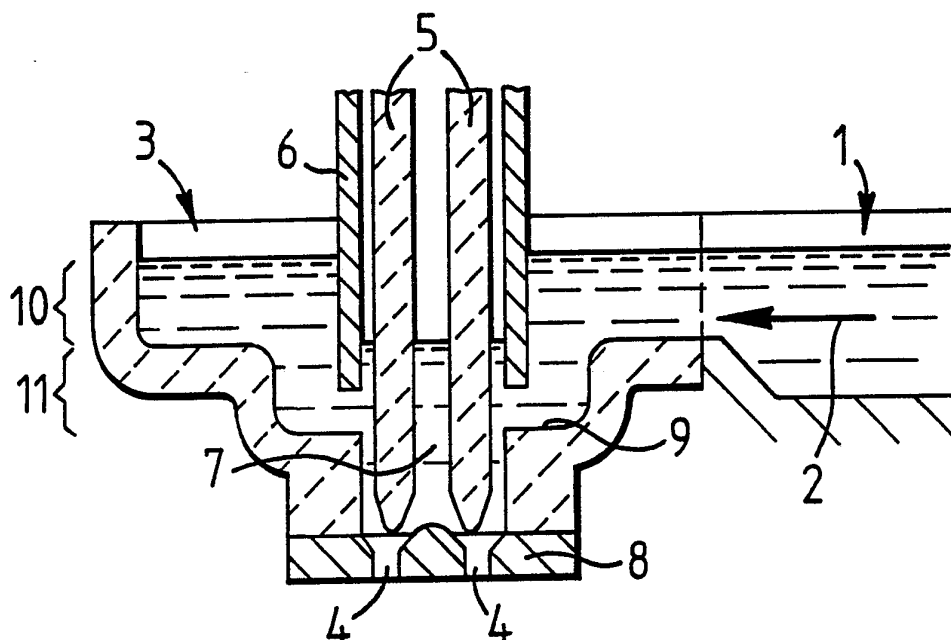




INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 : C03B 7/09	A1	(11) International Publication Number: WO 92/20630 (43) International Publication Date: 26 November 1992 (26.11.92)
(21) International Application Number: PCT/GB92/00895 (22) International Filing Date: 18 May 1992 (18.05.92) (30) Priority data: 9110807.6 17 May 1991 (17.05.91) GB (71) Applicant (for all designated States except US): BH-F (ENGINEERING) LIMITED [GB/GB]; 174 Milton Park, Abingdon, Oxon OX14 4SE (GB). (72) Inventor; and (75) Inventor/Applicant (for US only) : STANLEY, George, Michael [GB/GB]; 12 St. Peters Road, Dunstable, Bedfordshire CU5 4HY (GB). (74) Agent: GALLAFENT & CO.; 8 Staple Inn, London WC1V 7QH (GB).		(81) Designated States: AT (European patent), AU, BE (European patent), CA, CH (European patent), CS, DE (European patent), DK (European patent), ES (European patent), FR (European patent), GB (European patent), GR (European patent), IT (European patent), JP, KR, LU (European patent), MC (European patent), NL (European patent), SE (European patent), US. Published <i>With international search report.</i> <i>With amended claims and statement.</i>

(54) Title: GLASS FEEDERS**(57) Abstract**

A basin (3) for the forehearth of a glass-making furnace has its internal volume divided into upper (10) and lower (11) portions by means of an annular shoulder, with the horizontal cross-sectional area of the upper portion being significantly greater than that of the lower portion. The base of the basin (3) has in it a glass-discharge outlet (4). When in use, the outlet (4) has aligned with it a relatively-movable cylinder (6) acting as a flow-metering valve. The cylinder (6) may be rotated about its axis at a constant or adjustable speed, or it may be non-rotary and have a separately-driven stirrer movable about it to prevent or reduce the formation of stagnant areas.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	FI	Finland	MI	Mali
AU	Australia	FR	France	MN	Mongolia
BB	Barbados	GA	Gabon	MR	Mauritania
BE	Belgium	GB	United Kingdom	MW	Malawi
BF	Burkina Faso	GN	Guinea	NL	Netherlands
BG	Bulgaria	GR	Greece	NO	Norway
BJ	Benin	HU	Hungary	PL	Poland
BR	Brazil	IE	Ireland	RO	Romania
CA	Canada	IT	Italy	RU	Russian Federation
CF	Central African Republic	JP	Japan	SD	Sudan
CG	Congo	KP	Democratic People's Republic of Korea	SE	Sweden
CH	Switzerland			SN	Senegal
CI	Côte d'Ivoire	KR	Republic of Korea	SU	Soviet Union
CM	Cameroon	LI	Liechtenstein	TD	Chad
CS	Czechoslovakia	LK	Sri Lanka	TG	Togo
DE	Germany	LU	Luxembourg	US	United States of America
DK	Denmark	MC	Monaco		
ES	Spain	MG	Madagascar		

- 1 -

GLASS FEEDERS

This invention relates to glass feeders and, in particular, to feeder arrangements for feeding molten
5 glass from a furnace forehearth to one or more processing stations where the molten glass is converted into useful objects, for example, bottles and jars.

10 In the production of glass objects, particularly the mass production of bottles and jars, on a continuous basis, it is of considerable importance to be able to control the characteristics of the glass as it leaves the furnace and moves towards an appropriate forming unit, for example an independent section container forming machine of known
15 type.

It is well appreciated that major problems can arise in terms of consistency of manufacture if great care is not taken to operate under homogeneous and effectively
20 invariant conditions. The problem, however, is that the attainment of such conditions is particularly difficult to achieve.

Conventionally, glass is manufactured by charging the raw

- 2 -

materials into one end of an essentially elongate furnace while applying heat, for example from oil burners, to heat the raw materials and fuse them together to form a glassy mass. The glassy mass moves away from the ingredient feed point, down the furnace, gradually becoming more and more homogeneous. It then flows, very slowly since it is very viscous, into a number of channels, perhaps as many as six or eight in a large furnace, known as forehearth and at the end of each channel there is located in the floor of the channel an aperture through which molten glass is discharged.

By ensuring a sufficient length of forehearth, and by applying appropriate insulation and/or heating, it is possible to ensure that, by the time the glass reaches the end of the forehearth and is ready for discharge, it is relatively free of bubbles and has a relatively stable internal pattern of temperature and viscosity. It is not, however, easy to ensure that discharge from the forehearth is always even.

A major problem arises from the fact that the glass, when discharged, must be in a highly viscous state, so that it may be moulded and, at the same time, cooled such that as it is moulded to its final shape, it has cooled to a temperature at which it is effectively sufficiently rigid to maintain that shape during subsequent cooling and annealing steps. Because the glass on discharge to the forehearth is highly viscous, and because, in any event, it moves very slowly, attempts to control the precise temperature and homogeneity of the emergent glass are fraught with difficulty.

In order to be able to control the overall flow of glass

- 3 -

from the forehearth, it is a known practice to provide located above the aperture or apertures in the forehearth through which molten glass may pass, a metering cylinder which may be lowered on to the forehearth floor to
5 prevent glass flow, and may be raised to permit glass to flow under its edge and through the aperture or apertures in the forehearth floor. In operation, such a cylinder may be rotated about its axis when it has been raised a little way from the forehearth floor, and such rotation
10 can assist in homogenising the glass, but only to a limited extent. Alternatively, the cylinder may be stationary, and other stirring members moved in the glass to promote an homogeneous glass condition within the region above the aperture(s). Actual discharge of the
15 molten glass through the aperture is conventionally achieved by the use of one or more vertically reciprocating plungers above the aperture(s) which act to form successive gobs of glass below the aperture which are cut off by synchronised shears to fall into a chute
20 and be transported to a forming station.

Such a system is disclosed, for example, in US 3 133 803, and, in addition, in that case flow may be adjusted by the use of a vertically-adjustable skimmer block set in
25 the roof of the forehearth and which acts as a gate under which molten glass flows before running across a shallow land and down an inclined wall set to one side of a well into which the glass then flows and which surrounds the metering cylinder and gob plunger, and in which a shallow
30 layer of molten glass forms. The glass is spread out in an attempt to render it more easily heatable or coolable, but such spreading out leads to problems of uneven flow and possible bubble entrainment.

- 4 -

Such an approach using a thin glass layer is unconventional, and has not been adopted widely in practice. In contrast, conventionally, the depth of glass in a forehearth is 100 to 160 mm, this depth being
5 a compromise between making the forehearth sufficiently shallow that the temperature of the glass passing through it can be quickly controlled with little thermal lag, and making the forehearth deep enough to enable sufficient glass to flow along it. The discharge end of the
10 forehearth is conventionally even deeper, for example 200 to 350 mm, giving a reservoir of glass of supposedly even characteristics from which gobs are successively drawn.

We have now found surprisingly that substantially
15 improved homogeneity, together with improved possibilities for glass condition control, may be achieved by specifically designing the shape of the discharge end of the forehearth.

20 Thus, according to a first feature of the present invention, there is provided a glass furnace forehearth output end comprising a basin designed in use to be full of molten glass and having substantially at the centre of its base one or more glass discharge apertures, and
25 wherein the internal surface of the basin has a substantially annular shoulder notionally dividing the basin vertically into a lower section and an upper section, the horizontal cross sectional area of the lower section being substantially less than that of the upper
30 section, and the transition between the two sections occurring at a level designed to be substantially half way down the maximum depth of glass in the basin during use.

- 5 -

Such a pouring basin may be used in conjunction with a cylindrical control member as described above which may, if desired, be rotated.

- 5 In the use of such a basin, it is found that the consistency of the output of molten glass from the orifices in the floor of the basin, whether that output be a continuous flow or in the form of successive gobs, is substantially improved with respect to conventional
10 known arrangements. The exact reasons for this are not clear, but it appears that treatments designed to assist in conditioning the glass and rendering it homogeneous in the forehearth continue to operate on the larger surface area upper region of molten glass, while in the lower,
15 relatively much smaller cross sectional area, section, a rapid, homogenised effectively helical flow of glass downwardly is achieved without difficulty. The flow is helical if the tube is rotated.
- 20 Because of the relatively small volume of the lower section (and the correspondingly short passage time therein for the molten glass) it is believed that inhomogeneities do not have a chance to build up and the resulting outflow shows a high degree of consistency
25 leading to easier operation and, in particular, fewer reject items.

The present invention may be applied to feeding units both for continuous feed of molten glass and intermittent
30 feed. It is of particular value in glass feeder arrangements where, within the rotating cylinder, are located one or more axially reciprocable gob plungers which cooperate with one or more corresponding apertures in the base of the forehearth to generate a train of

- 6 -

successive gobs of molten glass which are passed to successive stations in a glass container forming machine or the like.

5 The detailed construction of the pouring basin in accordance with the present invention may vary very widely and will vary with the particular installation, type of glass, desired feed rate and the like. However, it is possible to make some general observations relating
10 to the construction.

First of all, the basin may be of monolithic construction or made up by assembling a number of refractory shapes together. Monolithic constructions are preferred and
15 according to a specific feature of the present invention, there is provided a glass-pouring basin having an open top and an apertured base, the top having a lateral inlet for connection to a forehearth, and the internal volume of the basin being notionally divided into an upper
20 larger horizontal cross-sectional area section of substantially the same depth as the forehearth channel and, divided therefrom by a region of the inner wall of the basin, having in vertical section a convex shape, a lower substantially-smaller horizontal cross-sectional
25 area section, the vertical depth of the lower section being substantially equal to that of the upper section. The shape of the wall of the basin in section may vary from three distinct lines, two vertical and one horizontal, with a squarish shoulder or knee dividing the
30 upper from the lower section of the basin, to a smoother curve including an inflexion between an upper concave section starting near the top of the basin and a lower convex section terminating at the floor of the basin.

- 7 -

By substantial equality in connection with the vertical depths of glass in the two sections is not meant a mathematical equality but rather a general approximate equality, though this can itself vary within relatively wide limits. Indeed, it may not be particularly clear exactly where the lower section merges into the upper, particularly if the wall has not got a clearly defined annular shoulder but, for example, a sloping shoulder. Generally speaking, the transition from the upper to the lower region will occur at 40 to 60 percent of the total glass depth in the basin in use.

If desired, associated with the upper part of the basin (though they may also be provided for the lower smaller horizontal cross sectional area section) there may be glass condition sensors, for example temperature or viscosity sensors, and/or means to temper or condition the glass, for example heating means or particular insulation means.

The invention is illustrated by way of example with reference to the accompanying drawings in which:

Figure 1 is a typical diagrammatic section through the end of a forehearth in accordance with known feeder design;

Figure 2 is a view corresponding to Figure 1 but showing the end of the forehearth provided with a basin in accordance with the present invention;

Figures 3 and 4 are respectively known and inventive structures, again illustrated diagrammatically, for a feeder designed to have a higher throughput of molten

- 8 -

glass than those shown in Figures 1 and 2 respectively.

Referring to the drawings, like reference numerals are used throughout to denote like parts. Thus common to all
5 four structures is a refractory lined forehearth 1 through which molten glass flows in the direction of the arrow 2 towards a feeder. At its end, the feeder is constructed as a refractory lined or monolithic basin 3 having in its base 9 a glass-discharge outlet 7 closed in
10 turn by a closure member 8 having in it one or more apertures 4 through which glass may stream, or gobs of glass may be pressed by means of a vertically reciprocating pair of gob plungers 5 actuated by means not illustrated in the drawing. For the sake of clarity,
15 the top structure, which is conventionally located above the feeder and which may, for example incorporate heating means, has been omitted.

Surrounding the plungers is a refractory hollow metering
20 cylinder 6 which is slowly rotated and which may be raised and lowered to leave a gap between its lower end and the floor of basin 3 when it is desired to dispense and adjust the flow of glass through the outlet apertures.

25 The known structure of Figure 1 does not lead to particularly homogeneous output from the apertures. However, when, in accordance with the present invention, the basin is divided into an upper portion 10 and a lower
30 smaller cross-sectional area portion 11, it is surprisingly found that improved results are obtained. Preliminary experiments with structures in accordance with the invention have shown that the molten glass tends to flow gently and homogeneously through the forehearth

- 9 -

channel into the top portion of the basin maintaining good homogeneity and is then rapidly and symmetrically moved down in the annular space between the cylinder 6 and the outer walls of the lower portion of the basin as molten glass is drawn through the apertures. With the gob feeder arrangement shown, the glass has only a relatively short dwell time in the lower space between the basin wall and the rotating cylinder, so it stays homogeneous while it is formed into gobs and ejected through the apertures 4.

A particular advantage of the basin design in accordance with the present invention is that it may be operated in simple fashion to avoid the formation of large and essentially stagnant volumes of molten glass. These tend to form in the upper regions of known pouring basins, and lumps of relatively more viscous glass can tend to break off from the stagnant regions and become entrained in, but not homogeneously mixed with, the glass as it flows out of the basin, thus leading to inhomogeneities in the products made from the glass. We have found that such problems may be minimised or alleviated entirely when operating with a basin in accordance with the present invention by regularly varying the rotational speed of the refractory cylinder and hence moving the location of the stagnant region. The effect is enhanced if the upper portion of the refractory cylinder which is located in the upper section of the basin is of larger diameter than the lower portion thereof located in the lower section of the basin.

Further advantages of the basin structure of the present invention consist in the availability of a relatively larger upper surface area for temperature control of the

- 10 -

body of glass in the basin compared to the volume of the basin itself as contrasted with known basin designs. The narrower lower region, however, lends itself to fine temperature control, for example achieved by the provision of extra insulation or extra heating, thus improving the overall controllability of the glass dispensing process at the output end of the forehearth.

The basic design according to the present invention provides the advantages outlined above when used in connection with fixed cylinder/separate stirrer arrangements as well as with the rotating cylinder arrangement illustrated.

The detailed geometry and geometrical ratios may be varied widely without departing from the scope of the present invention. In contrast to the prior art basins, which were not divided into upper and lower regions, clearly distinct from one another, the present invention, by providing that division, provides a considerably improved homogeneity of glass output together with enhanced control possibilities.

It is within the purview of the present invention for the basin to be made and sold as a separate product. This permits it to be retro-fitted on to the forehearth of an existing furnace. The manner in which the basin could be connected to a forehearth does not form part of the subject-matter of this invention, and so will not be described herein in any greater detail.

- 11 -

CLAIMS

1. A dispenser basin for the forehearth of a glass-making furnace and intended to be full of glass when
5 in use, the basin having in its base a glass-discharge outlet, and having in its internal surface a substantially-annular shoulder notionally dividing the basin volume vertically into a lower portion and an upper portion, in which the lower portion has a
10 horizontal cross-sectional area which is substantially less than that of the upper portion, and in which the depth of the shoulder from the intended free surface of the glass in the basin is about half the depth of glass in the basin during
15 use.
2. A basin as claimed in Claim 1, in which the walls of its lower portion are substantially concentric with the discharge outlet.
20
3. A basin as claimed in Claim 2, in which the horizontal cross-section of the lower portion changes little with depth.
- 25 4. A basin as claimed in any preceding claim, in which the discharge outlet is adapted to be closed by a closure member having in it at least one aperture of cross-sectional area smaller than that of the outlet.
- 30 5. A basin as claimed in any preceding claim, in position on the forehearth of glass-making furnace, and having associated with it a vertically-movable hollow metering cylinder substantially coaxial with

- 12 -

the axis of the said outlet.

6. A basin as claimed in Claim 5, including means for rotating the cylinder about its axis.
- 5 7. A basin as claimed in Claim 6, in which the rotary driving means is adapted to rotate the cylinder at an adjustable or variable speed.
- 10 8. A basin as claimed in any of claims 5 to 7, in which the cylinder circumscribes one axially- and vertically-reciprocable plunger for each aperture in the closure plate.
- 15 9. A basin as claimed in any of Claims 5 to 8, in which the metering cylinder has an upper and a lower portion when in use, with the lower portion being of smaller diameter than the upper portion and the lower portion of the metering cylinder being
20 intended to be circumscribed by the lower portion of the basin when in its operative position.

AMENDED CLAIMS

[received by the International Bureau on 2 October 1992 (02.10.92);
original claims 1,5 and 6 replaced by amended claim 1; claims 2,3 and 4 unchanged;
original claim 8 cancelled; original claims 7 and 9 replaced by claims 5 and 6
(2 pages)]

1. A dispenser basin for the forehearth of a glass-making furnace and intended to be full of glass when in use, the basin having in its base a glass-discharge outlet, and having in its internal surface a substantially-annular shoulder notionally dividing the basin volume vertically into a lower portion and an upper portion, in which the lower portion has a horizontal cross-sectional area which is substantially less than that of the upper portion, and in which the depth of the shoulder from the intended free surface of the glass in the basin is about half the depth of glass in the basin during use, and a sleeve in the upper portion of the basin, characterised in that the sleeve constitutes a metering cylinder which projects downwardly into the lower portion of the basin, and is movable vertically whereby the gap of adjustable width between the bottom of the sleeve and the base of the basin functions as a metering orifice.
2. A basin as claimed in Claim 1, in which the walls of its lower portion are substantially concentric with the discharge outlet.
3. A basin as claimed in Claim 2, in which the horizontal cross-section of the lower portion changes little with depth.
4. A basin as claimed in any preceding claim, in which the discharge outlet is adapted to be closed by a closure member having in it at least one aperture of cross-sectional area smaller than that of the

outlet.

5. A basin as claimed in any preceding Claim, including means for rotating the metering cylinder at an adjustable speed.
6. A basin as claimed in any preceding Claim, in which the metering cylinder has an upper and a lower portion, with the lower portion being of smaller diameter than the upper portion, and the lower, narrower, portion of the cylinder being intended to be circumscribed by the lower portion of the basin when in its operative position.

STATEMENT UNDER ARTICLE 19

The claims of this application have been amended into the two-part format required under the PCT. The introduction of claim 1 has been based on the disclosure in US 2 969 614 cited in the search report. This citation shows an agitator sleeve or tube of fixed length in the upper part of a forehearth, the sleeve being able to be rotated at a fixed speed.

This specification does not disclose the provision of a metering cylinder of such a length that it extends into the lower portion of the dispenser basin by such a distance that its lower end co-operates with the floor of the basin to function as a metering orifice. These features were the subject-matter of the claims 5 and 6, which have now been incorporated in the amended claim 1.

1/2

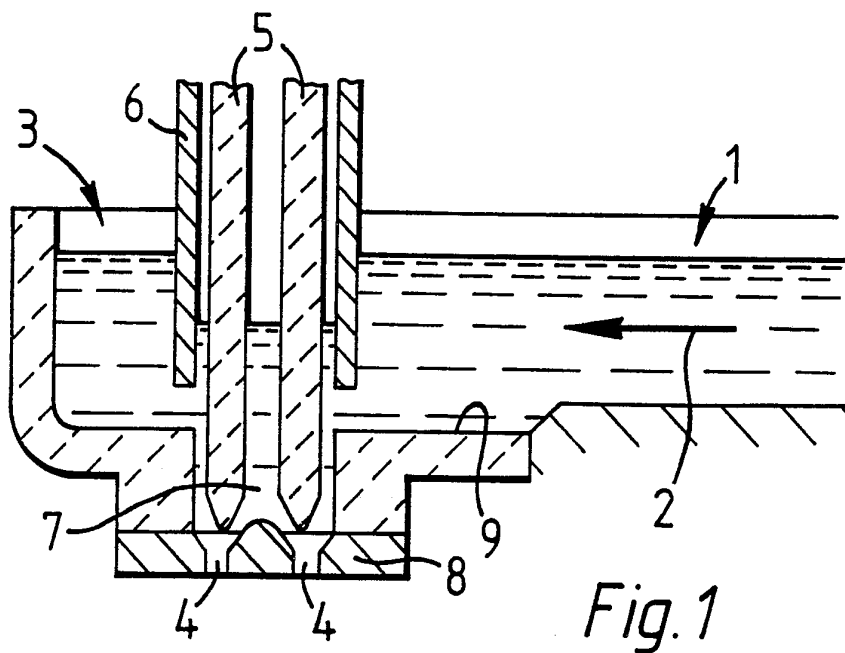


Fig. 1

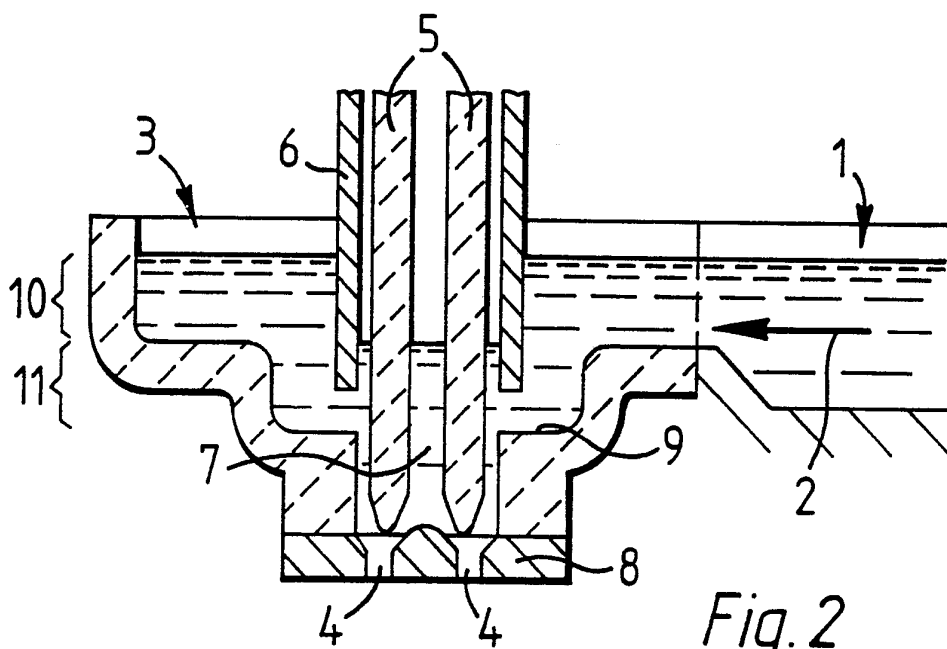


Fig. 2

2/2

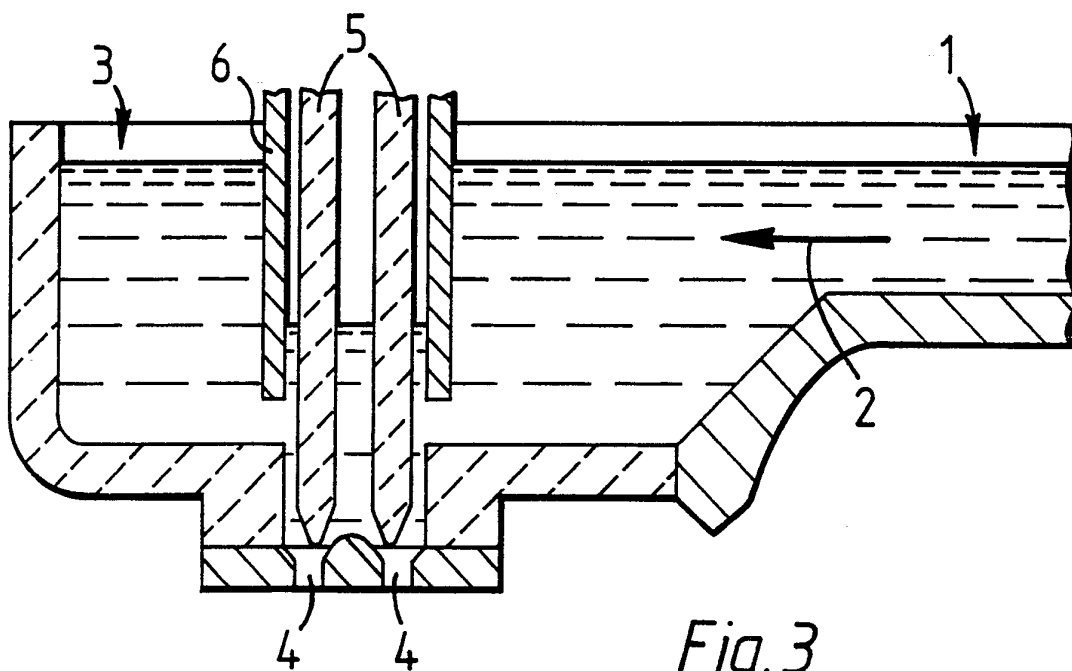


Fig. 3

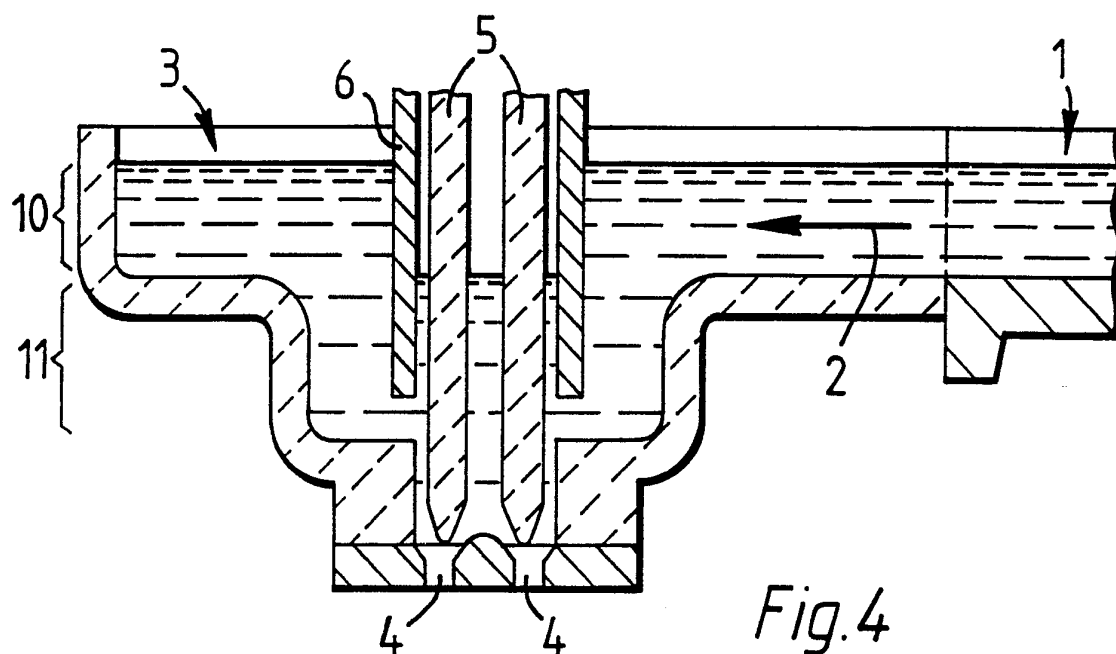
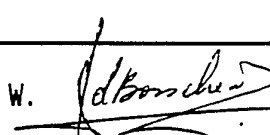


Fig. 4

INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 92/00895

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶		
According to International Patent Classification (IPC) or to both National Classification and IPC		
Int.Cl. 5 C03B7/09		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁷		
Classification System	Classification Symbols	
Int.Cl. 5	C03B	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁸		
III. DOCUMENTS CONSIDERED TO BE RELEVANT⁹		
Category ¹⁰	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
X	US,A,2 969 614 (STEWART) 31 January 1961 see the whole document ----	1,2
X	US,A,2 010 334 (STEWART) 6 August 1935 see the whole document ----	1-3
A	US,A,3 133 803 (DENMAN) 19 May 1964 see the whole document ----	1
¹⁰ Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "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) "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 "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 "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step "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. "&" document member of the same patent family		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	
22 JULY 1992	31. 07. 92	
International Searching Authority	Signature of Authorized Officer	
EUROPEAN PATENT OFFICE	VAN DEN BOSSCHE W. 	

**ANNEX TO THE INTERNATIONAL SEARCH REPORT
ON INTERNATIONAL PATENT APPLICATION NO. GB 9200895
SA 59487**

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information. 22/07/92

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A-2969614		None	
US-A-2010334		None	
US-A-3133803		None	