluminum (metal spun) to precise specifications and can be made from other suitably strong material e.g. new generation industrial polymers.

The main oil filter INLET FITTING (Page E fig. 3) and OUTLET FITTING and
20 locking disc (Page E fig.9) are positioned differently to these of an fuel filter. A PERFORATED LOCATION DISC (Page E fig.6) is positioned below the oil inlet fitting (Page E fig. 3) and LOCKING DISC (Page E fig. 1) encased in the SHAPING CONTROL DOME (Page E fig. 4) covering the top of the filter module. The FILTER CORE (Page E fig.8a) is held in the outer casing
25 surrounded by the FILTER ELEMENT (Page E fig.8). The filter element and core assembly are seated firmly on the lower rim inside the outer casing shored up by a PERFORATED LOCATION DISC (Page E fig.6). The center core features CORE PLUGS (Page E fig.7) on both ends of the filter core to prevent oil bypassing the filter. Various smaller components such as O-rings,
30 circlips and fittings complete the assembly.

AXIAL DEPTH FILTER dimensions are dependent on filter demands and are relative to other mechanisms such as engine size, pressure, load and output. Diameters, height and weight will vary according to designs and fitting

particular applications. Units from as small as a few centimeters across to
5 large units with great capacity can be constructed.

Water, purged during the filtering cycle, can be drained periodically from the
drain-cock, positioned at the bottom of the filter when deposited water is seen
in the Catchment Bowl assembly (Page D fig.12 & Page F)

10

The AXIAL DEPTH FILTER can be manufactured to any specifications and
any size depending on its final application. Materials used may vary
depending on the final utilization and intention, i.e. AXIAL DEPTH FILTER
used on land (Trucks and machinery) or at sea (boats and ships).

15

Installation.

The installation and use an AXIAL DEPTH FILTER is uncomplicated. The
filter is designed to attach perpendicular, to any suitable flat, vertical surface.
A specially designed filter clamp holder (Page A) secures the filter firmly in an
20 equipped position. These holding clamps or brackets are adapted to suit
varying applications in case of vibration or difficulty in positioning.

Because of its compactness the AXIAL DEPTH FILTER can be fitted
wherever sufficient, suitable space is available. After the filter is securely
25 positioned, the various pipeline and pressure hose connection can be made.

The length of the 'hose or pipe-line' depends on the AXIAL DEPTH Filter's
designed purpose (distance between engine, fuel-tank, reservoir etc. and
filter). In essence all hose connections vary considerably and are dependant
30 upon use and application. A filter used on a semi trailer will need different
connections, and pipe lengths, to that of a tractor or a motor yacht / boat.

The AXIAL DEPTH FILTER module is commonly used as a secondary 'in-line'
filter before the manufacturers primary filter. It can be installed on the
35 pressure or vacuum side of the fuel supplies line.

The AXIAL DEPTH FILTER are commonly fastened by the use of a filter strap assembly (Page A), or similar fastening method suitable for the intended application. If used on a truck, it may be positioned behind the driver's cab.

On machinery, tractors and the like, it may be best positioned where the operator can get best access to the unit.

When the AXIAL DEPTH FILTER has expired (satiated) and is exchanged with a new filter module the low point filter drain plug can be removed and re-installed on the replacement AXIAL DEPTH FILTER.

Unique Manufacturing technique.

Although the filter outer casing can be made from several different metals or other suitable materials the method described herein is that for aluminum metal spinning.

The outer casing (Pages A & G) is spun in the customary manner incorporating the pre-installed, necessary fittings (Page D). The walls extend beyond the height of the filter component inserts beyond the stepped section (Page H fig.1). After all Component items (Pages D & E) Are 'loaded' into the outer casing the Shaping Control Dome with fittings fitted (Page H fig.2) is firmly positioned onto the stepped section (Page H fig.3). The Shaping Control Dome becomes a permanently 'sealed-in-template' when the rest of the material is formed around the Shaping Control Dome into the final shape. By closely following the template shape, the fitting at the top of the filter is sealed permanently into the AXIAL DEPTH FILTER

To assist with understanding this invention reference will now be made to the accompanying drawings which depict one typical example of the invention:

Quick reference index to pages and principal parts.

10 **Page A (fig. 1) Shows the AXIAL DEPTH (fuel) FILTER** as it appears as a positioned unit including a separate mounting bracket.

(Fig. 2) Shows the AXIAL DEPTH (hydraulic oil) FILTER as it appears as a positioned unit including a separately available mounting bracket.

15 **Page B Shows an AXIAL DEPTH (oil) FILTER including Figs.1 to 6.**

Fig. 1 = Oil Inlet

Fig. 4 = Perforated DISC

Fig. 2 = Filter Element

Fig. 5 = Oil Outlet

Fig. 3 = Filter Outer Casing

Fig. 6 = Filter Core

20 **Page C Shows an AXIAL DEPTH (fuel) FILTER including Figs.1 to 8.**

Fig. 1 = Fuel Outlet

Fig. 5 = Fuel Inlet

Fig. 2 = Perforated Disc

Fig. 6 = Bleed Valve

Fig. 3 = Filter Element

Fig. 7 = Water Separator Disc

Fig. 4 = Perforated Disc

Fig. 8 = Filter Core

25

Page D Shows an exploded view of the inner components of a complete AXIAL DEPTH (fuel) FILTER including Figs. 1 to 12.

Fig. 1 = Locking DISC

Fig. 7 = Core Plug

Fig. 2 = O – Ring

Fig. 8 = Filter Element and Core

30 Fig. 3 = Fuel Outlet Fitting

Fig. 9 = DISC Spacer

Fig. 4 = Shaping Control Dome

Fig. 10 = Fuel Inlet Fitting

Fig. 5 = Circlip

Fig. 11 = Water Bleed Valve

Fig. 6 = Perforated DISC

Fig. 12 = Water Separator Assembly

Fig. 6a=Water separator disc

Fig. 13 = Bleed Valve (Drain Cock)

35

Page E Shows an exploded view of the inner components of a complete

5 **AXIAL DEPTH (oil) FILTER including Figs. 1 to 9**

Fig. 1 = Locking Disc

Fig. 6 = Perforated Disc

Fig. 2 = O – Ring

Fig. 7 = Core Plug

Fig. 3 = Inlet Fitting

Fig. 8 = Filter Element

Fig. 4 = Shaping Control Dome

Fig. 8a Filter Core

10 Fig. 5 = Circlip

Fig. 9 = Outlet Fitting

Page F Shows an exploded view of the Water Catchment Bowl - 1 to 5

Fig. 1 = Bowl Location Plate

Fig. 4 = Location Stem

Fig. 2 = Seal

Fig. 5 = Bleed Valve (Drain Cock)

15 Fig. 3 = Glass Inspection Bowl

Page G (Fig. 1) Shows a schematic view of an AXIAL DEPTH (oil) FILTER.

(Fig. 2) Shows a schematic view of an AXIAL DEPTH (fuel) FILTER.

20 **Page H Shows a side view of an AXIAL DEPTH FILTER illustrating the upright extended, residual metal and the spinning progression of the final metal forming of the upper part of the casing over the shaping control dome into a finished seamless outer envelope, or casing including Figs. 1 to 3.**

Fig. 1 = Yet to be formed metal casing

25 Fig. 2 = Shaping Dome complete with fitting

Fig. 3 = Seat for Shaping Dome

30

35

The claims defining the invention are as follows:

5 1/ The AXIAL DEPTH FILTER is of superior methodology in removing free water and other impurities and contaminants from fuels and oils.

2/ The AXIAL DEPTH FILTER is made using a unique manufacturing metal spinning method resulting in an entirely seamless filter housing without
10 welds or other fastening devices.

3/ The AXIAL DEPTH FILTER is inexpensive, cost effective and exceptionally efficient and can be utilized in numerous situations and in unlimited variations on land and at sea.

15

4/ The AXIAL DEPTH FILTER is manufactured from readily available durable basic materials to withstand the rigors of application and demands put on the unit.

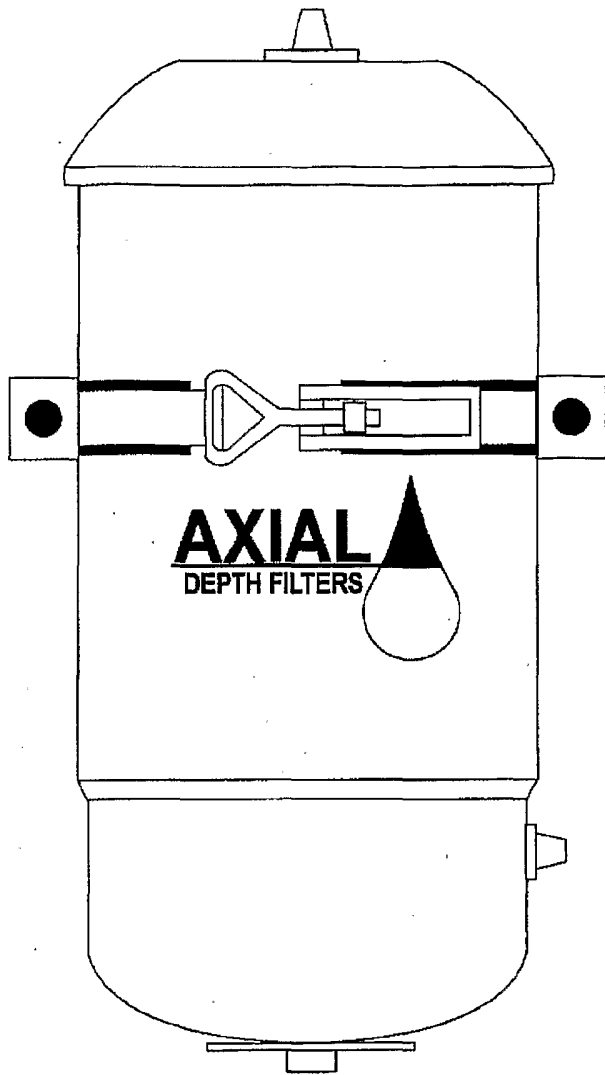


FIG 1.

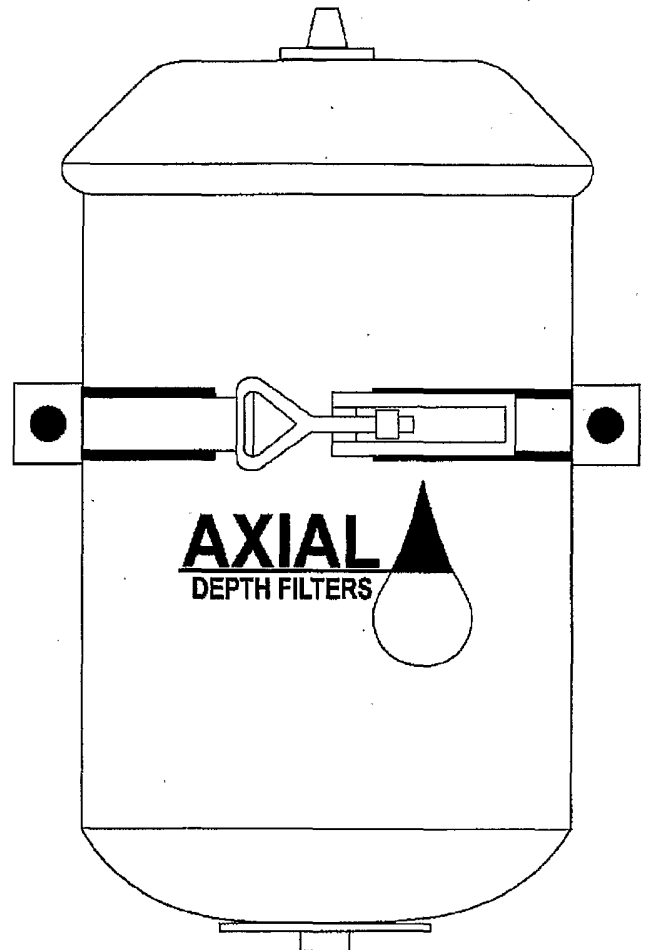
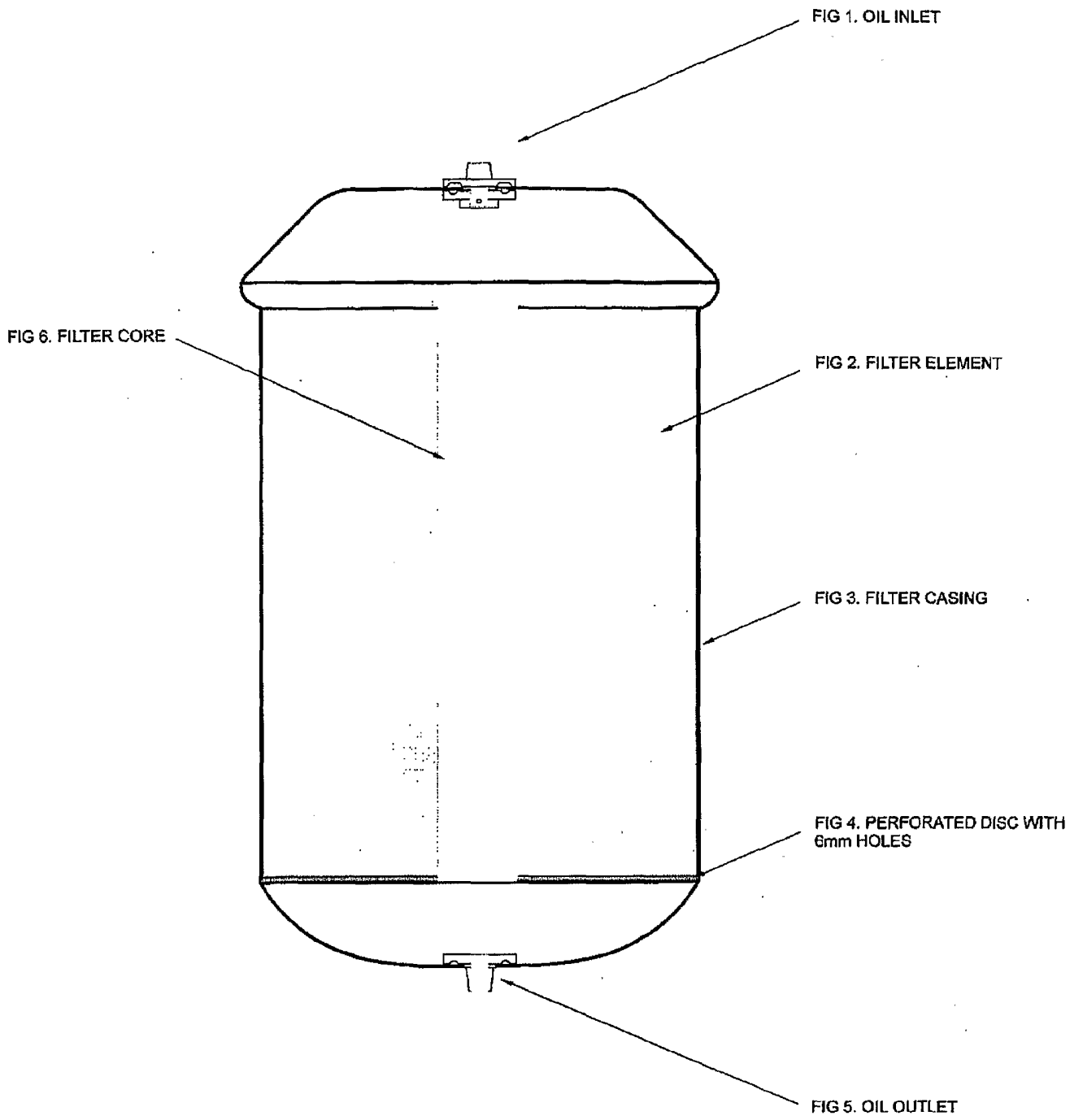
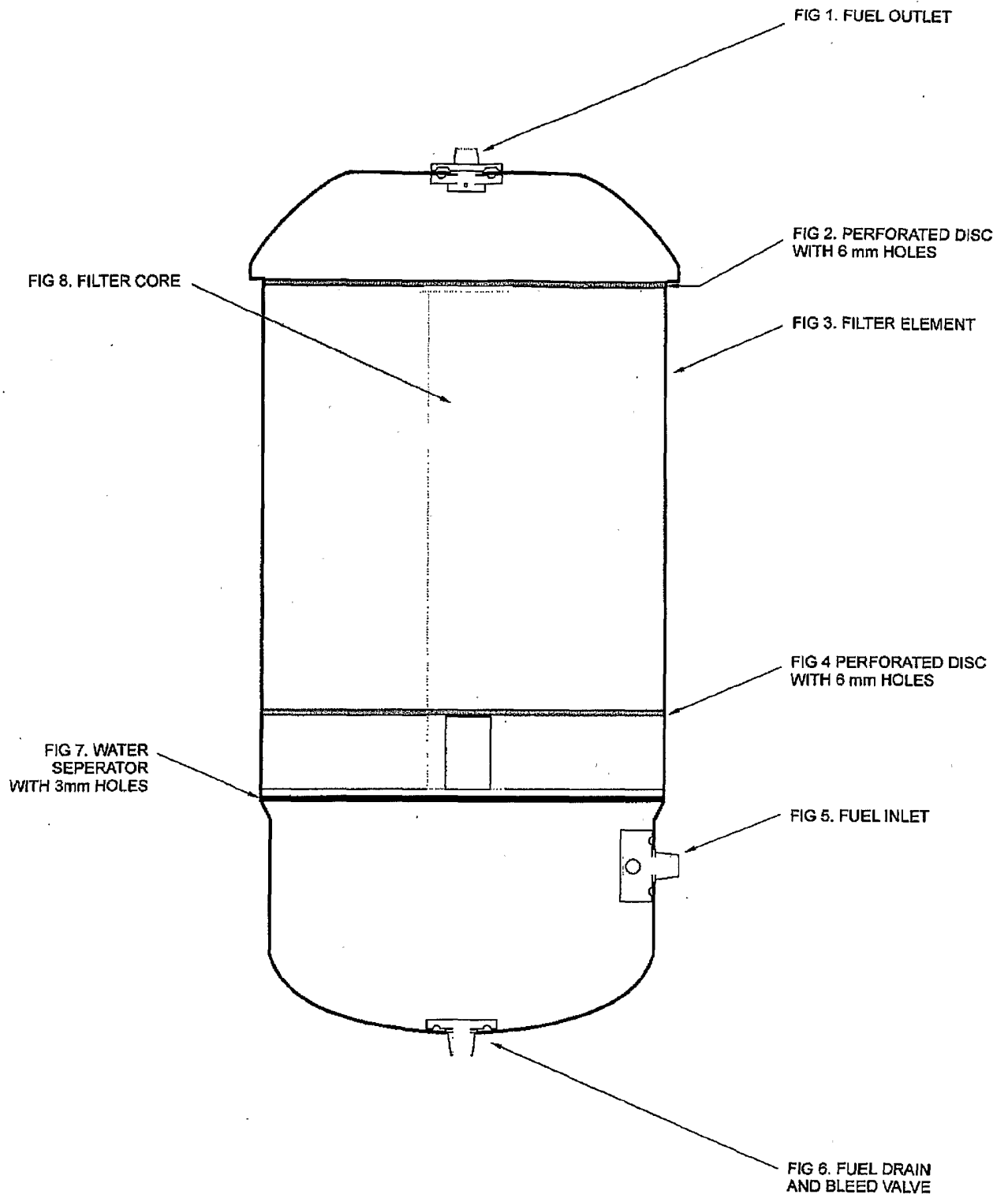
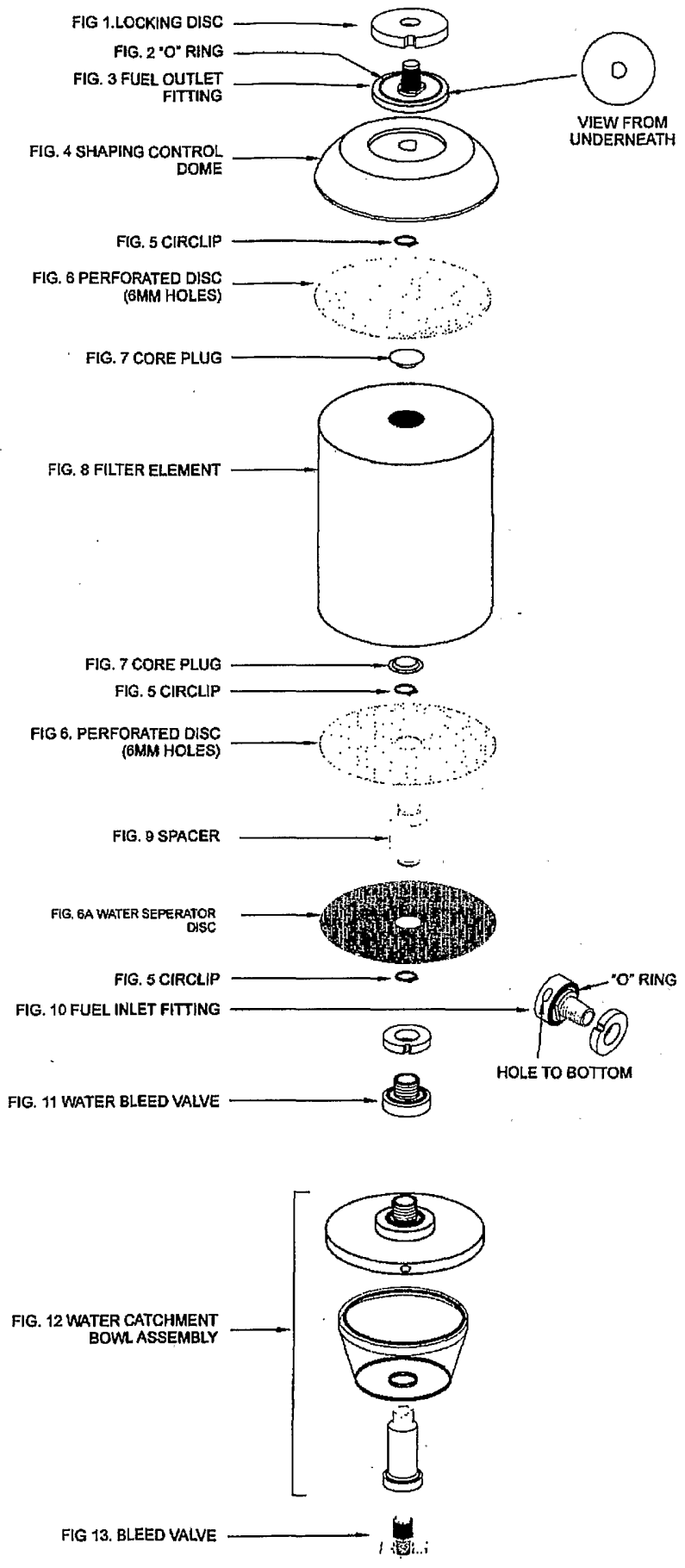
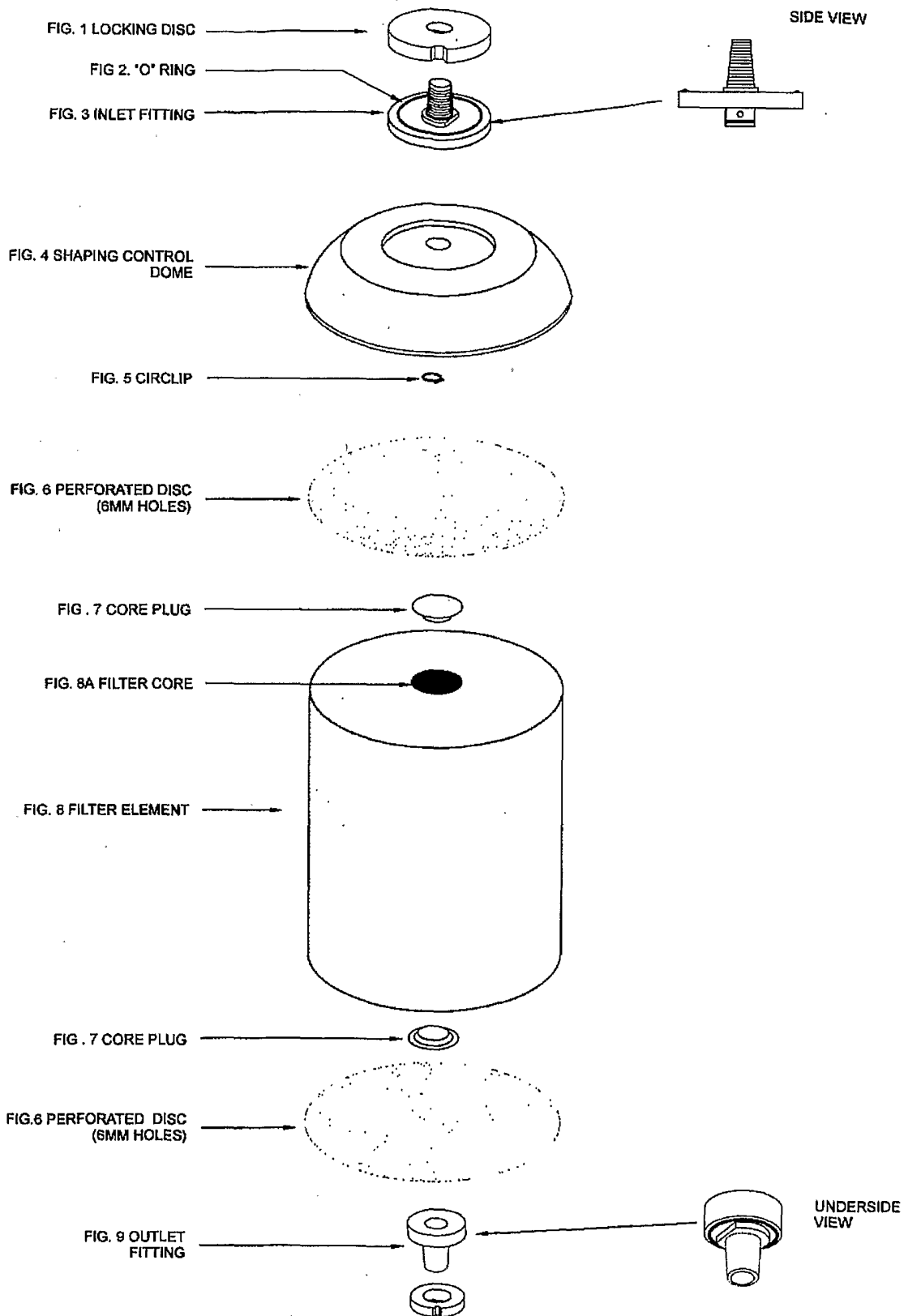


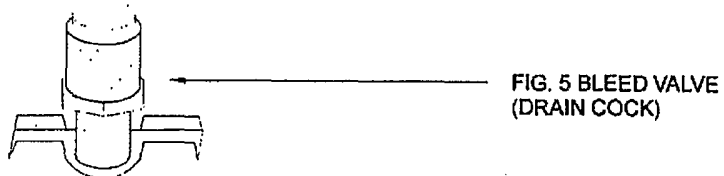
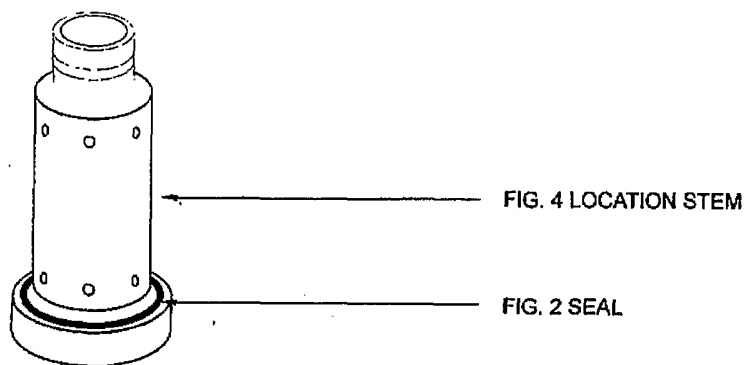
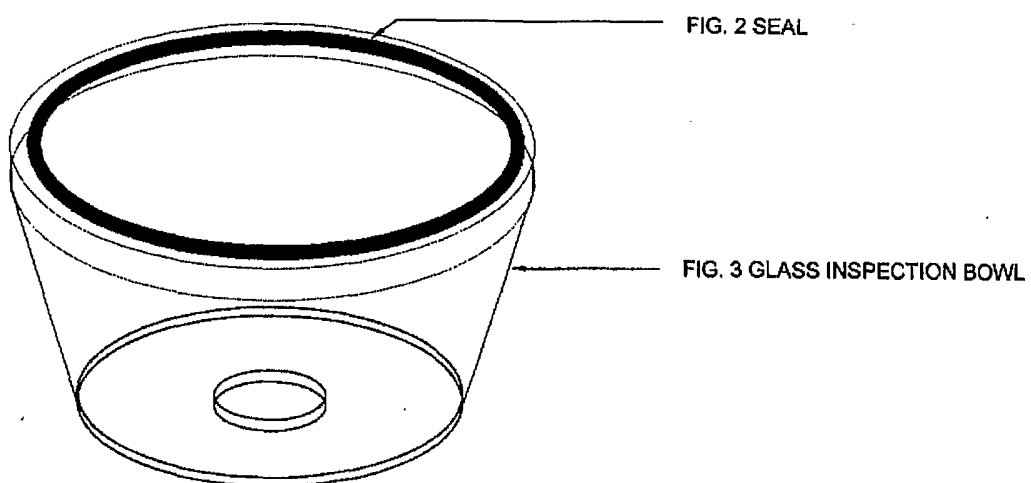
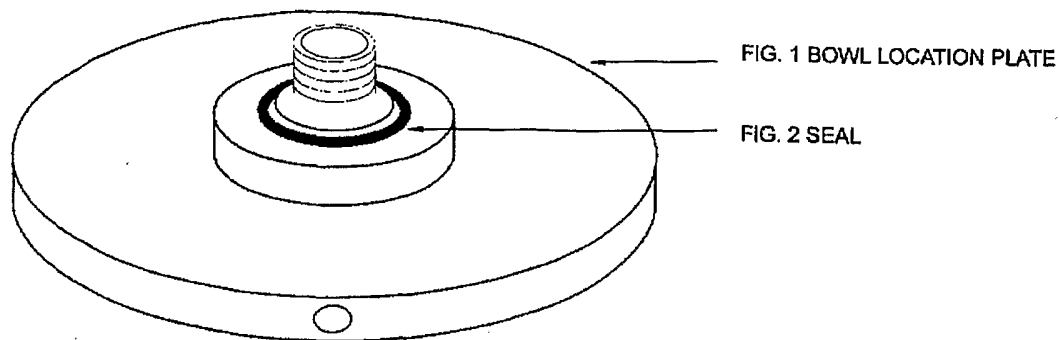
FIG 2.











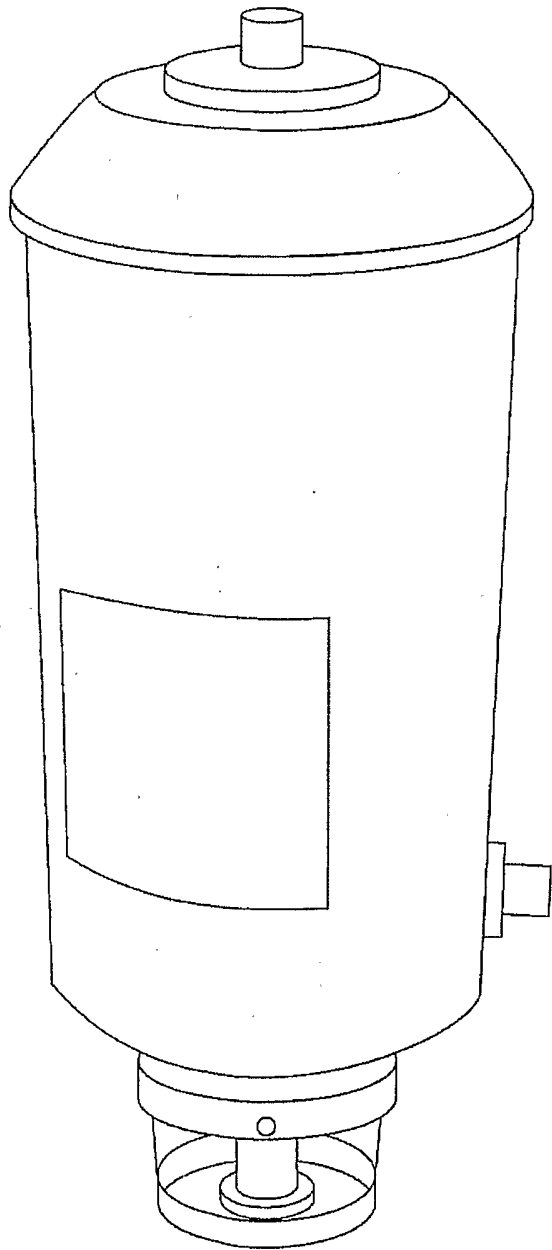


FIG. 2

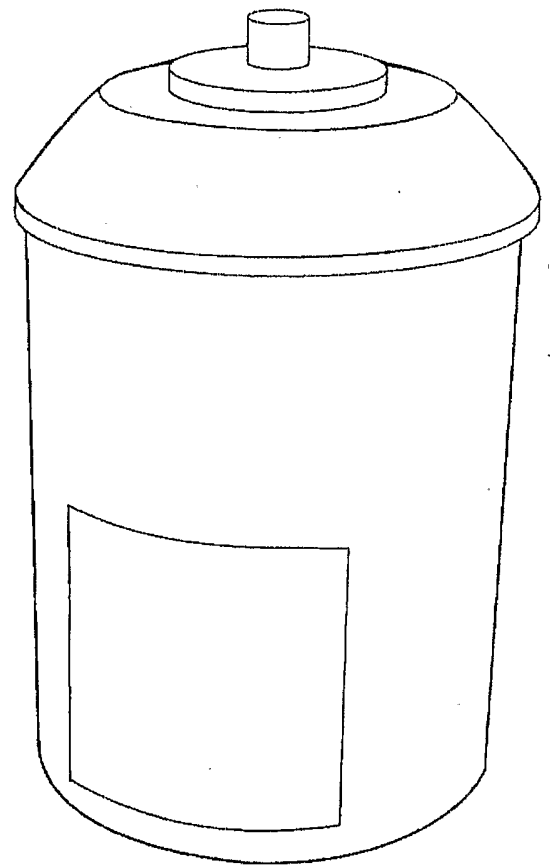
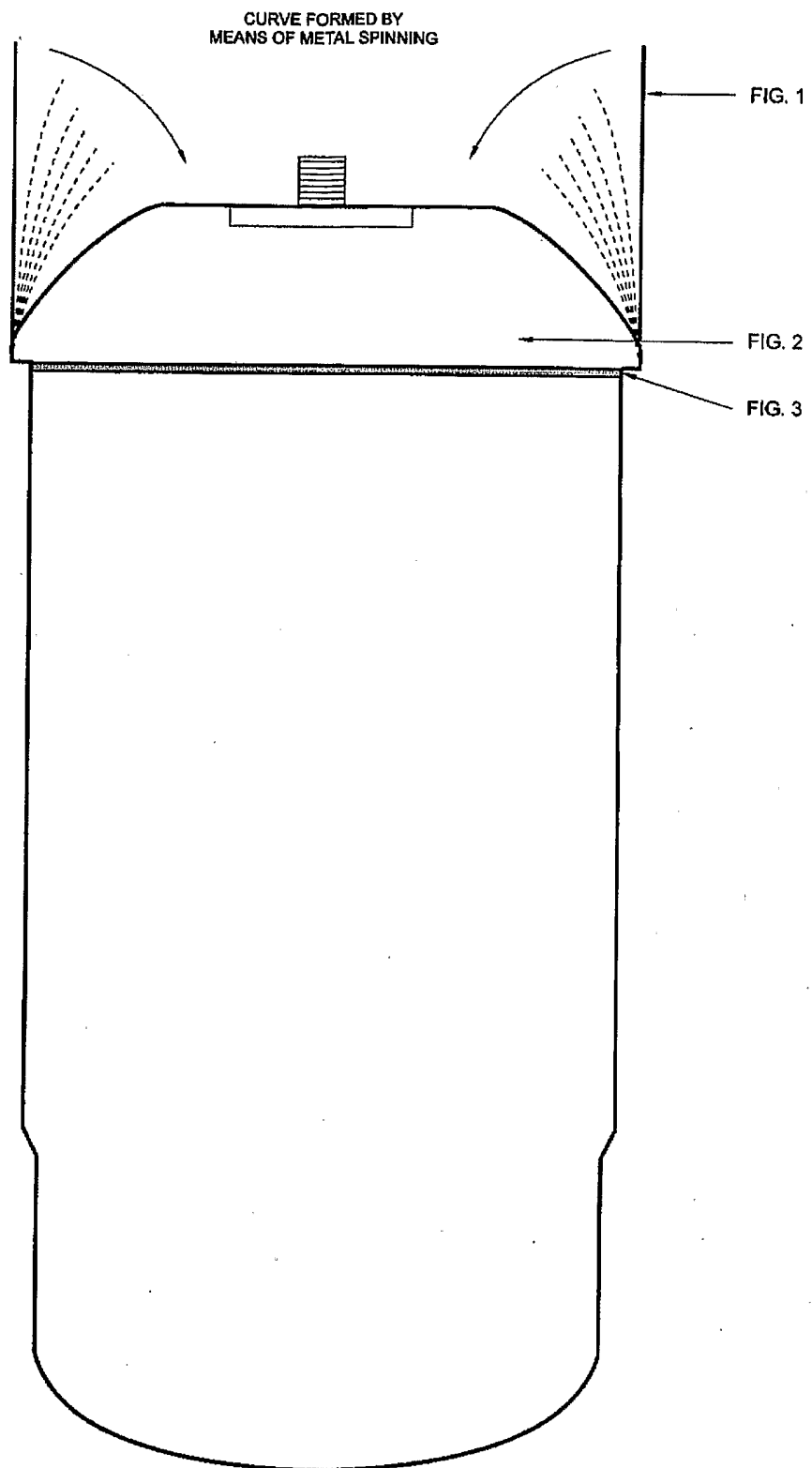


FIG. 1



INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU2004/000183

A. CLASSIFICATION OF SUBJECT MATTER		
Int. Cl. 7: B01D 27/08		
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) IPC7 B01D 27/08		
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) DWPI + KW((INLET+ OR OUTLET) AND SEAMLESS)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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X,Y	EP,A,1281425 (ROBERT BOSCH GMBH) 5 February 2003 See whole document	1-4
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<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C <input checked="" type="checkbox"/> See patent family annex		
* "A"	Special categories of cited documents: document defining the general state of the art which is not considered to be of particular relevance	"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
"E"	earlier application or patent but published on or after the international filing date	"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
"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)	"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
"O"	document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"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 19 May 2004		Date of mailing of the international search report: 25 MAY 2004
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaaustralia.gov.au Facsimile No. (02) 6285 3929		Authorized officer M.R. OLLEY Telephone No : (02) 6283 2143

INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU2004/000183

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
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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.
X,Y	US,A,4125469 (HENTON et al) 14 November 1978 See whole document	1-4

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/AU2004/000183

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report	Patent Family Member
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EP 1281425	DE 10138122
EP 1316347	DE 10158570
EP 0393393	DD 296989
WO 03004128	CA 2452010 EP 1412048
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Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.	
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