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Ir. et al**Vereenigde Octrooibureaux****Nieuwe Parklaan 97****NL-2587 BN 's-Gravenhage (NL)**(54) **Mobile tank container.**

(57) The invention relates to a mobile temperature-regulated tank container (1) comprising a tank (2) of oblong shape, an insulating housing (42) in which the tank is accommodated and a cooling device (76) by which the space between the tank and the housing can be cooled. The tank is mounted in the housing in such a manner that in use the longitudinal direction of the tank is at least substantially vertically oriented, a horizontal cross section of the tank comprises substantially a closed loop elongated in a first direction and a horizontal cross section of the housing has an at least substantially rectangular shape of which the long sides are at least substantially parallel to the first direction.

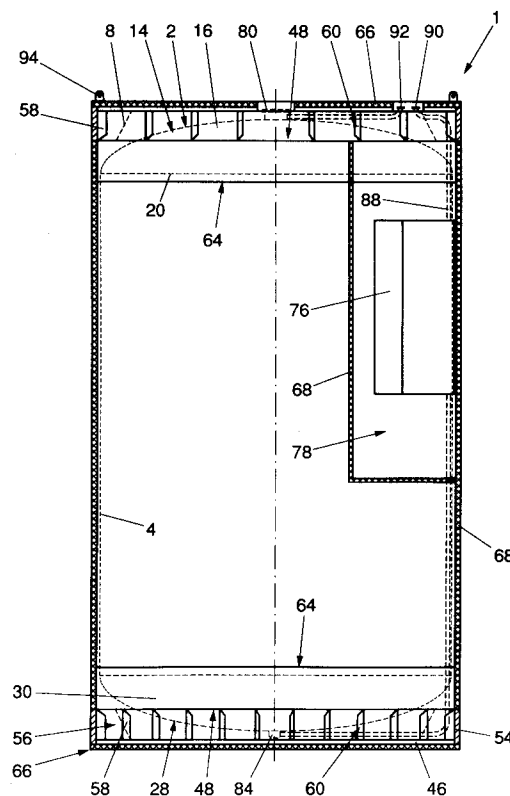


FIG. 1

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This invention relates to a mobile temperature-regulated tank container comprising a tank of ob-long shape, an insulating housing in which the tank is accommodated and a cooling device by which the space between the tank and the housing can be cooled.

Such tank containers are known *inter alia* from German Gebrauchsmuster no. 34297 and are used for the transport of liquids over land and over sea. In this connection, one may for instance think of the transport of deep-cooled concentrated fruit juice. A disadvantage of such a tank container is that in connection with its dimensions it is not suitable to be placed in a wide range of container ships. Moreover, a relatively small part of the volume of the rectangular container is used for storing the liquids referred to, so that the container is experienced as unattractive from an economic point of view.

In addition, for the transport and storage of liquid foods often plastic bags are used which, in filled condition, are placed in steel drums. The steel drums are transported in reefer ships or cooling containers. In this connection it is disadvantageous, however, that many operations are necessary for loading, unloading and processing the liquids. Moreover, the package can only be used a single time, so that much waste is produced, which adversely affects the environment. Further, recycling the drums requires much energy and a considerable loss of product arises in that residues of liquid are left behind in the plastic bags.

It is also known to transport large amounts of liquid foods in tank ships. This method of transport, however, is little flexible because it is economically unacceptable to transport smaller amounts since in that case the tank is not completely filled. Furthermore, it is not possible to transport many different kinds of liquids since the number of separate tanks on a ship is often small. A further economic disadvantage is that obtaining a return load is only possible to a very limited extent.

The object of the invention is to obviate these disadvantages. Accordingly, the invention is characterized in that the tank is mounted in the housing in such a manner that in use the longitudinal direction of the tank is at least substantially vertically oriented, a horizontal cross section of the tank comprising substantially a closed loop elongated in a first direction and a horizontal cross section of the housing having an at least substantially rectangular shape of which the long sides are at least substantially parallel to the first direction.

As a result of the vertical arrangement of the tank, a container is realized which can also be used on container ships while making optimum use of the loading space of the container ship. This makes it possible to maintain the standard size of a stack

of 20-foot containers, three containers wide and almost five high. Moreover, what is achieved by virtue of the specific shape of the tank is that a large part of the volume of the container is used for the storage of liquid, which entails a great economic advantage. Due to the fact that each container comprises a cooling provision of its own, it is entirely self-supporting. Also, by using a container, rather than a multiplicity of drums which are transported in box containers, a major saving of space, and hence of costs, can be realized. Such saving of costs is also manifest in that, rather than having to handle many drums, only one container needs to be handled if a greater or lesser load is needed for the next trip. Loading and unloading the container can for instance be carried out by a pump unit with flexible hoses, arranged on or in the container. A great practical advantage is that the environmental tax which is due in many countries is reduced since the container need not be cleaned but returns while being cooled and, for instance, under nitrogen.

A major advantage is that the container according to the invention can also be used as a temporary storage place in a port of unloading and thus functions as a tank terminal. The mobile tank container which in fact also incorporates a mobile tank terminal can for that purpose be simply arranged at a location suitable for storage.

According to a particular embodiment of the invention, the cross section of the tank substantially has a shape made up of two segments of a circle. Such a shape has as an advantage that the tank can be exposed to particularly high internal pressure but also to external loads due to, for instance, the movement of a ship.

More particularly, the segments of a circle comprise more than a semicircular arc. Thus the ratio between the volumes of the tank and the container can be rendered optimal without the tank losing robustness. According to a particularly practical embodiment, the longitudinal wall of the tank is composed of two sidewalls comprising a part of a cylindrical surface. It will be clear that starting from two cylinders, a tank according to the invention can be manufactured relatively simply. According to a particularly advantageous embodiment of the invention, the tank comprises on the inside thereof a partition extending in the longitudinal direction of the tank and comprising at least one passage. Thus the tank is additionally strengthened and moreover the occurrence of uncontrolled liquid flows within the tank, for instance as a result of the movement of a ship, is prevented. For a further strengthening of the container, a bottom surface and a top surface of the tank are made up of two convexly curved surfaces, each fixed to a sidewall.

According to an advanced embodiment of the container, the tank is secured to a lower frame and an upper frame of the housing. The container can then be simply displaced with a crane whose hooks are secured in eyes connected with the upper frame. The tank then provides a rigid connection between the upper and lower frames of the housing. The sidewalls of the housing are preferably fixed to the lower and upper frames of the housing and serve mainly for thermal insulation of the tank and need not contribute to the robustness of the container.

According to a practical embodiment, a top surface of the tank comprises at least one man-hole, so that the tank is readily accessible. Preferably, a bottom surface of the tank comprises a closable inlet/outlet for filling and unloading the tank, which renders loading and unloading of the tank simple.

For obtaining an extra robust construction, the lower frame and the upper frame of the housing are preferably each provided with a skirt construction to which the tank is affixed. In particular, the tank is designed as a pressure tank, the container being provided with a riser which opens into a sump at the bottom of the tank for unloading the tank with the aid of pressure with, for instance, nitrogen.

The invention will be further explained with reference to the drawing. In the drawing:

Fig. 1 is a first partly cutaway side elevation of a tank container according to the invention;

Fig. 2 is a second partly cutaway side elevation of the tank container of Fig. 1;

Fig. 3 is a partly cutaway top plan view of the tank container of Fig. 1; and

Fig. 4 shows a partition of the tank of Fig. 1.

Figs. 1-3 show a tank container according to the invention, indicated by reference numeral 1. The container 1 comprises a tank 2, depicted as a broken line, which is constructed, for instance, from stainless steel and whose longitudinal direction is vertically oriented. The tank is composed of two cylindrical sidewalls 4, 6. As a result of all this, a horizontal cross section of the tank substantially comprises a closed loop elongated in a first direction. The first direction is indicated in Fig. 3 with an arrow P. In the present embodiment, a horizontal cross section of the tank substantially has a shape composed of two segments of a circle because the sidewalls 4, 6 each form part of a circular cylinder having centerlines M1 and M2, respectively. The above-mentioned segments of a circle preferably comprise more than half an arc of a circle, as in this exemplary embodiment.

The tank 2 further comprises a partition 8 (Fig. 4, which shows, in addition to the partition 8, the contours of the tank 2) with various passages 10. In

this exemplary embodiment, the edges 12 of the sidewalls 4, 6 are connected with the partition 8, for instance by means of welds. The top surface 14 of the tank 2 is made up of two convexly curved surfaces 16, 18 having their lower edges 20, 22 connected to sidewall 4 and sidewall 6, respectively. Side edges 24, 26 of the curved surfaces 16, 18 are each connected to a different side of the partition 8. Similarly, the bottom surface 28 of the tank 2 is composed of two convexly curved surfaces 30, 32 which have their upper edges 34, 36 connected to sidewall 4 and sidewall 6, respectively. Side edges 38, 40 of the curved surfaces 30, 32 are each connected to an opposite side of the partition 8. All this boils down to the partition 8 having its edges projecting outside the tank 2.

The tank 2 is accommodated in a thermally insulating housing 42 of the container 1. The housing 42 comprises an upper frame 44 and a lower frame 46 between which and to which the tank 2 is fixed. The tank 2 ensures a rigid and sufficiently robust joint between the upper frame 44 and the lower frame 46.

The lower frame 46 comprises a horizontal inner plate 48 having an opening 50 through which extends a part of the lower end of the tank 2. The lower frame 46 further comprises a horizontal outer plate 52 which by means of a vertical framing strip 54 is connected with the inner plate 48. The tank 2 is carried by a skirt construction comprising a number of vertical plates 58 mounted on top of the outer plate 52. At their upper ends the plates 58 are bevelled so as to conform to the outer surface of the tank 2. The plates 58 disposed under the sidewall 4 are directed radially with respect to the centerline M1, while the plates 58 located under the sidewall 6 are directed radially with respect to the centerline M2. The vertical edges 60 directed to the centerlines M1 and M2 are connected to the outside of an upright loop-shaped closed inner framing strip 62 which, at its lower end, is likewise connected with the top side of the outer plate 52. The lower frame 46 further comprises an upright loop-shaped closed outer framing strip 64 of which the inside is connected to the outside of the tank 2 and a lower edge is connected to the top of the inner plate 48. Along the inside of the outer plate 52 and the strip 54, insulation plates 66 are arranged, shown schematically in the drawing.

The upper frame 44 is substantially identical to the lower frame 46, comparable parts being indicated by the same reference numerals in the drawing.

Around the tank 2 insulation is provided in rectangular form by means of self-supporting sandwich panels 68 having insulating properties. The sandwich panels 68 are connected to the lower frame 46 and the upper frame 44 and together they

thus form the insulating housing 42 for the tank 2. A horizontal cross section of the housing 42 forms a rectangle with long 72 and short 74 sides. The longitudinal direction of a cross section of the rectangular housing 42 is then parallel to the direction indicated by the arrow P. What is thus achieved is, on the one hand, that the volume of the tank 2 is only a little smaller than the volume of the housing 42. This is in contrast with a cylindrical tank having a circular cross section which is placed in such a rectangular housing. On the other hand, the shape of the tank ensures sufficient space 75 between the outside of the tank and the inside of the housing 42 to enable proper cooling of the tank. For this purpose, the container comprises a cooling device 76 which is located in a niche 78 formed on the outside of the housing 42. The cooling device 76 is of a generally known type and cools the space 75 between the outside of the tank 2 and the inside of the housing 42.

The tank 2, at the top thereof, further comprises two manholes 80, 82 coinciding with the centerlines M1 and M2, respectively, the upper frame further comprising two hatches (not shown) permitting access to the manholes.

For loading and unloading the container 1, the tank 2 comprises at the lower end thereof two closable inflow/outflow openings 84, 86 whose positions coincide with the centerlines M1 and M2, respectively.

The inflow/outflow openings 84, 86 are preferably connected with a hose system 88 which is connected to a closable passage 90, provided in the upper frame 44 and accessible from the outside of the container, for the purpose of loading and unloading the container.

In particular, at the top thereof, the tank 2 further comprises a nitrogen inlet 92 for unloading the container 1 by means of pressure with nitrogen via the riser 88 located outside the tank. It is also possible to unload the tank without nitrogen via a pump 93 indicated in dots in Fig. 2. The container further comprises eyes 94 mounted on top of the upper frame 44, by which the container can be placed with the aid of a crane. Thus the container can also be placed on a quay or like embankment and there serve as a tank terminal.

Claims

1. A mobile temperature-regulated tank container comprising a tank of oblong shape, an insulating housing in which the tank is accommodated and a cooling device by which the space between the tank and the housing can be cooled, characterized in that the tank is mounted in the housing in such a manner that in use the longitudinal direction of the tank is at least

substantially vertically oriented, a horizontal cross section of the tank comprising substantially a closed loop elongated in a first direction and a horizontal cross section of the housing having an at least substantially rectangular shape of which the long sides are at least substantially parallel to the first direction.

2. A mobile tank container according to claim 1, characterized in that a horizontal cross section of the tank substantially has a shape composed of two segments of a circle.

3. A mobile tank container according to claim 1, characterized in that said segments of a circle comprise more than half an arc of a circle.

4. A mobile tank container according to any one of the preceding claims, characterized in that the sidewall of the tank is composed of two sidewalls comprising a part of a surface of cylinder.

5. A mobile tank container according to any one of the preceding claims, characterized in that the tank comprises on the inside thereof a partition extending in the longitudinal direction of the tank and comprising at least one passage.

6. A mobile tank container according to claim 5, characterized in that the partition is oriented at least substantially perpendicularly to said first direction.

7. A mobile tank container according to claims 4 and 6, characterized in that the longitudinal edges of the partition are respectively connected with the tank near the longitudinal edges of the sidewalls.

8. A mobile tank container according to claim 4, characterized in that a bottom surface and a top surface of the tank are each composed of two convexly curved surfaces each fixed to a sidewall.

9. A mobile tank container according to any one of the preceding claims, characterized in that the tank is fixed to a lower frame and an upper frame of the housing.

10. A mobile tank container according to claim 9, characterized in that the sidewalls of the housing are connected to the lower frame and the upper frame of the housing.

11. A mobile tank container according to claim 10, characterized in that the sidewalls comprise insulating sandwich panels.
12. A mobile tank container according to claim 9, characterized in that outer walls of the lower and upper frames are provided with insulating plates. 5
13. A mobile tank container according to claim 8, characterized in that a top surface of the tank is provided with at least one manhole. 10
14. A mobile tank container according to claim 8, characterized in that a bottom surface of the tank comprises at least one closable inlet/outlet for filling and unloading the tank. 15
15. A mobile tank container according to claim 9, characterized in that the lower frame and the upper frame of the housing are each provided with a skirt construction to which the tank is fixed. 20
16. A mobile tank container according to any one of the preceding claims, characterized in that the tank is designed as a pressure tank, the container comprising a riser which opens into a sump at the bottom of the tank for unloading the tank with the aid of pressure with, for instance, nitrogen. 25 30
17. A mobile tank container according to any one of claims 1-15, characterized in that the container comprises a riser which opens into a sump at the bottom of the tank and a pump for unloading the tank. 35
18. A mobile tank container according to any one of the preceding claims, characterized in that the container can also be used as a tank terminal. 40

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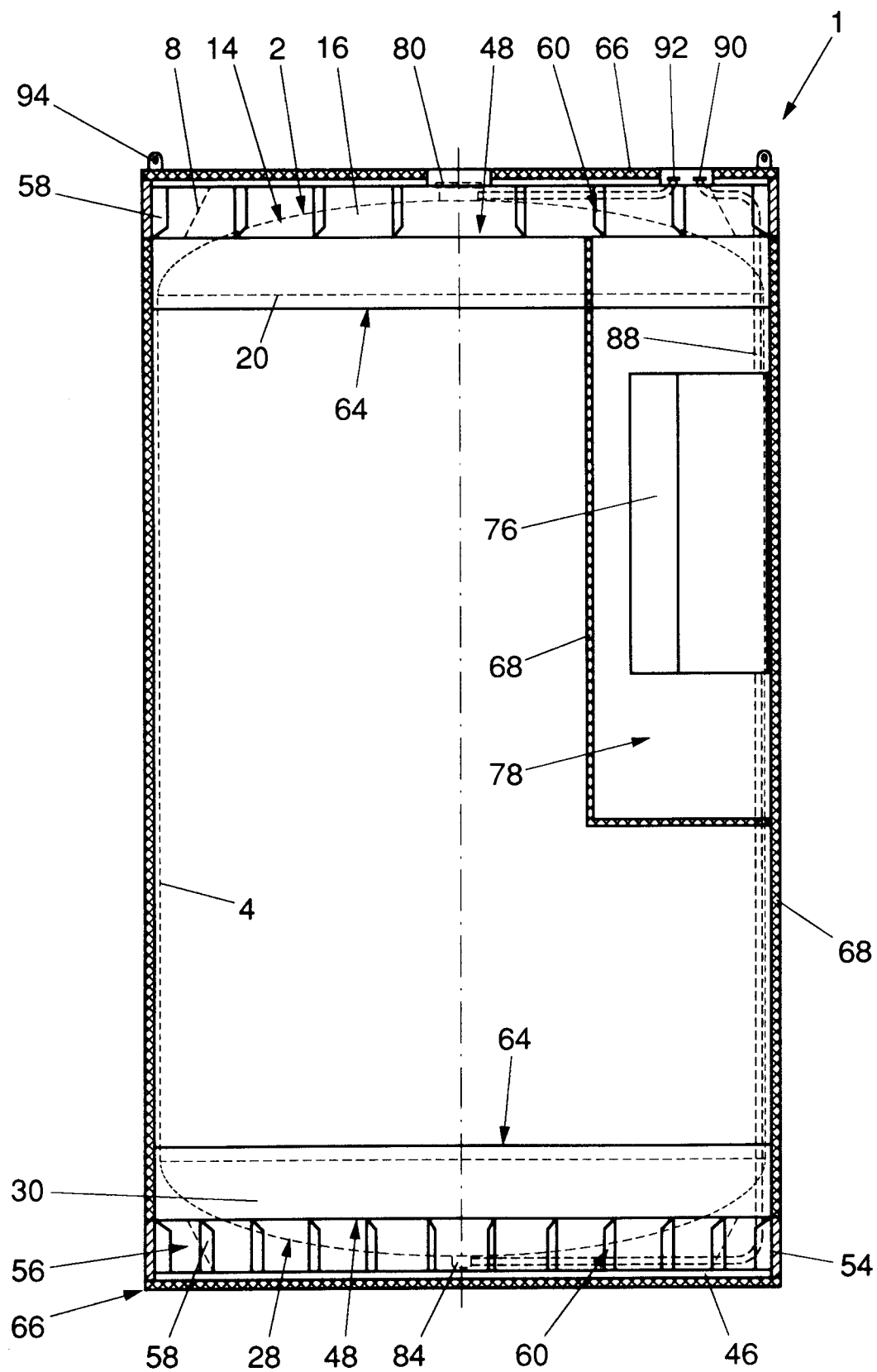


FIG. 1

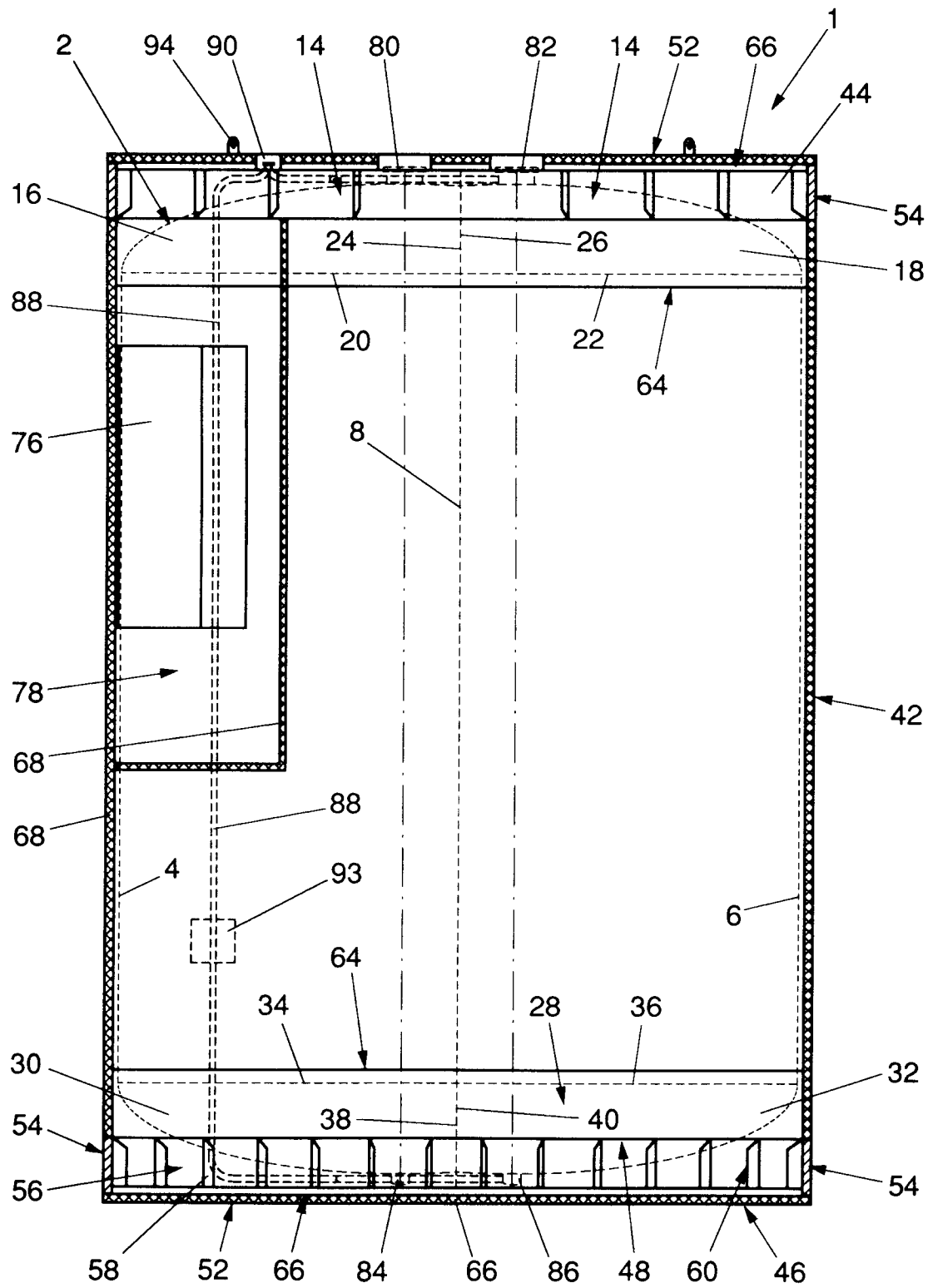


FIG. 2

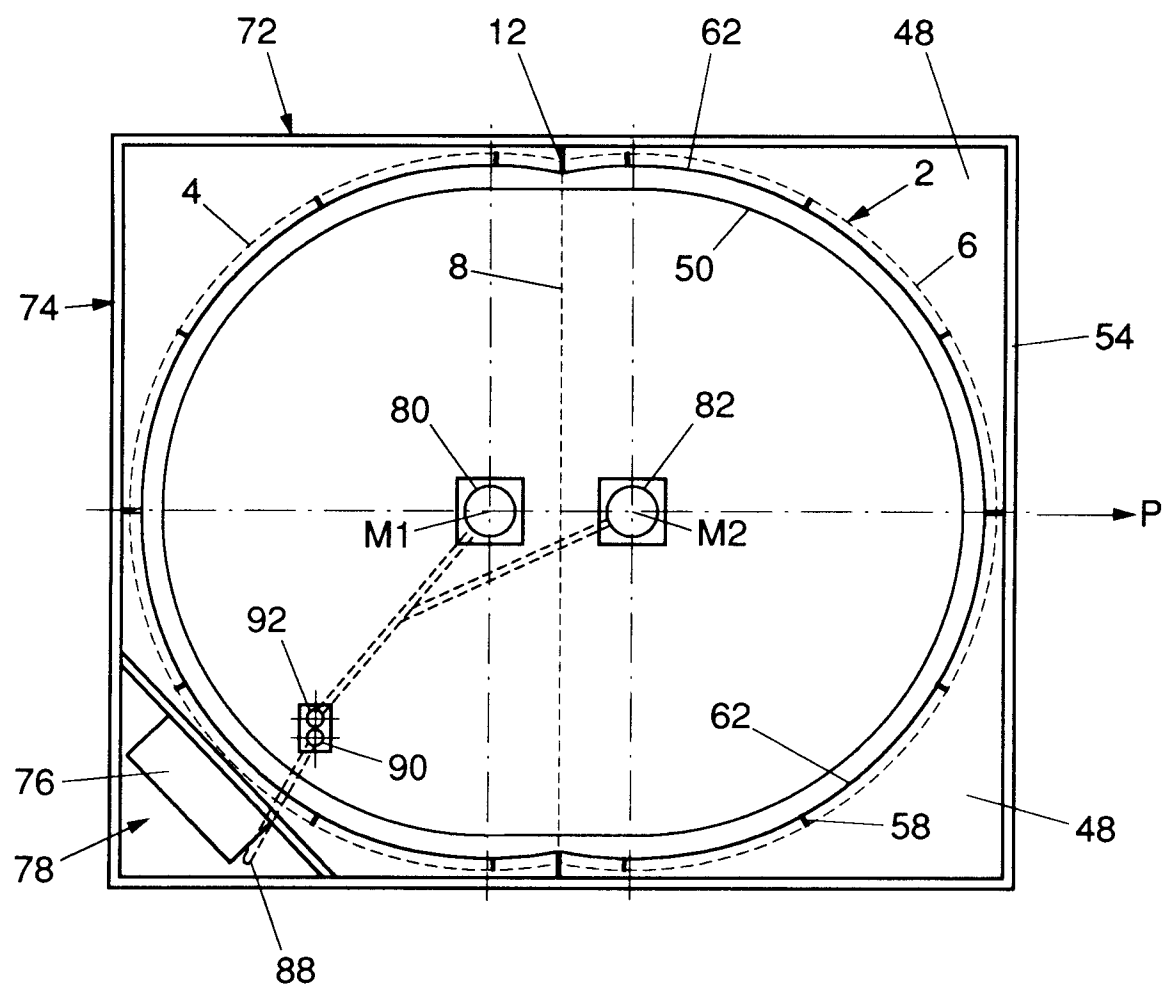


FIG. 3

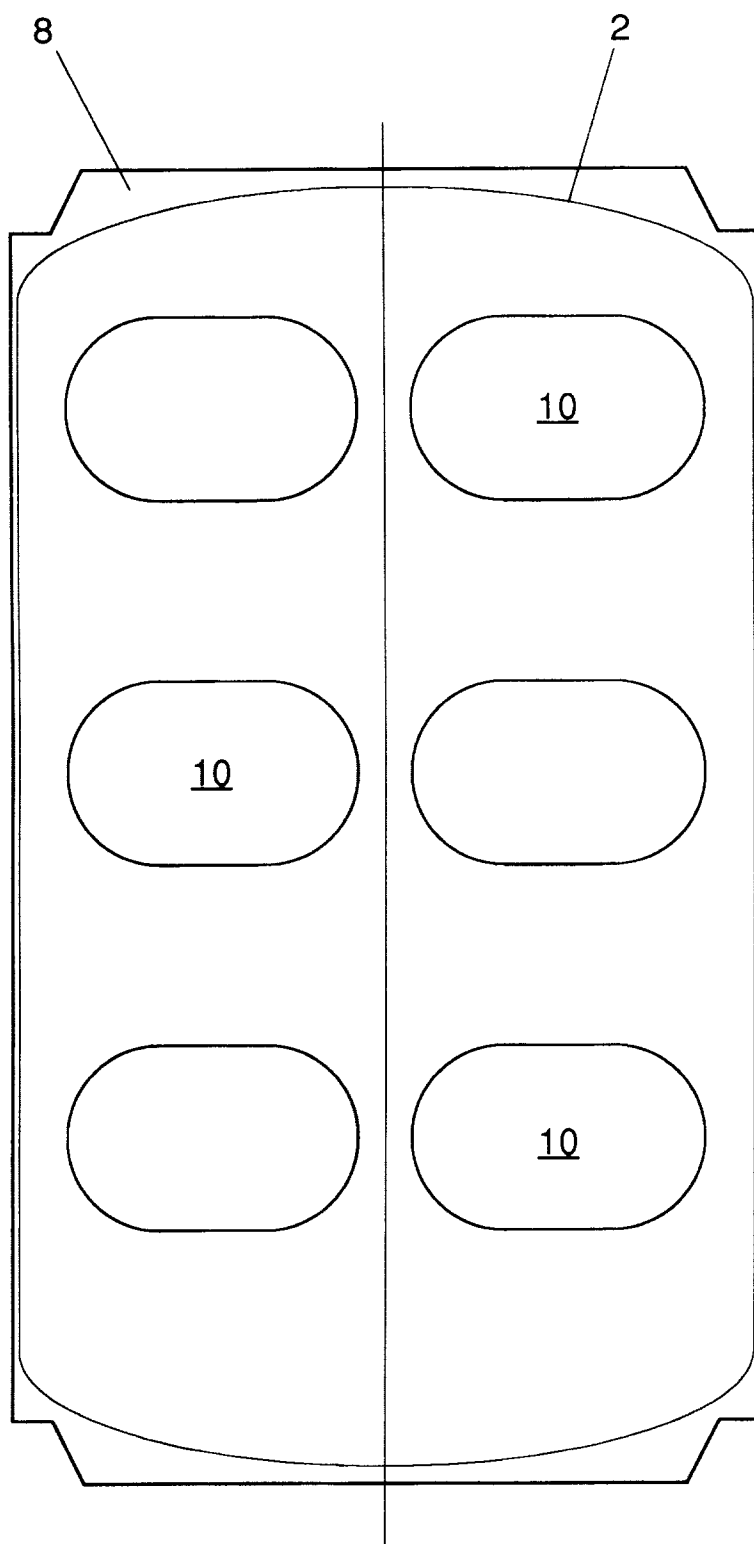


FIG. 4



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EUROPEAN SEARCH REPORT

Application Number
EP 94 20 3667

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.6)
A	WO-A-89 00962 (H. CASSENS) * abstract *	1	B65D88/74 B65D88/12
A	EP-A-0 382 918 (WESTERWÄLDER EISENWERK GERHARD) * abstract *	1	
A	US-A-3 814 290 (GERHARD) * column 2, line 44 - line 48; figures 1,4 *	1	
A	US-A-4 173 288 (SCHUTZ)		
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			B65D B60P
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 20 March 1995	Examiner Beernaert, J
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