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(71) Applicant: **AGFA-GEVAERT naamloze vennootschap**
Septestraat 27
B-2510 Mortsel(BE)

(72) Inventor: **Peeters, Dirk**
Konijnenveld 55
B-2550 Kontich(BE)

(72) Inventor: **Bormans, Jan Elisabeth**
Bemelstraat 26 bus 8
B-1150 Brussel(BE)

(54) **Container for liquids.**

(57) A container (10) for liquid material, which has a pouring opening (12) which is at least partially plugged by a venting member (13) of porous structure.

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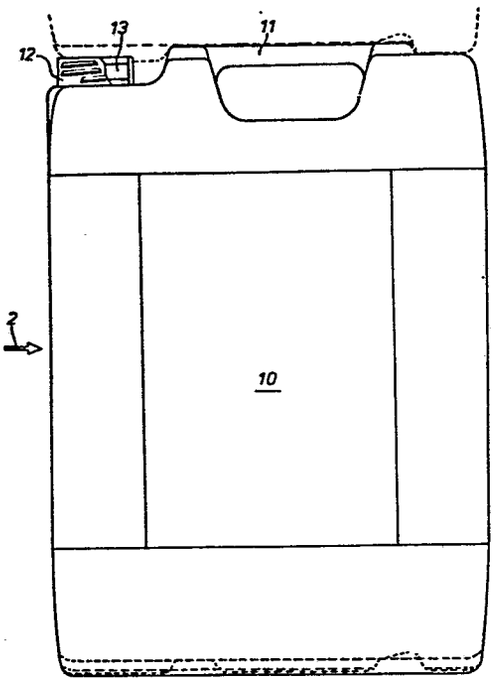

Fig 1

Container for liquids

It is known to provide containers for liquids, for example jerrycans, with a venting tube which intrudes into the interior of the container from the pouring opening in order to vent the container as liquid is being poured out. The maintaining of atmospheric pressure in the container enables the liquid to be smoothly and rapidly poured.

Smooth pouring is important for avoiding splashing of the liquid, which might result in wasting of the liquid and cause soiling of surfaces or articles adjacent a receptacle when a person tries to fill it from the container. This problem of splashing is encountered for example when pouring photographic processing solutions, such as developers or fixer solutions, from jerrycan-type containers in which they are sometimes marketed, into a tray-like receptacle forming part of a table-top processing machine or into the filling opening of a closed processor tank.

It is desirable for the container to allow smooth pouring of the liquid as quickly as possible, in the interest of the person handling the container, particularly if the full container is fairly large and heavy. To take as an example a 20 litre jerrycan filled with a photographic developer solution, as frequently used in photographic processing departments, the filled container has a weight of about 26 kgs. The emptying of such a jerrycan while it is held almost horizontally at a height of about 1 meter requires a considerable effort, the more so the slower is the pouring rate.

The provision of a venting tube avoids a fitful, jerky discharge of the liquid, but involves additional production costs which it would be desirable to reduce. The relative increase in production costs is small in

the case of metal containers, such as metal jerrycans, but it is very appreciable in the case of containers made of synthetic polymeric material because of the relatively low cost of the containers and the problems associated with the fixation of the venting tube in the container.

A further problem associated with the use of venting tubes is the fact that they reduce the size of the pouring opening via which the container is filled. Filling, which is usually automated, takes place through a filling tube which is inserted into the pouring opening and this filling tube must in consequence of the presence of the venting tube, be of smaller diameter and the filling time is therefore longer.

The present invention aims to provide a container with an inexpensive venting means.

According to the present invention there is provided a container for liquid material, characterised in that it has a pouring opening which is at least partially plugged by a member of porous structure such that it preserves air paths between the interior and exterior of the container during pouring of liquid from the container through that member, when the container is held so that the liquid level in the container is above that member.

The ability of members of various porous structures to permit flow of venting air in countercurrent to the outflow of liquid even if the liquid level in the container is above the porous member is surprising. The phenomenon is apparently dependent on the member having a sufficiently labyrinthian arrangement of interstices or open cells. Possibly the preservation of air paths is attributable, at least to some extent, to turbulence.

However the invention is not dependent on any specific theory. It is a simple matter to determine by tests whether or not a given porous member will function in the required manner. The required function is capable of fulfilment by members of a variety of porous structures. The porous member may be of open cellular or sponge-like structure, or it may be composed of natural or synthetic fibres or filaments and be of woven or non-woven construction. It may be made, e.g., from synthetic material or metal. The porous member may be coated with a protective or reinforcing coating, for example to make it resistant to the chemical action of a material which is stored or which is to be stored in the container, and/or to increase the rigidity of said member.

The porous member offers to liquid flow through the member a resistance which depends on the porosity of the member, i.e. on the ratio of its internal open volume to its overall volume, and on the thickness of the member, i.e. its dimension parallel with the flow direction through the pouring opening of the container. It is desirable to achieve as small a flow resistance and as great a venting as possible, consistent of course with the essential function of preserving paths for the flow of venting air in countercurrent to liquid as above referred to. The appropriate porosity and thickness values can be determined empirically.

The invention is applicable to containers of various forms but is particularly suitable for application to substantially rigid containers such as jerrycans and rectanguloid pourer tins.

The container preferably has a removable cap or other closure device for closing the pouring opening.

The pouring opening of the container may be defined e.g. by a neck or spout or other protrusion of the container, which protrusion may be shaped or formed to make connection with the filling opening of a given apparatus or receptacle. In preferred embodiments the container pouring opening is defined by a neck in which the porous member is fitted, preferably at a position spaced from the free end of the neck. Containers having this combination of features and from which liquid can be poured smoothly and rapidly can be produced economically and are convenient to use.

Preferably the cross-sectional area of the pouring opening is only partially plugged by the porous member. In these circumstances the resistance to outflow of liquid from the container is less. Preferably the unplugged part of the pouring opening is less than half the overall cross-sectional area of the opening.

In particularly preferred embodiments of the invention the periphery of the porous member conforms to the inner surface of the pouring opening but such member has a port or aperture which extends through its thickness and constitutes a said unplugged part of the pouring opening.

Preferably the unplugged part of the pouring opening is a part of the opening which is a bottom part thereof when the container is tipped into a pouring position with the pouring opening below the main bulk of the container.

In certain advantageous embodiments of the invention the porous member is fitted into the pouring opening in an elastically deformed condition so that the member is retained by the stored elastic recovery forces.

An embodiment of the invention, selected by way of

example, will now be described with reference to the accompanying drawings, in which :

Fig. 1 is a side view of a plastics jerrycan;

2 is a front view according to arrow 2 in Fig. 1,

3 is a top view of the jerrycan in Figs. 1 and 2,

4 is a plan view of a porous member, and

5 is an edge-on view of that member.

Referring to Figs. 1 to 3, a plastics jerrycan 10 of generally rectanguloid form is provided with a handle 11 for carrying the jerrycan, and with a neck 12 defining a pouring opening for filling and emptying the jerrycan. The opening may be closed by a screw cap, not illustrated. The jerrycan is designed in such a way that it may be vertically stacked. To that end, the bottom of the jerrycan has a profile that may closely fit on the top of another jerrycan, as shown in broken lines in Fig. 1. The form and rigidity of the illustrated jerrycan are such that up to three filled jerrycans may be vertically stacked for palletized transport. The illustrated jerrycan is a 20 litre model manufactured by extrusion blow moulding that is used by Agfa-Gevaert N.V., Mortsel, Belgium for the supply of photographic processing liquids such as developer, fixer, and other compositions.

The pouring opening defined by the neck 12 of the jerrycan is provided with a sponge-like venting member 13, illustrated in cross-hatching in Figs. 1 and 3. The venting member 13 is fitted in the neck 12 in slightly elastically deformed condition and is situated at some distance below the free end of the neck so as to leave above the venting member an air space which prevents adherence of such member to the metal sealing foil which is sealed onto the top of the neck by induction heating.

The venting member 13 is shown in detail in Figs. 4 and 5. The member has the form of a disc. It can be

manufactured by punching the member from a sheet of sponge-like material. Suitable materials are foamed synthetic polymeric material. A material combination that shows excellent properties as to porosity, stiffness and chemical resistance is reticulated polyurethane foam that has been coated with polyvinylchloride.

The venting member is provided with a circular port or aperture 14 in what is a bottom part of the pouring opening when the container is tipped into a pouring position with the pouring opening below the main bulk of the container, e.g. as shown in Fig. 3. It has been found that the provision of the port 14 has no unfavourable influence on the venting of the jerrycan. The provision of such port reduces the resistance to outflow of liquid from the container thereby reducing the time necessary for emptying the jerrycan. It should be noted however that the flow resistance afforded by the venting member would be very low even in the absence of that port. For this reason the forces that act on the venting member during pouring of liquid are small. It is therefore sufficient for the venting member to be held in the neck merely by the outward pressure of elastic recovery forces in the member.

Various results obtained when emptying water from a 20 litre jerrycan as illustrated, with and without a venting member, are tabulated in the Comparative Table given below.

The venting member used in each of the tests was a disc of reticulated polyurethane foam with a density of 30 $kg.m^{-3}$ and with a PPI value (pores per inch) of 10. The disc was made by punching it from a sheet of foam. The sheet was soaked in a polyvinyl chloride solution of 50 kg of polyvinyl chloride per cubic metre

of solution so that the final density of the coated foam amounted to 65 $kg.m^{-3}$. In each case the diameter of the venting member was 45 mm and its thickness was 10 mm. In one test the venting member had no port or aperture. In another test the venting member had a port 14 as illustrated in Figs. 3 and 4, 21 mm in diameter, the distance between the centers of the venting member and of the port being 11 mm.

The inner diameter of the neck 12 of the jerrycan was 44 mm and its internal height was 30 mm. The venting member was in each case located in the neck of the jerrycan so that the upper face of the member was 8 mm below the free end of the neck. The venting tube used in one test was in accordance with previously known practice. The tube was a plastics tube with an outer diameter of 9 mm and an inner diameter of 6 mm, and extended into the interior of the jerrycan from the pouring opening.

The expression "progressively inclined" in the column "Position of jerrycan", means that the jerrycan was progressively tilted as quickly as possible consistent with maintaining a smooth outflow of water. The outflow commenced at an inclination of the jerrycan of about 40 degrees to the vertical and the inclination was progressively increased to about 100 degrees to the vertical.

Comparative Table

Venting means	Position of jerrycan	Liquid flow	Time for emptying
PU-foam with port	horizontal	smooth	112 s
PU-foam no port	horizontal	smooth	123 s
Venting tube	horizontal	smooth	50 s
None	horizontal	uncontrolled, shock-wise	35 s
None	progressively inclined	smooth	160 s

It will be understood that the invention is not limited to the described embodiment.

The sponge-like venting member may have other dimensions than those given above. The member may be foamed from plastics other than polyurethane. The member may also be made from other materials such as stainless steel wire, natural or synthetic fibers bonded by a suitable agent, etc.

The port 14 may be omitted, or may have forms other than that illustrated. Instead of providing a port such as 14 the venting member can have a peripheral recess or cut-out, e.g. a cut-out of sectoral shape such as a 90° sector or quadrant, so that the unplugged part of the pouring opening is defined by the venting member and the inner surface of the container neck.

The venting member may be held in place by fitting it into a corresponding annular groove in the neck of the container, by welding or soldering in the case of metal members and containers, etc.

The venting member can be fitted before sealing or closing the container for marketing. Alternatively, the venting member can be fitted after opening the container. The fitting of the venting member is in such

case facilitated if the member is mounted in a collar or the like that can be easily pushed into the pouring opening of the container.

A container according to the invention can for example be a rectanguloid pourer tin or a small plastics drum. The container needs not necessarily be rigid, it can be flexible or even collapsable. The venting member can be provided in a spout or a similar pouring-aid for the container, which may be separable from the container.

WE CLAIM :

1. A container for liquid material, characterised in that it has a pouring opening which is at least partially plugged by a member of porous structure such that it preserves air paths between the interior and exterior of the container during pouring of liquid from the container through that member, when the container is held so that the liquid level in the container is above that member.

2. A container according to claim 1, wherein the cross-sectional area of the pouring opening is only partially plugged by said member and the unplugged part of the pouring opening is less than half the overall cross-sectional area of such opening.

3. A container according to claim 1 or 2, wherein the periphery of the porous member conforms to the inner surface of the pouring opening but such member has a port or aperture which extends through its thickness and constitutes an unplugged part of the pouring opening.

4. A container according to any preceding claim, wherein the said member is of disc-like form.

5. A container according to any preceding claim, wherein said member is made of a polymer foam.

6. A container according to any preceding claim, wherein said member is made from reticulated polyurethane foam.

7. A container according to any preceding claim, wherein the said member is fitted into the pouring opening in an elastically deformed condition so that the member is retained by the stored elastic recovery forces.

8. A container according to any preceding claim, wherein the said member has a polyvinyl chloride coating.

9. A container according to any preceding claim, wherein such container is made of synthetic polymeric material, and is in the form of a jerrycan.

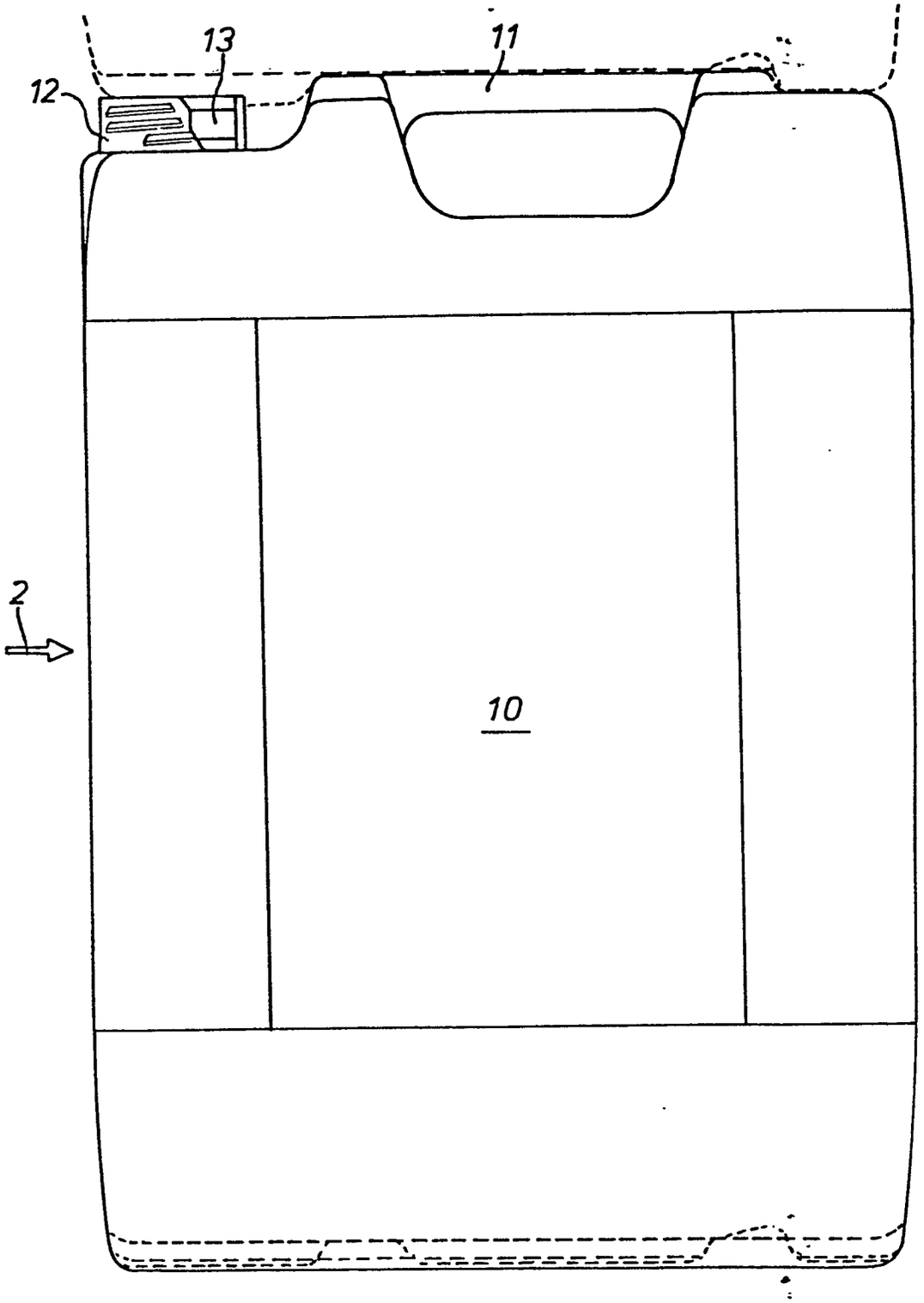

Fig 1

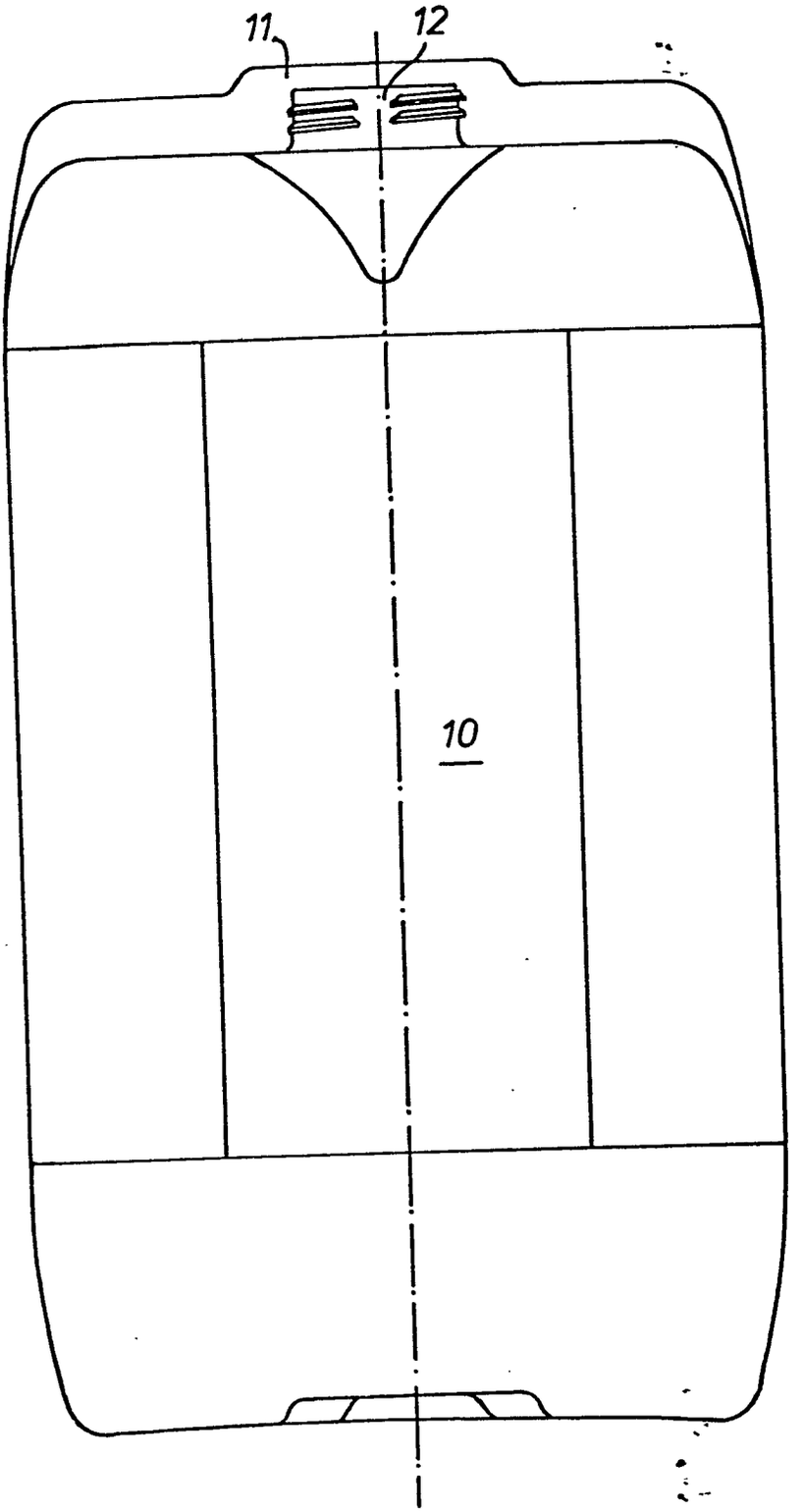

Fig. 2

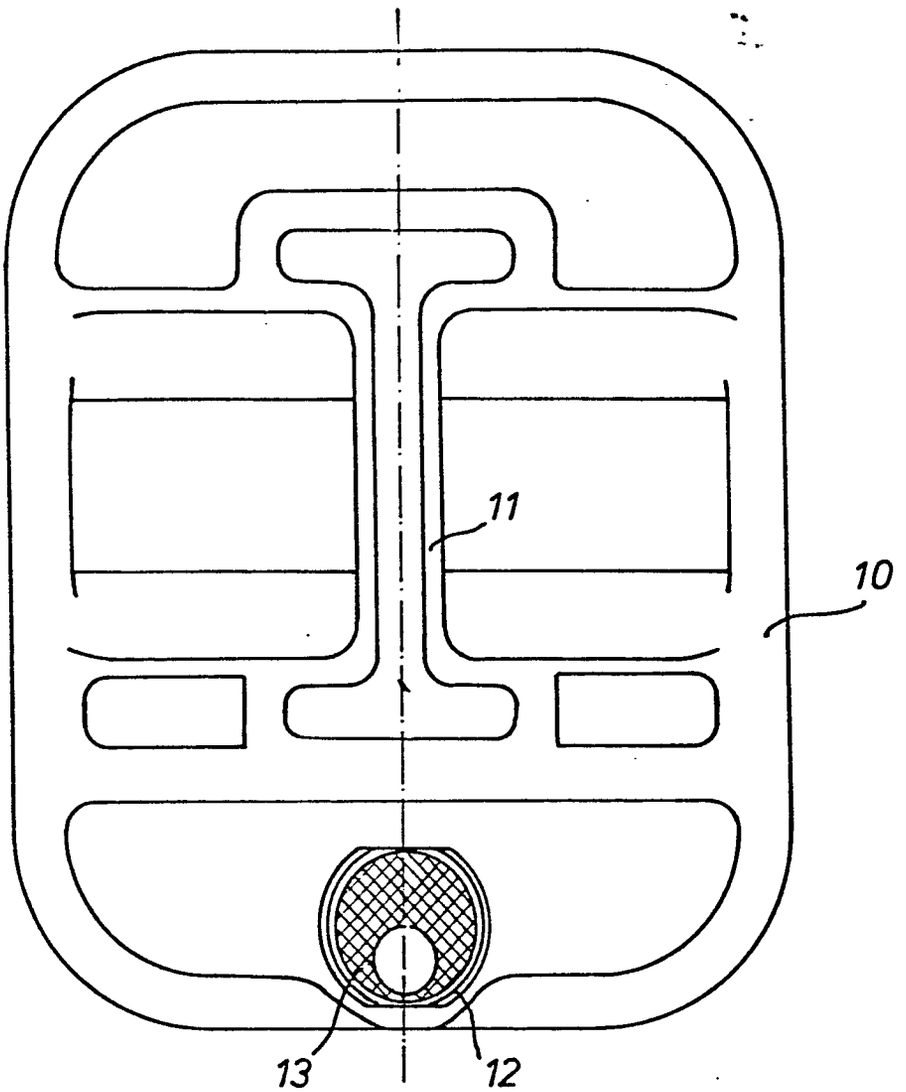

Fig. 3

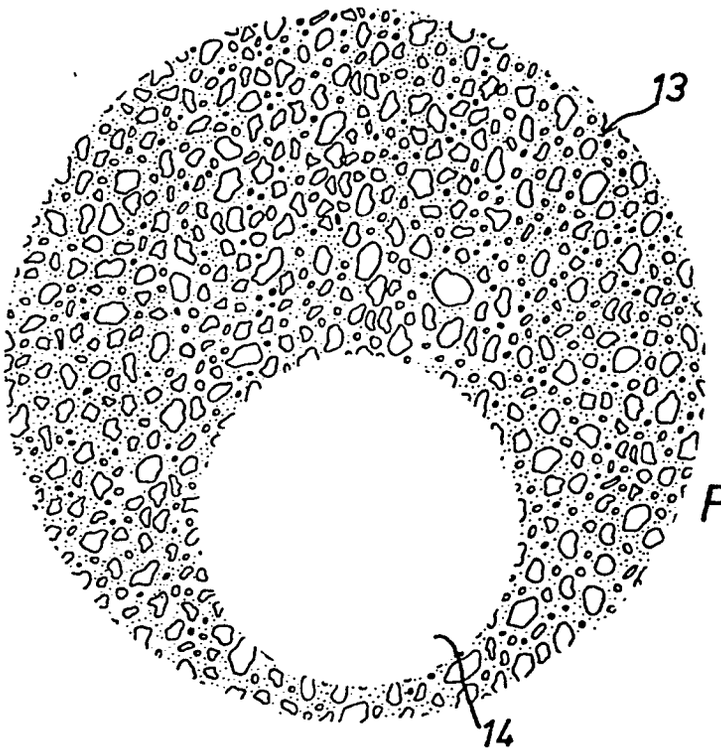

Fig. 4

Fig. 5

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EUROPEAN SEARCH REPORT

Application number
EP 80 20 0872

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl.³)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
	GB - A - 797 812 (CHAPMAN) * Patent specification * --	1,2,3	B 65 D 25/38
	GB - A - 912 220 (CHAPMAN) * Patent specification * --	1,2,3	
	FR - A - 962 157 (VITOR) * Patent specification * --	1,2,3,7	TECHNICAL FIELDS SEARCHED (Int. Cl.³)
	FR - A - 771 019 (BADOIS) * Patent specification * --	1	
	DE - A - 2 151 741 (ROSENTHAL) * Page 16, paragraph 2 - page 17, figure 4 * ----	1,4,5	

CATEGORY OF CITED DOCUMENTS

X: particularly relevant
A: technological background
O: non-written disclosure
P: intermediate document
T: theory or principle underlying the invention
E: conflicting application
D: document cited in the application
L: citation for other reasons

&: member of the same patent family, corresponding document

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	13-01-1981	VANTOMME

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