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Publication number:

**0 281 052
A1**

12

EUROPEAN PATENT APPLICATION

21

Application number: **88102984.7**

51

Int. Cl.4: **F15B 1/06**

22

Date of filing: **29.02.88**

30

Priority: **06.03.87 IT 1960987**

43

Date of publication of application:
07.09.88 Bulletin 88/36

84

Designated Contracting States:
DE ES FR GB IT

71

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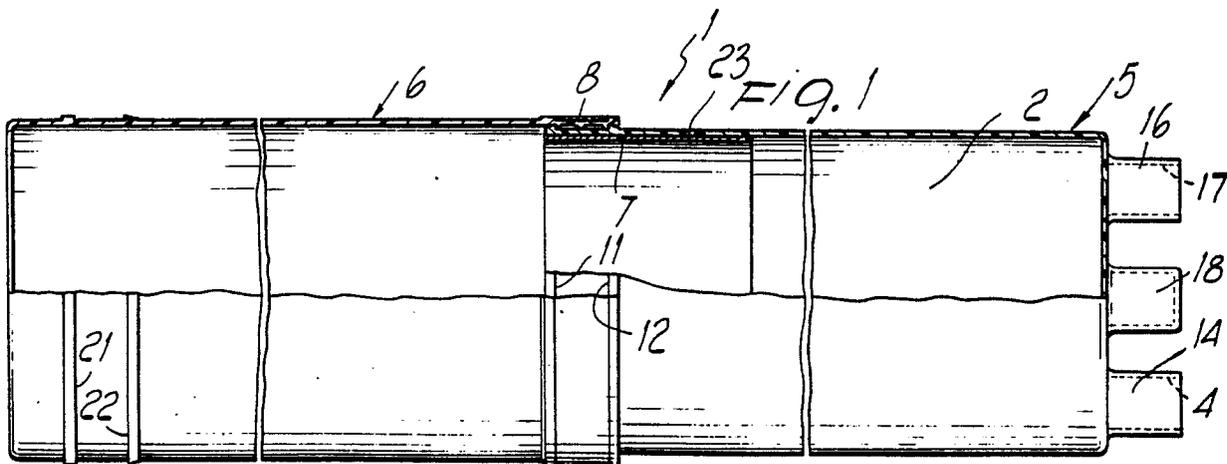
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Tank for hydraulic systems with high safety against infiltration of air from outside.

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The present invention relates to a tank for hydraulic systems with high safety against the infiltration of air from outside, comprises a container (1) which internally defines a cavity (2) for the containment of the working liquid and which is provided with at least one inlet port (3) and/or with one outlet port (4) connectable to a hydraulic circuit. The tank is insulated in an airtight manner at least from outside inwards and is elastically deformable at its operating pressures.

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TANK FOR HYDRAULIC SYSTEMS WITH HIGH SAFETY AGAINST INFILTRATION OF AIR FROM OUTSIDE

The present invention relates to a tank for hydraulic systems with high safety against infiltration of air from outside.

As known, hydraulic tanks, which feed pumps, are rigid and, during the phase of aspiration, are subjected to a negative pressure which is particularly elevated in the case of pumps without a return since a considerable quantity of liquid is aspirated from the tank.

In order to permit adequate functionality of the components, air, which has been carefully filtered, is allowed to pass into the tank, so as to reduce the negative pressure. Even in the event that the negative pressure inside the tank is not high enough to necessitate the ingress of air, the negative pressure caused anyway during the aspiration phase causes accidental infiltrations of air into the tank via zones of the circuit which are defectively or insufficiently sealed. The infiltrations of air, occurring either voluntarily or accidentally, are undesirable because, besides the fact that since air is compressible there occurs a decrease in the performance of hydraulic components such as pumps and motors, air always has a humidity content. Thus, since the oils used in hydraulic systems are hygroscopic, humidity is retained inside the tank and after a certain number of operating cycles a considerable amount of water is found circulating in the system. The presence of water is greatly harmful to hydraulic systems since it causes oxidation of the hydraulic components, reduction or lack of lubrication of the hydraulic components where provided, and the freezing of the water at low temperatures with the consequent blocking or abnormal operation of the entire system.

Since known tanks are generally made of rigid material, though particular care is placed in filtering the air absorbed from outside, in any case during the operation of the system there occurs the infiltration of a high percentage of humidity when rather high negative pressures occur inside the tank.

The aim of the present invention is to eliminate the above described disadvantages by providing a tank for hydraulic systems capable of giving excellent assurances against infiltrations of air during operation.

Within the scope of this aim, an object of the invention is to provide a tank having a structure which is simple to manufacture and has a modest cost.

Another object of the invention is to provide a tank which can outwardly vent air which accidentally infiltrates into other areas of the hydraulic system fed by the tank.

This aim, as well as these and other objects which will become apparent hereinafter, are achieved by a tank for hydraulic systems with high safety against the infiltration of air from outside, comprising a container which internally defines a cavity, adapted for the containment of working liquid and being connectable to a hydraulic circuit, characterized in that said cavity is insulated in an airtight manner at least from outside inwards and in that said container is elastically deformable at operating pressures.

Further characteristics and advantages of the invention will become apparent from the description of a preferred, but not exclusive, embodiment of the tank according to the invention, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

figure 1 is a partially cut-away lateral elevation view of the tank according to the invention;

figure 2 is a front elevation view of the tank according to the invention;

figure 3 is a view of an enlarged detail of figure 1;

figure 4 is an exploded perspective view of the tank according to the invention, disassembled in its individual components;

figure 5 is a view illustrating the deformation of the tank during operation;

figure 6 is a reduced lateral elevation view of the tank according to the invention, pointing out its modularity.

With reference to the above described figures, the tank according to the invention, generally indicated by the reference numeral 1, comprises a container which defines in its interior a cavity 2 intended to contain the working liquid of a hydraulic circuit and which is provided with at least one inlet port 3 and/or with one outlet port 4 which are connectable in a known manner to a hydraulic circuit. According to the invention, the cavity 2 is insulated in an airtight manner from outside inwards and said container is elastically deformable at operating pressures.

Advantageously, the container of the tank is made of molded synthetic material, for example oilresistant rubber, which is elastically deformable at the normal operating pressures of the tank.

In the illustrated embodiment, the container is composed of a first portion 5 and of a second portion 6 having a substantially cylindrical configuration which are associated rigidly and coaxially with one another. More particularly, both the first and the second portion are constituted by cylinders, open at one base, and the first portion 5 is partially insertable with its open base in the open

base of the second portion 6.

At the area of superimposition of the portions 5 and 6, means for airtight connection are provided which can consist of a cylindrical stiffening body 7 which extends inside the first portion 5 at least in said area and of a cylindrical band 8 which can be tightened externally on the second portion 6 again in said area.

Advantageously, to increase airtightness, the second portion 6 is provided, on its inner surface, still at the superimposition area, with a pair of circumferential raised portions 9 and 10, axially spaced from one another, which are engageable, at the moment of the assembly of the first portion with the second portion, with a pair of circumferential abutments 11 and 12 which are correspondingly defined on the outer surface of the first portion 5 in the area of superimposition. The pair of raised portions 9 and 10 and the pair of abutments 11 and 12 can be optimally employed also for the correct mutual positioning of the portions 5 and 6 during assembly.

Furthermore, in order to have a further assurance against infiltrations of air, the second portion 6 has, on its inner surface, in an area intermediate between the pair of raised portions 9 and 10, a third raised portion 13 which is pressed against the outer surface of the first portion 5 in the area of superimposition as an effect of the tightening of the cylindrical band 8.

Moreover, tubular protrusions may be provided on the closed base of the first portion 5, which are to be provided directly during the molding step, for coupling to the hydraulic circuit to be fed.

In the illustrated embodiment six tubular protrusions have been provided, of which: one protrusion 14 which defines the outlet port 4, one protrusion 15 which defines the inlet port 3 and one protrusion 16 with a hole 17 for venting the air during filling of the tank with the working liquid; the tubular protrusions indicated by the numerals 18, 19 and 20 are provided in case the coupling to other ducts of the hydraulic circuit to be served is required, and can be appropriately perforated at assembly time.

Advantageously, furthermore, the second portion 6 is provided, on its lateral surface, proximate to its closed base, with a pair of circumferential abutments 21 and 22, spaced apart from one another and being similar to the circumferential abutments 11 and 12 of the first portion 5 to allow modular composition with another cylindrical portion 24 shaped like the second portion 6 if a tank having a greater volume is required. In this case it is sufficient to remove the closed base of the second portion 6 and to insert therein a cylindrical stiffening body identical to the cylindrical body 7 and to operate as for the connection of the first portion to the second portion.

In the tank according to the invention, non-return valve means are furthermore provided for the outward venting of the air from inside the cavity 2. Said valve means can consist of a known valve or of a simple hole 23 provided in an area of the tank which in assembly is arranged upwardly. In fact, since the tank is made of oilresistant rubber, a negative pressure in its interior causes the closure of the hole 23, while an increase in pressure in its interior causes the opening of said hole and allows the discharge of any air which has infiltrated into the hydraulic circuit due to phenomena of cavitation or to other causes.

The operation of the tank according to the invention is as follows.

When working liquid is drawn from the tank 1, a negative pressure is generated inside the cavity 2, which causes elastic contraction of the tank to occur. This contraction prevents the negative pressure from reaching such values as to draw in air from outside. When the liquid flows back into the tank, the same returns to its original form.

In the case of infiltrations of air in other areas of the hydraulic circuit fed by the tank, when said air reaches the tank it determines therein an overpressure which causes the inflation of the tank and therefore achieves the opening of the hole 23 with the consequent outward venting of the air.

In practice it has been observed that the tank according to the invention fully achieves the intended aim, since, by virtue of its elastic deformability, it offers adequate assurances against the filtration of air from outside.

Another advantage is the possibility of eliminating air which may accidentally form in other areas of the hydraulic circuit.

Not least advantage is that of providing a tank which can be successfully adopted on any hydraulic system.

The tank thus conceived is susceptible to numerous modifications and variations, all of which are within the scope of the inventive concept; moreover all the details may be replaced with technically equivalent elements.

In practice, the materials employed, so long as compatible with the specific use, as well as the dimensions, may be any according to the requirements and to the state of the art.

Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the scope of each element identified by way of example by such reference signs.

Claims

1. Tank for hydraulic systems with high safety against infiltration of air from outside, comprising a container (1) which internally defines a cavity (2), adapted for the containment of working liquid and being connectable to a hydraulic circuit, characterized in that said cavity (2) is insulated in an airtight manner at least from outside inwards and in that said container (1) is elastically deformable at operating pressures.

2. Tank, according to claim 1, characterized in that said cavity (2) is connected to outside through non-return valve means (23) for the outward discharge of air from inside.

3. Tank, according to claim 1, characterized in that said container consists of at least one first substantially cylindrical portion (5) and at least one second substantially cylindrical portion (6) connected in an airtight manner coaxially to one another.

4. Tank, according to claim 1, characterized in that said container (1) is made of molded elastically deformable synthetic material.

5. Tank, according to one or more of the preceding claims, characterized in that said first portion (5) and said second portion (6) each consist of a cylinder open at one base, said first portion (5) being partially insertable with its open base in the open base of the second portion (6), airtight connection means (7) being provided which act at an area of superimposition of said portions (5,6).

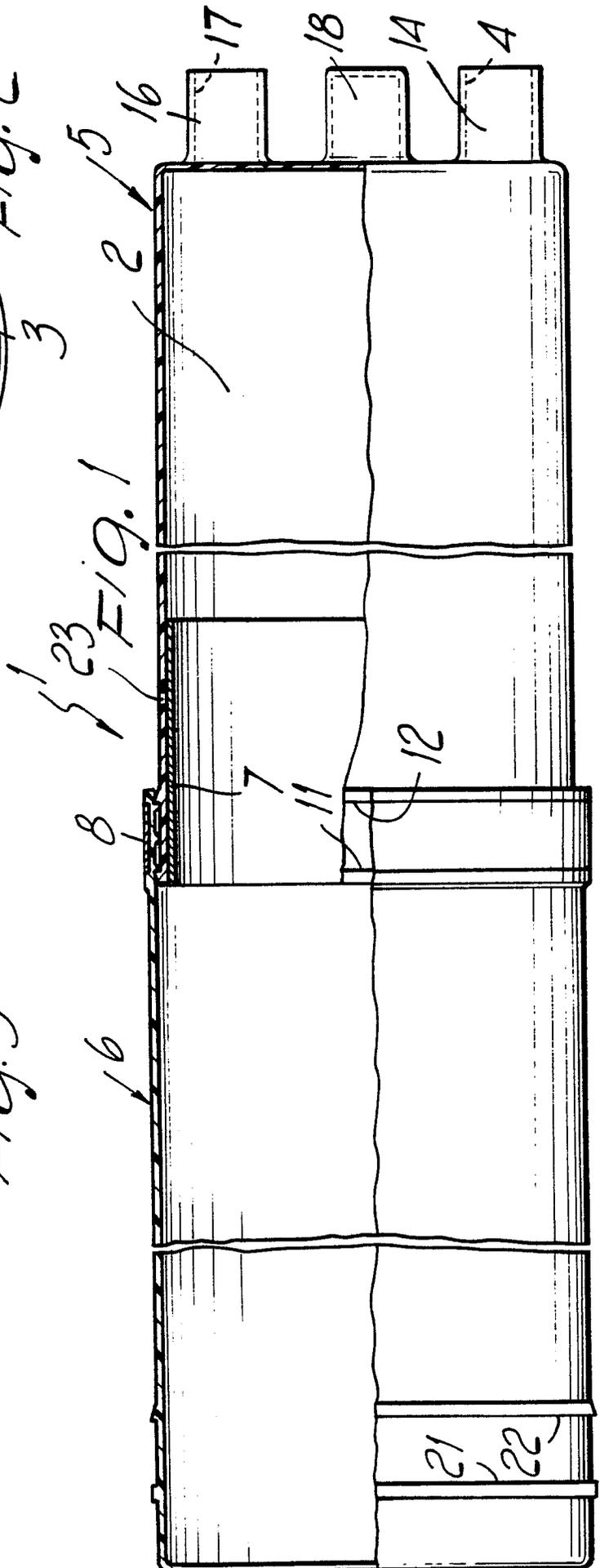
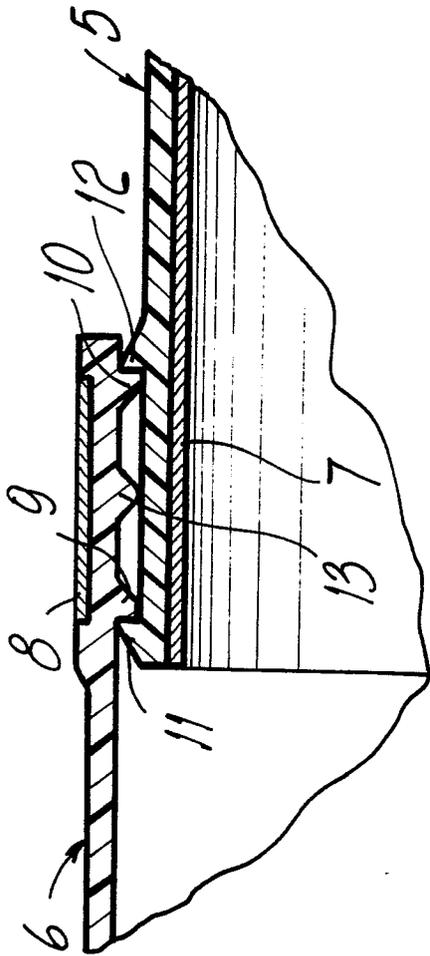
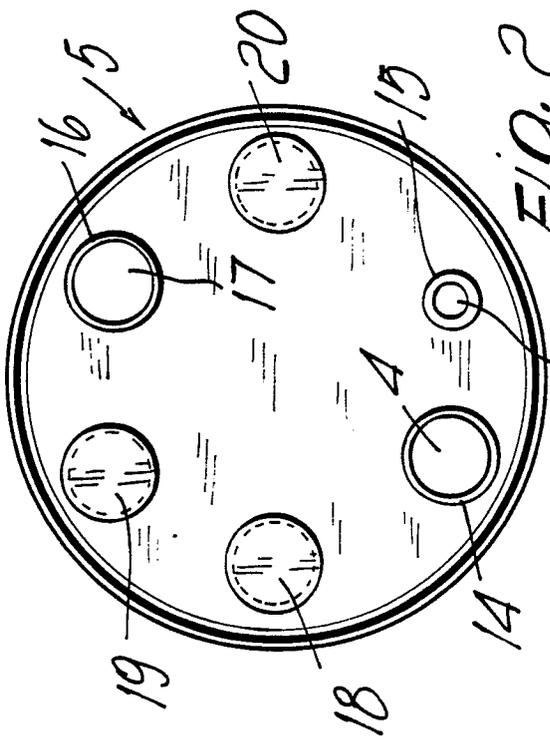
6. Tank, according to claim 5, characterized in that said connection means (7,8) consist of a cylindrical stiffening body (7) extending inside said first portion (5) at least in the area of superimposition, and a cylindrical band (8) which can be externally tightened on said second portion (6) in said area of superimposition.

7. Tank, according to claim 5, characterized in that said second portion (6) is provided, on its inner surface, at the area of superimposition, with a pair of circumferential raised portions (9,10), engageable against a pair of circumferential abutments (11,12), extending on the outer surface of said first portion (5) in the area of superimposition.

8. Tank, according to claim 7, characterized in that said second portion (6) is provided on its inner surface, between said pair of circumferential raised portions (9,10), with a third circumferential raised portion (13) acting on the outer surface of said first portion (5) in the area of superimposition.

9. Tank, according to one or more of the preceding claims, characterized in that said second portion (6) is provided, on its lateral surface, proximate to its closed base, with a pair of mutually spaced circumferential abutments (21,22) similar to said circumferential abutments (11,12) of said first

portion (5) for a modular composition of another second portion (24) by removal of said closed base.



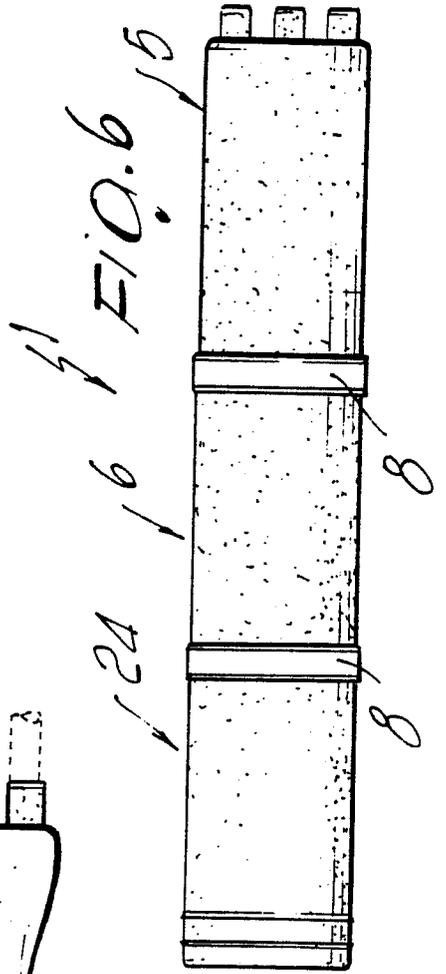
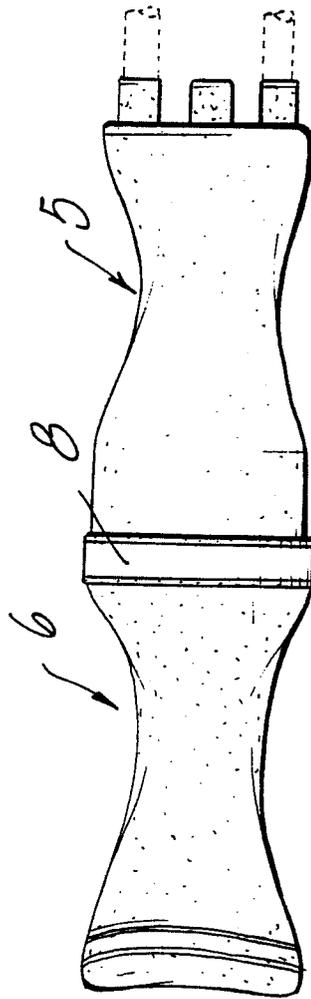
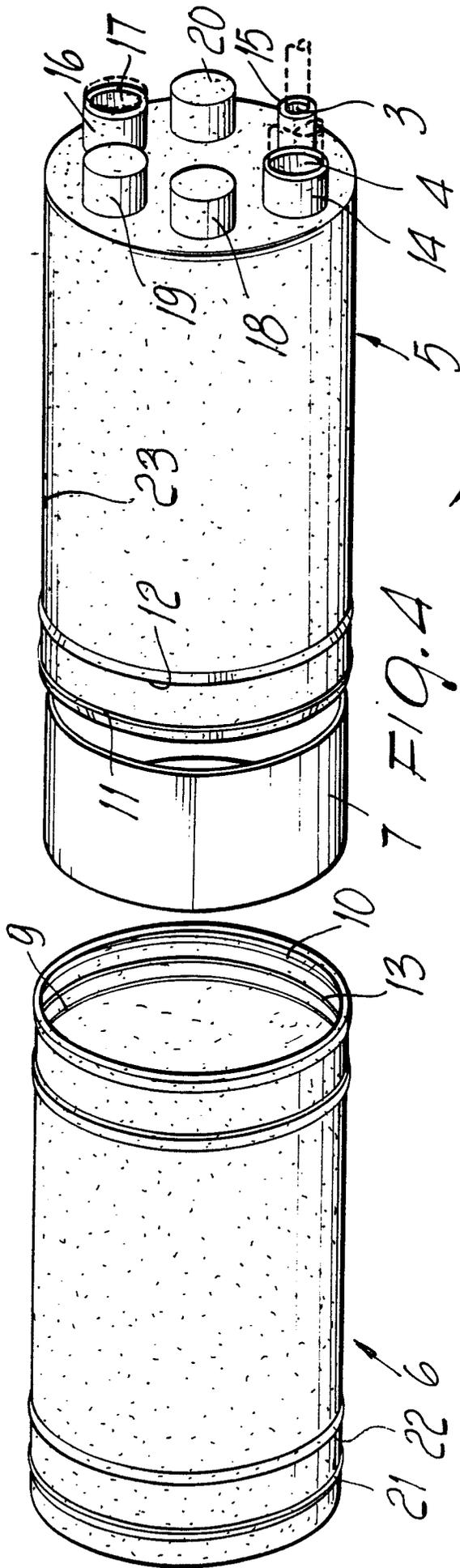


FIG. 5

FIG. 6



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.4)
X	GB-A-1 001 337 (RICHER) * Page 1, line 37 - page 2, line 76 * ----	1	F 15 B 1/06
A	GB-A-1 030 006 (BOYE) * Page 1, lines 34-60 * ----	1,2	
A	FR-A-1 508 236 (SEMA) * Page 2, left-hand column, lines 55-58 * ----	3-6	
A	GB-A-2 145 161 (MS INTERNATIONAL) ----		
A	DE-A-2 351 267 (SZIRANYI) ----		
A	US-A-3 935 882 (MATTHEWS) ----		
A	GB-A-2 160 592 (THAMES WATER) -----		
			F 15 B B 65 D
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 01-06-1988	Examiner KNOPS J.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			