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(54) **Boilers.**

(57) A boiler having a main heat exchanger (1) for heating water to be circulated under control of a diverter valve (4) through either a central heating system or a plate heat exchanger (2) for heating domestic hot water, is provided with an expansion vessel (3) including gas and water chambers (15, 16) separated by a diaphragm. The water chamber includes inlet ports (7, 8) for receiving returning circulated water from the plate heat exchanger (2) and the central heating system ; and an outlet port (21) communicating with a pump chamber having a discharge port (24) connected to the inlet of the main heat exchanger. Thus, circulating water passes through the water chamber of the expansion vessel which serves as a manifold allowing simplification of the pipework within the boiler.

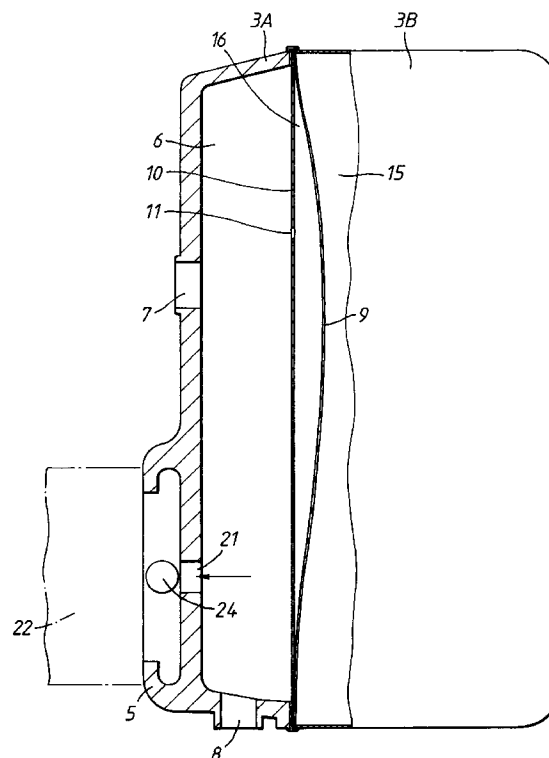


Fig.5

This invention relates to boilers of the kind having an expansion vessel and suitable for sealed, i.e. non open vented, water systems. In particular, the invention is concerned with expansion vessels, especially but not necessarily exclusively, suitable for use in the type of boiler unit known as a "combination boiler unit" and capable of providing hot water both for central heating and for consumption without need for hot water to be stored to be ready on demand.

Expansion vessels are required in sealed hot water central heating systems to accommodate expansion of the water in the system from cold to hot without generating an excessive increase in water pressure in the system.

Expansion vessels generally consist of a container, usually steel, of adequate strength to resist the maximum pressure in the system. Within this container is fitted a rubber diaphragm fixed to the periphery of the container such that it divides the volume of the container into two sections, namely a water chamber and a gas chamber. The diaphragm is free to move such that either of the sections can occupy all or none of the total volume of the vessel depending upon relative pressures within the sections. One section, i.e. the water chamber, has an inlet/outlet aperture for connection to the heating system whilst the other section is pressured with nitrogen, usually to a pressure of about 1 bar, thus biasing the diaphragm towards the water connection to reduce the volume of the water chamber when the system is cold. As the system warms up, the expansion volume of water passes through the connection into the vessel, forcing the diaphragm back and compressing the nitrogen in the gas chamber of the vessel.

The heat output of combination boilers is often relatively high in order to ensure the required hot water performance, and the expansion vessels used in these boilers are relatively large, e.g. around 8 litres capacity. As a consequence, the expansion vessel occupies a substantial portion of the total space within the boiler casing whilst serving a relatively simple function. Due to a general desire for combination boilers to be of compact design, the necessary pipework between the components of the boiler is often extensively manipulated, leading to difficulties of access to the components and their servicing.

The present invention addresses the foregoing drawbacks and provides an expansion vessel in or for a boiler unit having a heat exchanger for heating water to be circulated through a closed flow circuit, the expansion vessel comprising a container divided internally by movable wall means to form gas and water chambers, and a port for connecting the water chamber to the flow circuit, characterized in that a further port opens into the water chamber for connecting the water chamber to the flow circuit, one port being an inlet port and the other port being an outlet port so that water circulating through the flow circuit passes

through the water chamber.

By the water chamber of the expansion vessel having at least two connections it is adapted for communication with respective boiler components between which water flows during normal operation of the boiler, whereby the expansion vessel acts as a manifold to conduct flow of water between said components. Thus, use is made of the space within the expansion vessel allowing simplification of the pipe network within the boiler.

The invention in a most preferred form envisages an expansion vessel adapted for many of the other components in a combination boiler to be attached to or incorporated with the vessel, and in particular the part thereof enclosing the water chamber.

In a preferred construction a gallery interconnecting the water inlet and outlet connections is defined by an internal partition structure arranged to prevent the diaphragm moving to a position in which it would obstruct or prevent flow through the gallery. The gallery conveniently forms part of the water return flow path for both the central heating and hot water circuits of the boiler unit, although it could provide alternative connections without departing from the basic concept.

In an especially advantageous embodiment, the wall of the container forms at least partially a pump housing for a water circulation pump which is mounted on the vessel and includes a suction or discharge port constituted by one of the inlet/outlet connections of the water chamber.

The expansion vessel according to the invention can serve several functions. As well as acting as a normal expansion vessel, it can form part of both the central heating and hot water flow circuits, allowing such of the conventional pipework connecting boiler components to be eliminated. Thereby a boiler of a more compact design and/or having improved accessibility for maintenance purposes can be obtained. The invention also resides in a boiler incorporating the expansion vessel as described above.

To assist a clear understanding of the invention a more detailed description of an exemplary embodiment is given below with reference to the accompanying drawings, in which:-

Figure 1 is a schematic front view of a boiler unit incorporating an expansion vessel in accordance with the invention;

Figure 2 is a schematic plan view of the boiler unit shown in Figure 1;

Figure 2A is a larger scale view of the detail circled in Figure 2;

Figure 3 is a section along line A-A of Figure 1;

Figure 4 is a section along line B-B of Figure 1;

Figure 5 is a side view, shown partly in cross section, of the expansion vessel; and

Figure 6 illustrates the water flow circuits in the boiler unit.

Illustrated in the drawings is a gas boiler unit having a main heat exchanger 1 arranged to be heated by a gas burner (not shown). An outlet 12 from this heat exchanger is connected to the inlet of a diverter valve 4 having first outlet 13 connected to a pipe which will be connected to the upstream conduit of a central heating circuit, and a second outlet 14 connected by a short pipe to an inlet of a plate heat exchanger 2 through which water from the main heat exchanger is passed for heating water to be consumed in a domestic hot-water supply.

An expansion vessel 3 is mounted in the boiler casing alongside the main heat exchanger, below the diverter valve, and behind the plate heat exchanger. The vessel 3 is divided internally into two sections or chambers 15, 16 by a diaphragm 9, and is assembled from two container parts 3A, 3B with confronting external flanges which are sealed to each other by the edge of the diaphragm and are clamped together by a peripheral band or collar 20 as shown in Figure 2A. The rear chamber 15 is a gas chamber and contains nitrogen under pressure, and the front chamber 16 is filled with water and connected to the water flow circuits in the boiler as described below. The diaphragm 9 is moveable within the vessel 3 to vary the relative volumes of the chambers 15, 16 depending on the pressures within these chambers.

Defined within the chamber 16 by a partition wall 10 is a gallery 6 extending the height and width of the front wall of the expansion vessel. The partition wall consists of a plate, the edge of which is held by the diaphragm 9 and clamped between the container parts 3A, 3B as best seen in Figure 2A. The wall member 10 is spaced at a small distance from the front wall of the vessel so that the volume of the gallery takes up only a minor part of the internal volume of the vessel. The wall member 10 is included to prevent the diaphragm 9 being deformed under the gas pressure to such an extent that it would obstruct flow of water through the gallery 6. The plate 10 is perforated and as shown provided with a bleed orifice 11 to allow expanding water to reach and push back the diaphragm 9.

The expansion vessel has provided in the front part 3A of the container, which is formed as a casting, two inlets 7, 8 opening into the gallery, and an integral pump housing 5 defining a pump chamber communicating with the gallery 6 through an outlet port 21 which is also the suction port of the pump. The pump motor 22 is mounted directly on the front wall of the expansion vessel, the pump impeller 23 being received in the pump chamber for pumping water from the gallery 6 and out through a radial discharge port 24 leading from the pump housing.

The inlet 7 is connected by a short straight pipe to the outlet from the plate heat exchanger 2 for heating water having entered it from the main heat exchanger, and the inlet 8 is connected to the conduit at

the downstream end of the central heating circuit. Thus, return water having given up its heat in either the central heating circuit or in the plate heat exchanger for heating domestic hot water, will be conducted into the gallery 6 through inlet 7 or inlet 8, and will be pumped out back to the main heat exchanger 1 via a pipe connecting the pump discharge port 24 to the inlet of this heat exchanger. The pressure relief valve required to limit the maximum pressure within the system may be provided on the expansion vessel and be connected to the gallery 6 if desired.

In operation water is heated within the main heat exchanger 1 by the gas burner and the hot water flows via outlet 12 to the diverter valve 4. If no domestic hot water is being demanded, the valve 4 is adjusted to direct the water to outlet 13 and hence to the central heating circuit. The water passes through the central heating system and on return to the boiler unit is conducted through the inlet 8 into the expansion vessel 3. The pump 22, 23 pumps the water out of the gallery and back to the main heat exchanger to be reheated, and maintains the water flow through the circuit as described.

If domestic hot water is required, the valve 4 is actuated to divert the heated water flowing from the main heat exchanger to outlet 14 and hence to plate heat exchanger 2 for heating the domestic water flowing through the second side of the heat exchanger to provide hot running water. Having given up its heat, the boiler water exits the exchanger 2 and flows to the gallery 6 in the expansion vessel via inlet 7. The water is then pumped back to the main heat exchanger by pump 22, 23 to be reheated.

The expansion vessel 3 thus acts as part of the flow path as well as performing its usual function of accommodating expansion of the water due to heating, which is obtained in conventional manner due to the diaphragm 6. This saves space, allowing the boiler unit to be more compact and simplifies the arrangement of pipework within the boiler casing thereby facilitating servicing and maintenance.

Claims

1. An expansion vessel in or for a boiler unit having a heat exchanger (1) for heating water to be circulated through a closed flow circuit, the expansion vessel comprising a container (3) divided internally by movable wall means (9) to form gas and water chambers (15, 16), and a port (7, 8) for connecting the water chamber to the flow circuit, characterized in that a further port (21) opens into the water chamber (16) for connecting the water chamber to the flow circuit, one port being an inlet port and the other port being an outlet port so that water circulating through the flow circuit passes through the water chamber (16).

2. An expansion vessel according to claim 1, wherein the container is adapted to mount a pump (22) thereon at one of the ports (21) for circulating water around the flow circuit. 5
3. An expansion vessel according to claim 2, wherein the container includes pump housing means (5) forming at least partially a pump chamber for receiving a pump impeller (23) and communicating directly with said port (21). 10
4. An expansion vessel according to claim 3, wherein said port is the outlet port (21) and the pump housing means includes a pump discharge port (24). 15
5. An expansion vessel according to any one of claims 1 to 4, wherein the movable wall means comprises a diaphragm (9), and a substantially rigid perforated partition structure (10) is located within the water chamber (16) and defines a gallery (6) interconnecting the inlet and outlet ports for flow of water therebetween. 20
6. An expansion vessel according to claim 5, wherein the partition structure (10) is substantially planar. 25
7. An expansion vessel according to claim 5 or 6, wherein the partition structure is a plate (10) having the edge thereof connected to the diaphragm (10) and provided with a bleed orifice (11) to allow water to pass therethrough. 30
8. An expansion vessel according to any one claims 1 to 7, wherein the container includes two parts, one container part including said ports and being formed as a casting. 35
9. An expansion vessel according to any one of claims 1 to 8, wherein a further inlet port (7, 8) is provided for connecting the water chamber to a second water circulation circuit. 40
10. A boiler including an expansion vessel as claimed in any one of claims 1 to 9, wherein the expansion vessel (3) is mounted alongside a main heat exchanger (1) of the boiler, and a secondary heat exchanger for receiving hot water from the main heat exchanger is mounted in juxtaposition to the expansion vessel and has an outlet connected by a substantially straight pipe to an inlet port (7) of the expansion vessel. 45
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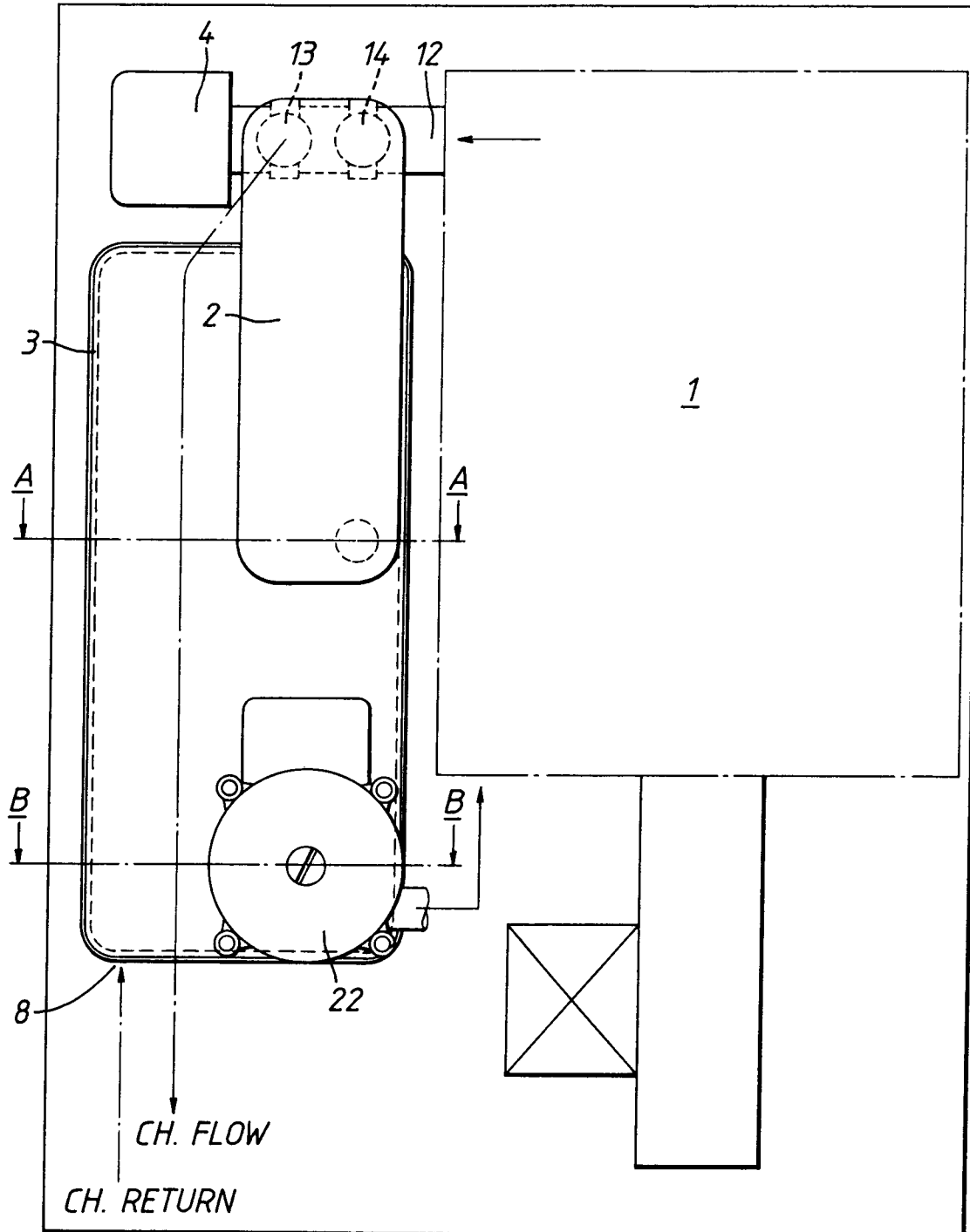


Fig.1

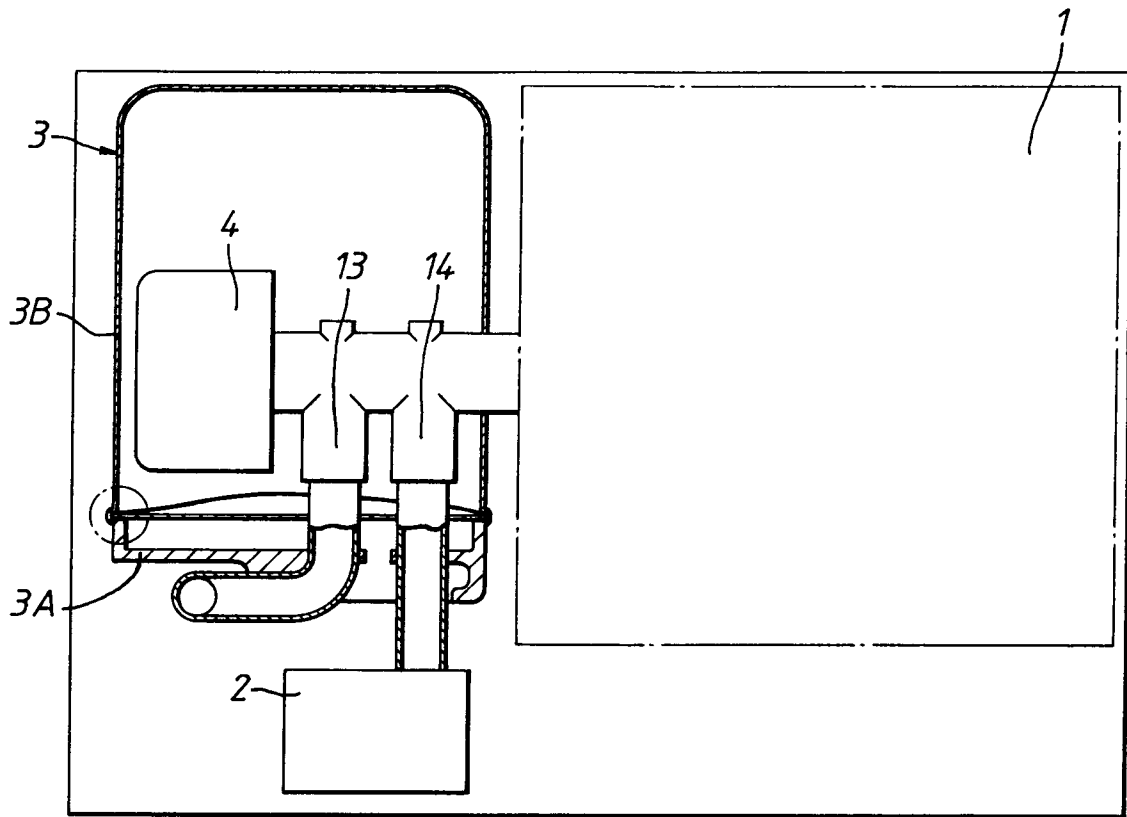


Fig. 2

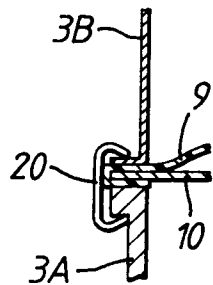


Fig. 2A

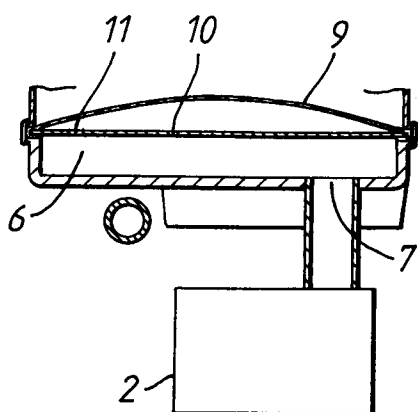


Fig.3

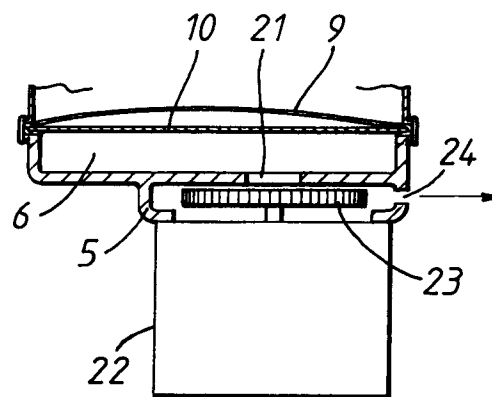


Fig.4

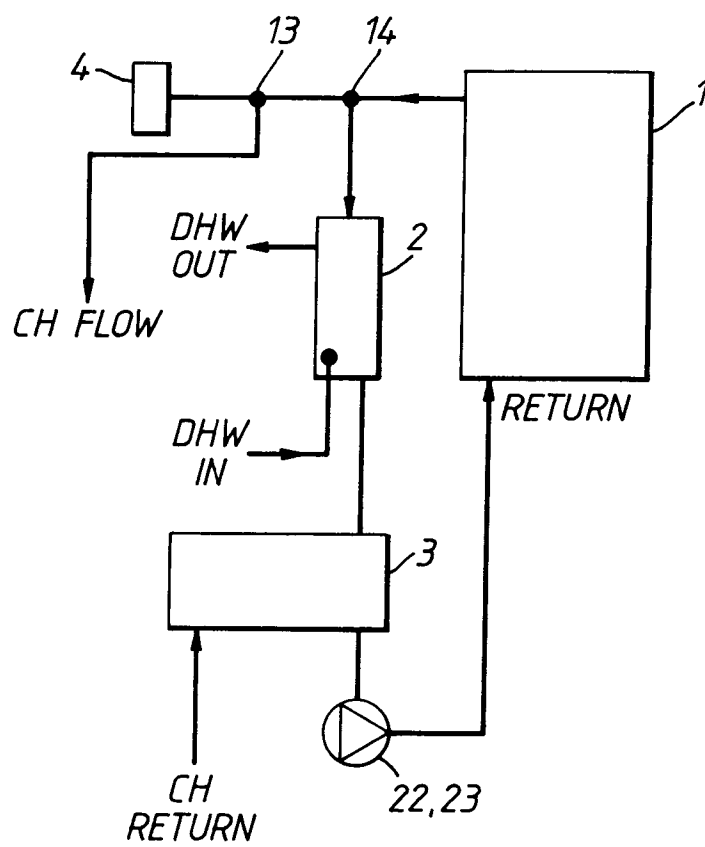


Fig. 6

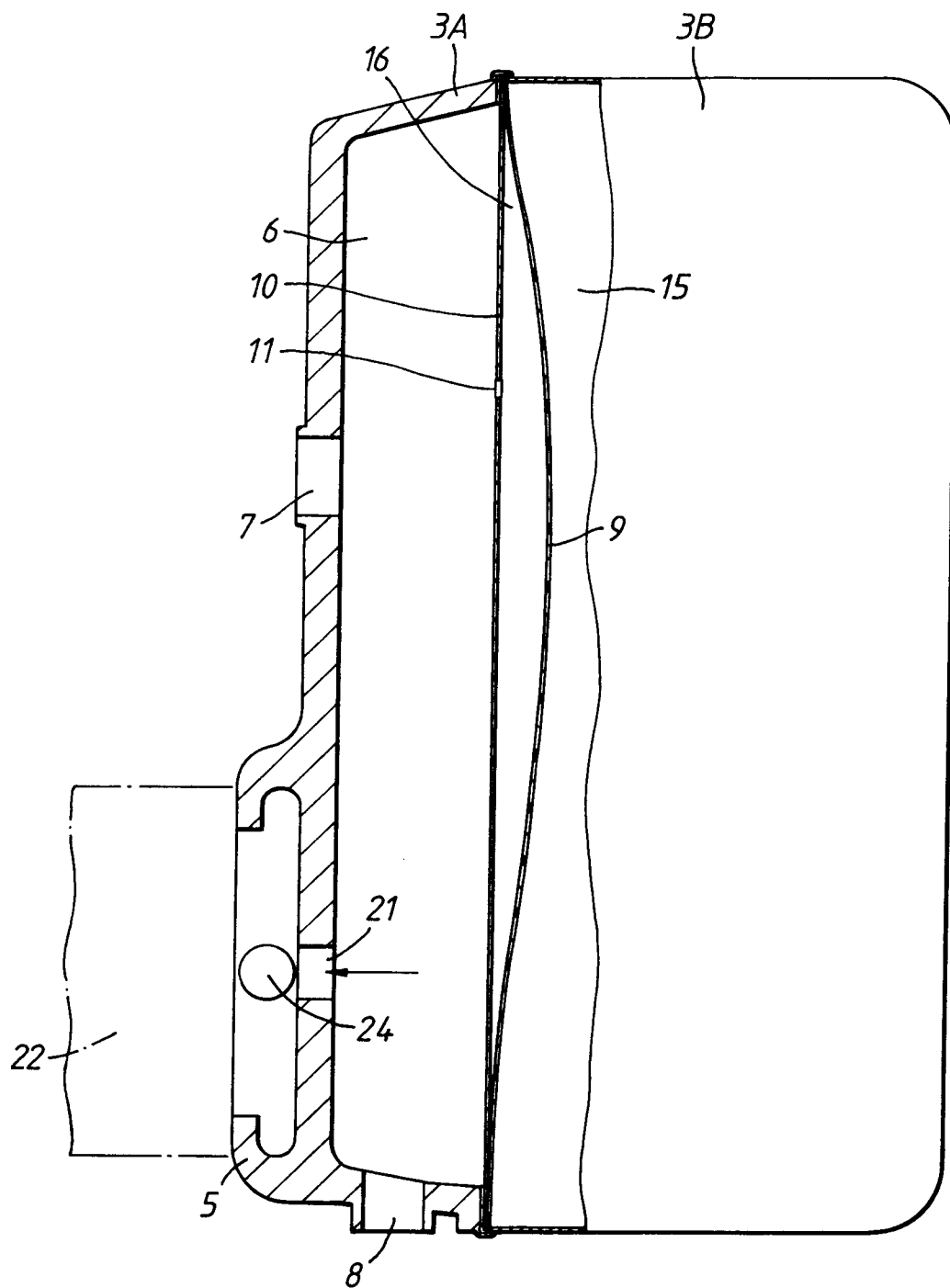


Fig.5



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 94 30 4510

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.5)
X	DE-U-85 29 850 (WAMSLER) * the whole document * ---	1,8-10	F24D3/10 F24H9/14
X	CH-A-520 900 (ATROL ARMATUREN GESELLSCHFT MBH) * the whole document * ---	1,5,7	
A	FR-A-1 346 034 (GRAF) * abstract; figures * ---	2	
A	FR-A-2 606 127 (MULLER & CIE) * abstract; figures * -----	2-4	
			TECHNICAL FIELDS SEARCHED (Int.Cl.5)
			F24D F24H
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 3 October 1994	Examiner Van Gestel, H
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