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(54) **A modular tank and a kit therefore**

(57) A tank assembly of modular composite construction has a body (2) comprising a side wall with end covers (6) at each end of the side wall. A side wall is formed by a plurality of arcuate side wall segments (4,5,8) interconnected by fasteners. Outwardly projecting peripheral connector flanges (18) on the side wall segments (4,5,8) and the end covers (6) are interconnected by fasteners to assemble the tank. One of the side wall portions is provided with an access hatch. Integral legs (19) project outwardly of some of the side wall segments (4) for supporting the tank. A number of reinforcing ribs (16) are provided on each side wall segment (4,5,8). Pipe fitting guide slots (26) may be provided on some of the side wall segments (4,5,8). The end covers (6) are dished and preferably are provided with pipe mounting elements (32) for connection of pipes to the tank.

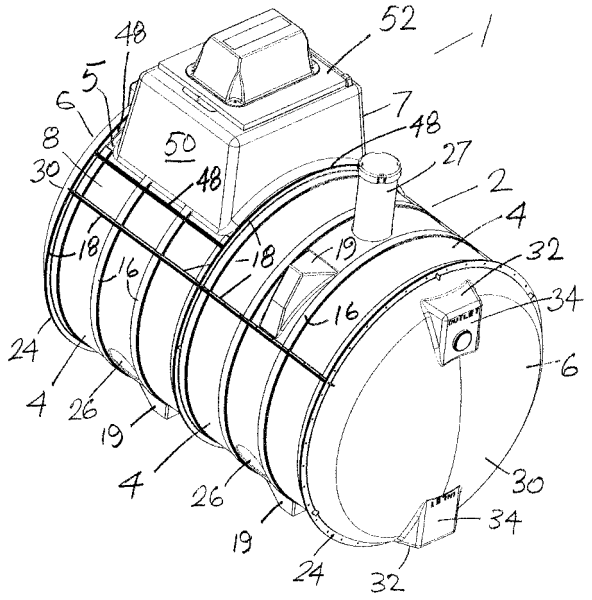

FIG1

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Description

Introduction

[0001] This invention relates to tanks for the storage of liquids.

Summary of the Invention

[0002] According to the invention, there is provided a tank assembly of modular composite construction, including:

a body comprising a side wall with end covers at each end of the side wall,

the side wall being formed by at least one composite side wall portion,

each side wall portion comprising three or more complementary side wall segments interconnected by fasteners,

one of the side wall segments in said at least one side wall portion having an access hatch,

a dished end cover being fastened to the side wall at each end of the side wall,

each of the side wall segments and the end covers having an outwardly extending peripheral connector flange for engagement with and attachment by fasteners to an adjacent side wall segment or end cover.

[0003] In one embodiment of the invention each end cover is reversible having a domed body surrounded by a peripheral mounting flange, the domed body being sized so that it will locate within an associated side wall portion upon which it is mounted.

[0004] Conveniently the end covers may be adapted so that two or more of the end covers are nestable together.

[0005] In another embodiment each end cover is of composite construction comprising two or more parts, each part having a connector flange for complementary engagement with an associated connector flange on the or each other part, said connector flanges being secured together by fasteners.

[0006] In one embodiment of the invention, a number of support legs are provided on one or more of the side wall segments. Ideally, each support leg projects outwardly of the mounting flange on the side wall segment.

[0007] In another embodiment, each side wall segment has a number of spaced-apart reinforcing ribs.

[0008] In a further embodiment, each side wall portion is cylindrical, being formed by a plurality of arcuate side wall segments.

[0009] In another embodiment, similar side wall segments are nestable together.

[0010] In another embodiment, each side wall segment has a number of outwardly projecting spaced-apart circumferential channel-section reinforcing ribs. Conveniently, an inwardly facing interior of each channel formed by a rib defines a support for mounting an internal divider wall panel within the tank, a periphery of the divider wall panel locating in said channel.

[0011] In another embodiment, a blind pipe fitting guide slot is provided on a side wall segment. An inner end of the guide slot can be cut out to allow the insertion of a pipe through the side wall.

[0012] In another embodiment, a pipe mounting element is provided on an end cover. Preferably, said pipe mounting element has a pipe attachment face substantially perpendicular to a central axis of the tank.

[0013] In another embodiment, the tank assembly further includes a riser turret adapted for complementary engagement with and extension of the access hatch.

[0014] In another embodiment a number of foot elements are provided on the side wall, each foot element being integrally formed with a side wall segment and extending outwardly beyond the connector flange on said side wall segment.

[0015] In another embodiment, a portion of the mounting flange on a number of the side wall segments is adapted to form support feet for the tank.

[0016] In another embodiment, a pipe mounting element is provided on the side wall and/or end covers, being formed integrally therewith.

[0017] In a further embodiment, the pipe mounting element is formed on a foot portion of a side wall segment.

[0018] In another embodiment each pipe mounting element has a drilling or cutting guide on a pipe mounting face of the pipe mounting element.

[0019] In another aspect, the invention provides a tank assembly kit for forming a tank of the type described herein, comprising a pair of the end covers and a plurality of the side wall segments.

Brief Description of the Drawings

[0020] The invention will be more clearly understood by the following description of some embodiments thereof, given by way of example only with reference to the accompanying drawings, in which:

Fig. 1 is a perspective view of a modular tank according to the invention;

Fig. 2 is an elevational view of the modular tank;

Fig. 3 is a plan view of the modular tank;

Fig. 4 is an end elevational view of the modular tank;

Fig. 5 is a detail perspective view showing portion of the modular tank, partially assembled;

Fig. 6a and Fig. 6b are detail perspective views showing a wall panel forming portion of the modular tank;

Fig. 7 is a perspective view of an internal divider wall forming portion of the modular tank;

Fig. 8 is a perspective view of the divider wall of Fig. 7 shown from an opposite side to that shown in Fig. 7;

Fig. 9 is a detail perspective view showing a turret wall component of the modular tank;

Fig. 10 is an enlarged detail perspective view showing an end cover of the tank;

Fig. 11 is another detail perspective view of the end cover shown in Fig. 10;

Fig. 12a and Fig. 12b are detail perspective views showing another wall panel forming portion of the modular tank;

Fig. 13 is a partially cut-away perspective view of the tank;

Fig. 14 is a perspective view showing the components for a number of tanks mounted in a container for transport;

Fig. 15 is a perspective view of the turret wall component of Fig. 9 with an associated riser turret mounted thereon to increase the height of the turret;

Fig. 16 is a perspective view of the turret wall component of Fig. 9 with another associated riser turret mounted thereon to increase the height of the turret;

Fig. 17 is an elevational view of the assembly shown in Fig. 16;

Fig. 18 is a perspective view of another modular tank according to a second embodiment of the invention;

Fig. 19 is a perspective view of a further modular tank according to a third embodiment of the invention;

Fig. 20 is a perspective view of another modular tank according to a fourth embodiment of the invention;

Fig. 21 is a perspective view of another modular tank according to the invention;

Fig. 22 is a perspective view of a further modular tank according to the invention;

Fig. 23 is a perspective view of another tank according to the invention; and

Fig. 24 is a perspective view of a further tank according to the invention.

Detailed Description of the Preferred Embodiments

[0021] Referring to the drawings, and initially to Figs. 1 to 14 thereof, there is illustrated a modular tank according to the invention indicated generally by the reference numeral 1. The tank 1 has a body 2 with a cylindrical side wall having a number of composite side wall portions each of which is formed by a number of associated curved side wall segments or panels 4, 5, 8, and domed end wall panels 6 at each end of the side wall. One of the side wall panels 5 incorporates an access turret 7. Each panel 4, 5, 6, 8 has a flanged periphery, said flanges overlapping on assembly and being bolted together to form the composite modular tank 1. One or more internal divider walls 10 may be mounted within the tank body 2 to subdivide the tank 1 into a number of separate compartments 11, 12, 13 (Fig. 3).

[0022] Referring in particular to Figs. 1, 5 and 6, in this case three side wall panels 4 can be assembled together to form a cylindrical side wall section of the tank 1. Each panel 4 has an arcuate shape, curving through 120°. Fig. 6 shows the side wall panel 4 which comprises a curved panel 15 with a number of spaced-apart circumferential channel-section reinforcing ribs 16. An endless flange 18 extends around a periphery of the panel 15 for connection by fasteners to adjacent side wall panels 4, 5, 8 or end wall panels 6 upon assembly of the tank 1.

[0023] It will be noted that a foot element 19 projects outwardly from the panel 15 and is integrally formed therewith extending outwardly beyond the connector flange 18 on the side wall panel 4. When the side wall panel 4 is used on an underside of the body 2, as shown in Figs. 1 and 5, the foot elements 19 on the two lowermost side wall panels 4 act as feet to support the tank 1. As can been seen in Fig. 4 a lowermost support face 20 of each foot 19 extends below a lowermost edge of a flange 24 on each end wall panel 6. Also, a cylindrical blind slot 26 is provided in the panel 15, being recessed into the panel 15 for reception of a pipe, such as the pipe 27 shown in Fig. 1. An opening for through passage of the pipe 27 is simply cut through an inner end 28 of the slot 26 to mount the pipe 27 in the slot 26.

[0024] Fig. 5 shows a number of the side wall panels 4 joined together to form a partially assembled tank 1. Flanges 18 of adjacent side wall panels 4 overlap and are bolted together with suitable sealing therebetween.

[0025] Referring in particular to Figs. 1, 2 and 4, each end wall panel 6 has a circular domed body 30 with a peripheral mounting flange 24 extending around an inner circumferential edge of the body 30 for overlap with and attachment to the associated mounting flanges 18 on the side wall panels 4, 5. It will be noted that the mounting flange 24 extends inwardly sufficiently so that if desired

the end wall panel 6 can be reversed with the dome 30 extending into the tank 1 so that the tank 1 may be mounted in an upright orientation.

[0026] Pipe mounting elements 32 project outwardly of the body 30 and present a generally vertical face 34 for attachment of inlet and outlet pipes (not shown). Blind pilot holes 36 are provided in said face 34 to act as pilot holes for drilling through said face 34 for reception and mounting of the inlet/outlet pipes.

[0027] Figs. 3, 7 and 8 show the divider walls 10. These are provided with a peripheral mounting flange 40 for attachment to the side wall 2 of the tank 1. It will be noted also that support ribs 42 are provided on the divider wall 10 for supporting a bacteria media and also provide added strength to the divider wall 10. The peripheral mounting flange 40 may conveniently locate in the inwardly facing channel 43 of the channel-section ribs 16 in the side wall panels 4, 8 to mount and support the divider walls 10 within the tank 1. Fig. 13 shows the divider walls 10 mounted within the tank 1.

[0028] Fig. 9 shows the side wall panel 5 incorporating the turret 7. The side wall panel 5 has a curved inner panel 45. This is similar in curvature to the side wall panels 4 described previously. An endless mounting flange 48 extends around a periphery of the panel 5 for connection by fasteners to the adjacent side wall panels 4, 8 and end wall panels 6. A generally rectangular turret body 50 projects upwardly from the inner panel 45. Side walls of the turret body 50 taper inwardly and upwardly from the inner panel 45. This allows nested stacking of a number of the side wall panels 5 with turret 7 as shown in Fig. 14. An opening at a top 51 of the turret body 50 is closed by an access hatch 52.

[0029] Fig. 12 shows the side wall panel 8. This is associated with the side wall panel 5 which incorporates the access turret 7. In some cases these side wall panels 5, 8 may be integrally formed. The side wall panel 8 comprises a curved panel 25 with a number of spaced-apart circumferential support ribs 16. An endless flange 18 extends around a periphery of the panel 25 for connection by fasteners to adjacent side wall panels 4, 5 and end wall panel 6 upon assembly of the tank 1.

[0030] Fig. 14 shows how components for a number of tanks can be conveniently nested together and stored on a container 54 for transport. In this case sufficient components for forming 34 tanks can be fitted in a single 40 foot container 54. Thus it will be appreciated that transport costs for the tanks 1 can be reduced by virtue of the modular knock-down construction of the tanks 1.

[0031] It will also be appreciated that if portion of the tank 1 becomes damaged it is only necessary to replace the damaged portion of the tank 1. This is readily easily achieved at minimum cost as the whole tank 1 does not have to be replaced, merely the damaged component.

[0032] The tank system of the invention has a number of advantages as follows:

1. Modularity - it is relatively easy to assemble the tanks in a range of sizes to suit particular requirements.
2. Easy repair - any damaged portion of the tank can be removed and replaced on site without having to replace the whole tank.
3. Easy extension - the size of the tank can be increased relatively easily if required by the addition of new modular sections if the capacity requirement increases, again without having to remove the old tank and supply a whole new tank.
4. The tank can be mounted in either a horizontal or a vertical orientation due to the reversible end covers.
5. The thickness of the wall panels can be adjusted to suit the depth at which the tank is to be located in the ground and/or alter the strength for particular applications.
6. The turret height is easily adjustable.
7. Transport of tank panels in flat configuration, or partially assembled tank sections for full assembly on site is relatively easy, cheap and efficient.
8. The internal divider walls are adjustable to split the interior of the tank into sections of desired size.

[0033] Figs. 15 shows the side wall panel 5 incorporating the turret 7 together with an associated riser turret 55 which sits on the turret body 50 and forms an upward extension thereof. Riser turrets 55 of different heights may be provided to facilitate mounting the tank 1 at the different depths in the ground.

[0034] Figs. 16 and 17 show the side wall panel 5 incorporating the turret 7 together with another associated riser turret 55 which sits on the turret body 50 and forms an upward extension thereof. The riser turret 55 is closed by a lid 56.

[0035] Fig. 18 shows an arrangement for a twin turret tank indicated generally by the reference numeral 60. Parts similar to those described previously are assigned the same reference numerals. Figs. 19 and 20 show two different arrangements for twin turret tanks, the tank 1 in each case being elongated by the addition of an extra side wall portion 65.

[0036] Referring now to Fig. 21, there is shown another modular tank according to the invention indicated generally by the reference number 70. Parts similar to those described previously are assigned the same reference numerals. In this case, composite end covers 71 are provided. Each end cover 71 has three parts 72,73,74 which are bolted together by means of peripheral mounting flanges 75 extending along a joining edges of the parts 72,73,74.

[0037] Referring now to Fig.22 there is shown another modular tank 80 according to the invention. Parts similar to those described previously are assigned the same reference numerals. In this case it will be noted that portion of the peripheral mounting flanges on the sidewall segments are adapted to form support feet 82 for the tank 80.

[0038] Referring now to Fig.23 there is shown another

modular tank 85 according to the invention. Parts similar to those described previously are assigned the same reference numerals. In this case it will be noted that the blind slots 26 which form pipe mounting elements are integrally formed with the feet 19 on the side wall panels 4.

[0039] Referring now to Fig.24 there is shown another modular tank according to the invention indicated generally by the referenced numeral 90. Parts similar to those described previously are assigned the same reference numerals. In this case the tank 90 is formed by four interconnected cylindrical sidewall portions 91,92,93,94.

[0040] It will be appreciated that the modular structure of the tank according to the invention allows great flexibility in constructing tanks of different sizes and in subsequently modifying the size of the tank at a later stage of desired. Also, any portions of the tank that become damaged can be readily easily replaced by simply replacing the damaged component rather than having to replace the whole tank.

[0041] The invention is not limited to the embodiments hereinbefore described which may be varied in both construction and detail within the scope of the appended claims.

Claims

1. A tank assembly of modular composite construction, including:

   a body comprising a side wall with end covers at each end of the side wall,
   the side wall being formed by at least one composite side wall portion,
   each side wall portion comprising three or more complementary side wall segments interconnected by fasteners,
   one of the side wall segments in said at least one side wall portion having an access hatch,
   a dished end cover being fastened to the side wall at each end of the side wall,
   each of the side wall segments and the end covers having an outwardly extending peripheral connector flange for engagement with and attachment by fasteners to an adjacent side wall segment or end cover.

2. The tank assembly as claimed in claim 1, wherein each end cover is reversible having a domed body surrounded by a peripheral mounting flange, the domed body being sized so that it will locate within an associated sidewall portion upon which it is mounted.

3. The tank assembly as claimed in claim 2, wherein two or more of the end covers are nestable together.

4. The tank assembly as claimed in claim 2 or claim 3, wherin each end cover is of composite construction comprising two or more parts, each part having a connector flange for complementary engagement with an associated connector flange on the or each other part, said connector flanges being secured together by fasteners.

5. The tank assembly as claimed in any preceding claim, wherein each side wall portion is cylindrical, being formed by a plurality of arcuate side wall segments.

6. The tank assembly as claimed in claim 5, wherein similar side wall segments are nestable together.

7. The tank assembly as claimed in any preceding claim, wherein each side wall portion has a plurality of spaced-apart outwardly projecting reinforcing ribs of channel section, an inwardly facing interior of each channel defining a support for mounting an internal divider wall panel within the tank, a periphery of the divider wall panel locating in said channel.

8. The tank assembly as claimed in any preceding claim further including a riser turret adapted for complementary engagement with and extension of the access hatch.

9. The tank assembly as claimed in any preceding claim, wherein a number of foot elements are provided on the side wall, each foot element being integrally formed with a side wall segment and extending outwardly beyond the connector flange on said side wall segment.

10. The tank assembly as claimed in any one of claims 1 to 8, wherein a portion of the mounting flange on a number of the side wall segments is adapted to form support feet for the tank.

11. The tank assembly as claimed in any preceding claim, wherein a pipe mounting element is provided on the side wall and/or end covers, being formed integrally therewith.

12. The tank assembly as claimed in claim 11, wherein the pipe mounting element is formed on a foot portion of a side wall segment.

13. The tank assembly as claimed in claim 11, wherein the pipe mounting element is provided on an end cover, said pipe mounting element having a pipe attachment face substantially perpendicular to a central axis of the tank.

14. The tank assembly as claimed in any one of claims 11 to 13, wherein each pipe mounting element has a drilling or cutting guide on a pipe mounting face of

the pipe mounting element.

15. A tank assembly kit for forming a tank as claimed in any preceding claim comprising a pair of the end covers and a plurality of the side wall segments.

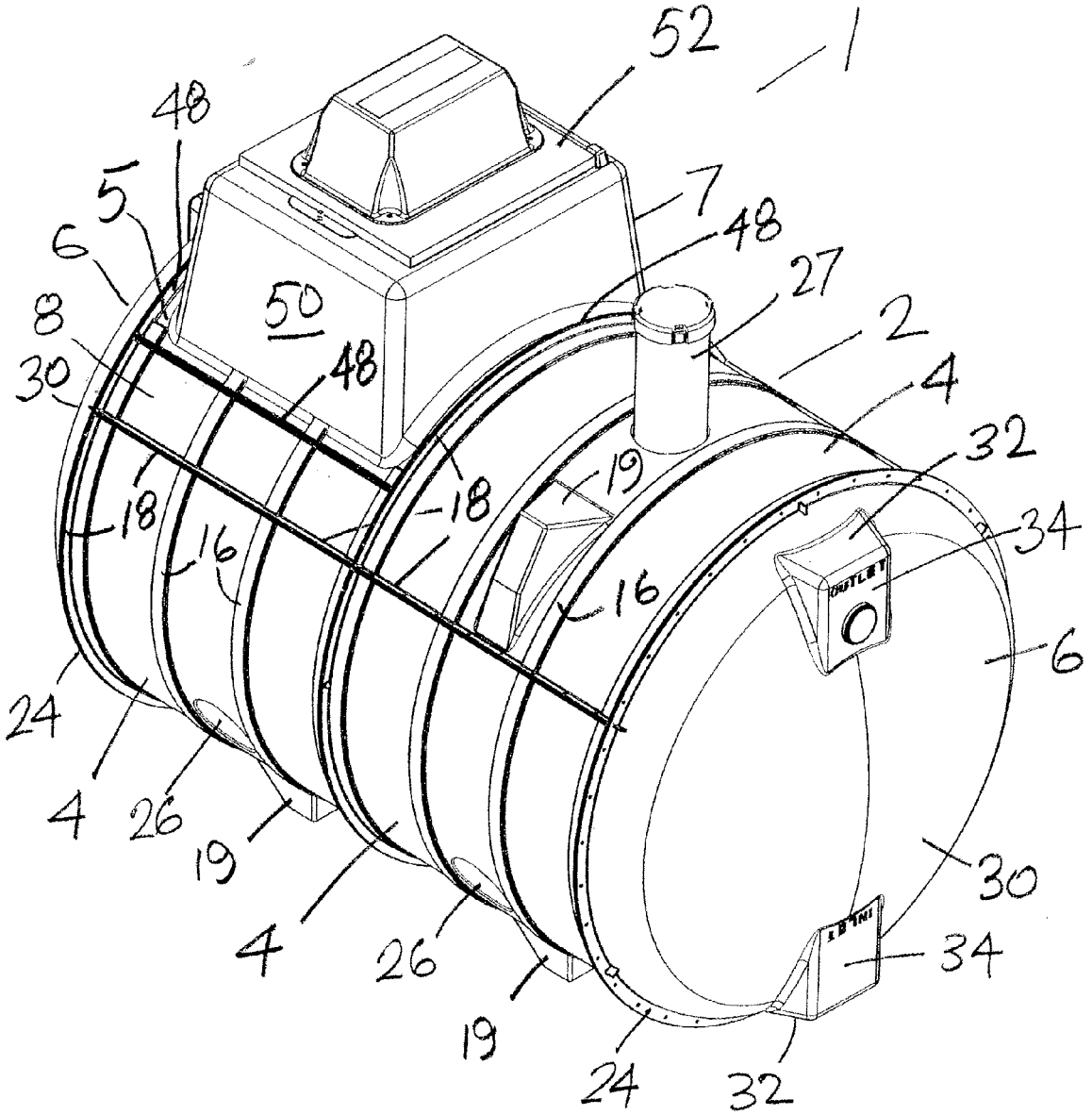

FIG 1

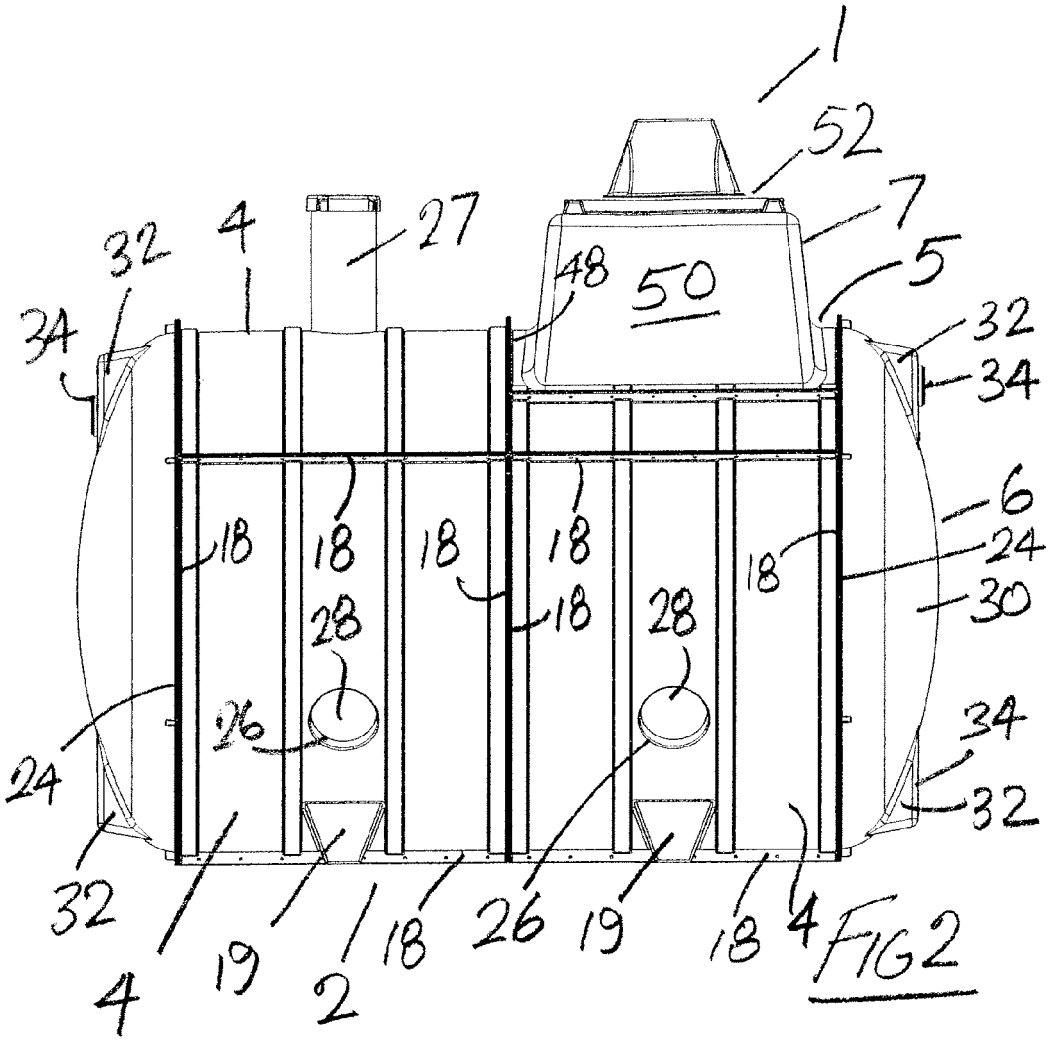

FIG 2

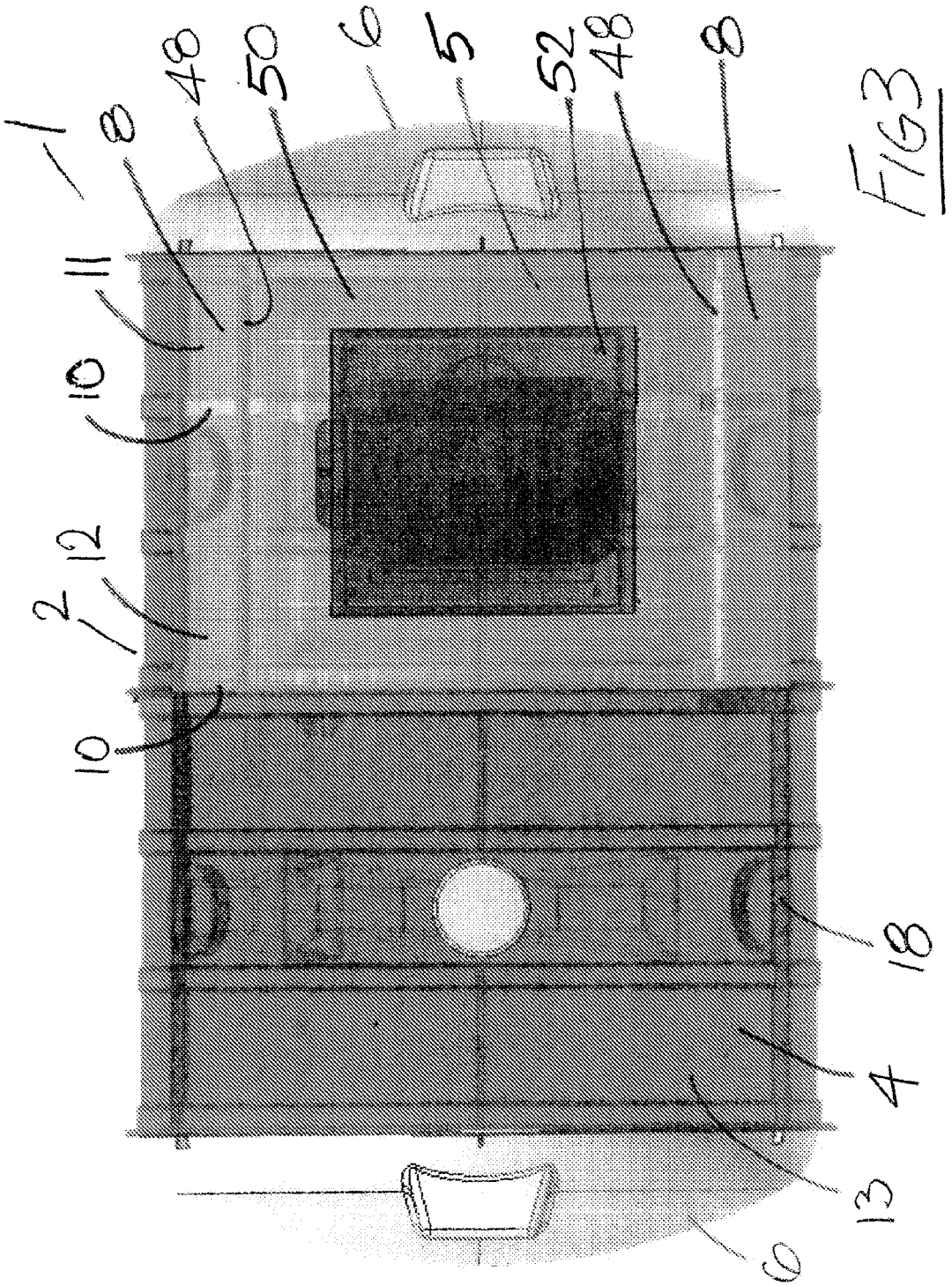

FIG 3

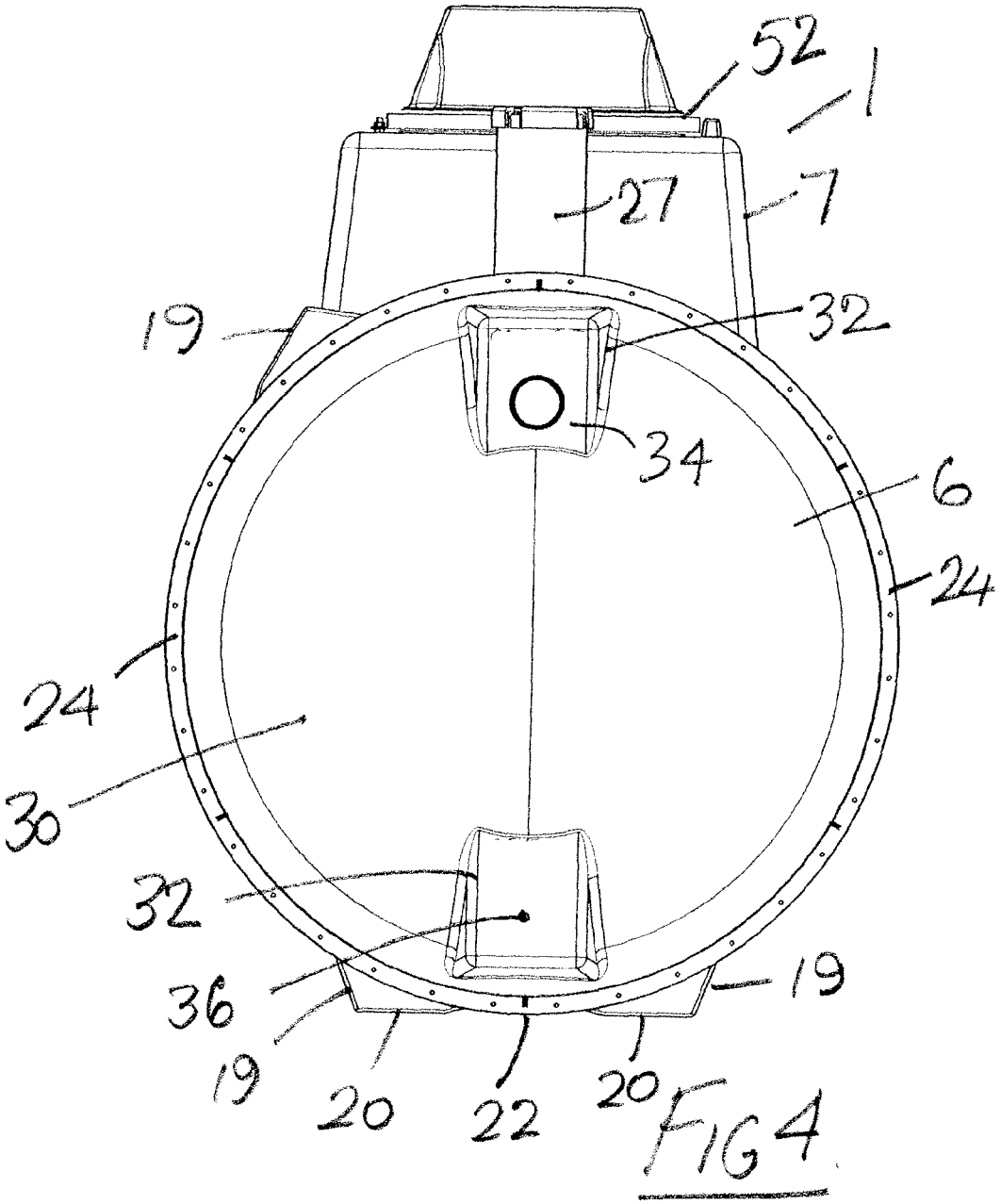

FIG 4

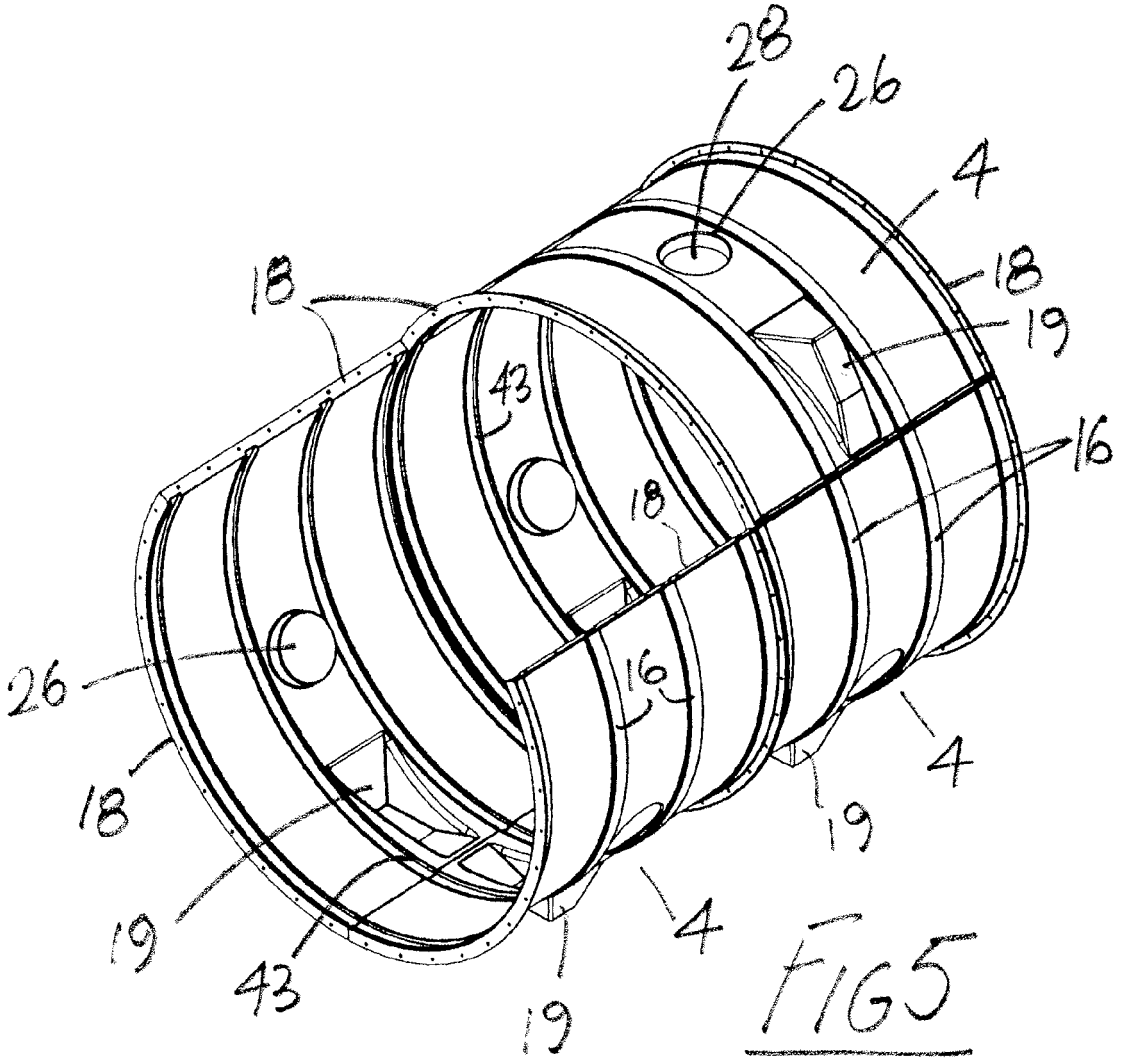

FIG 5

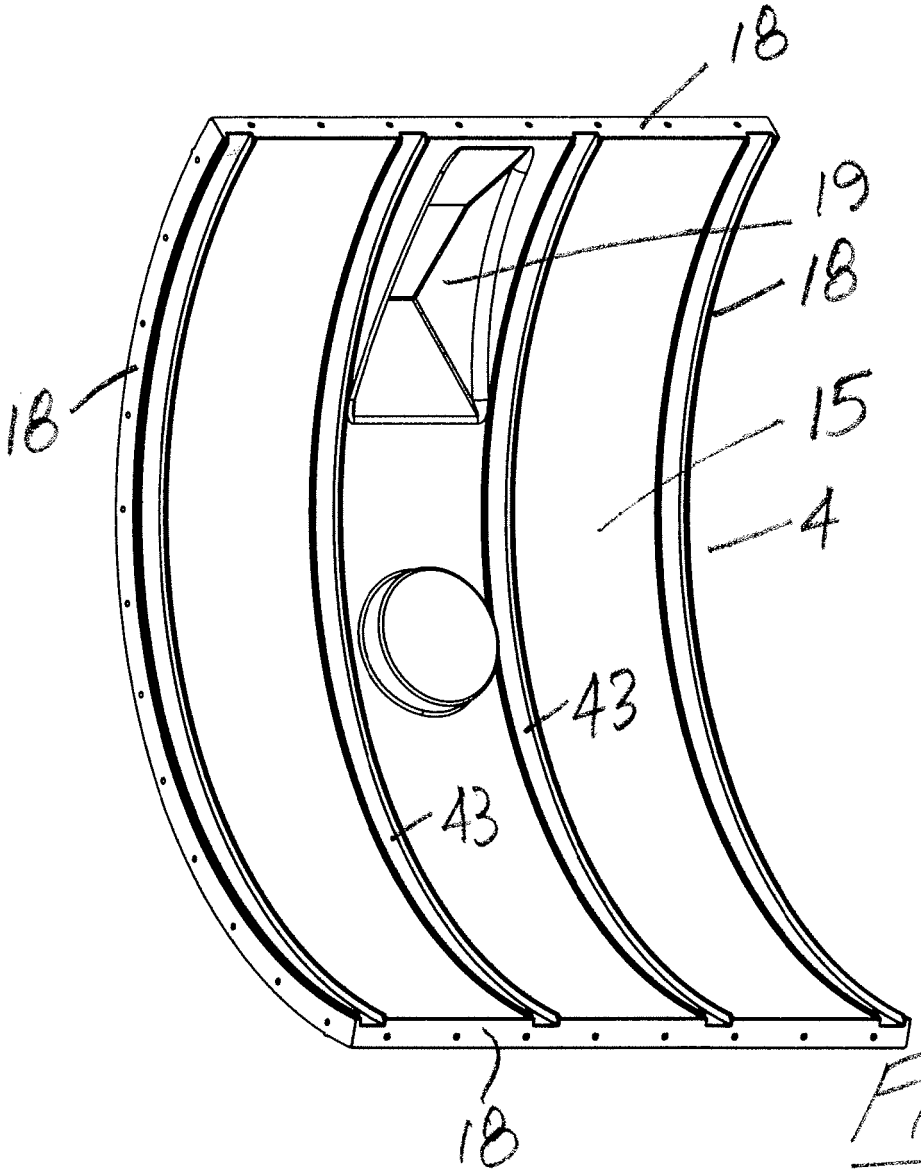

FIG 6a

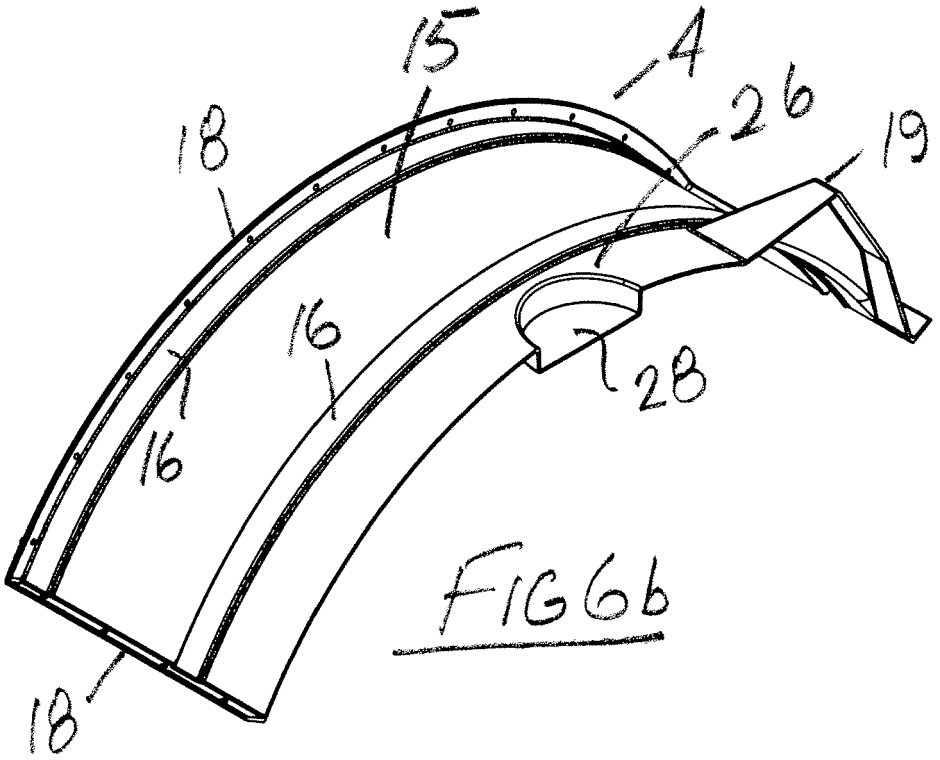

FIG 6b

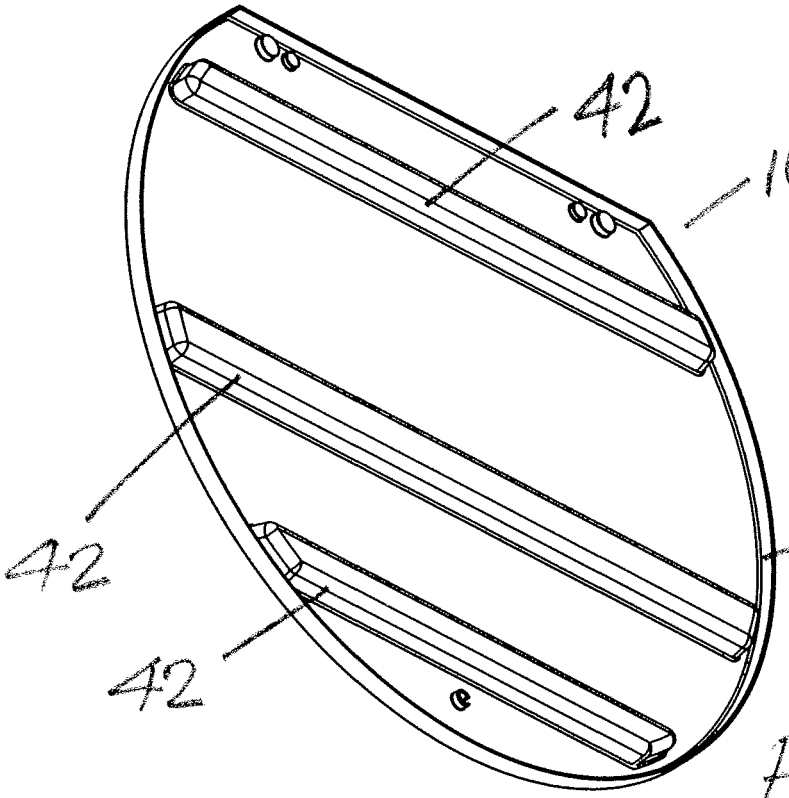

FIG7

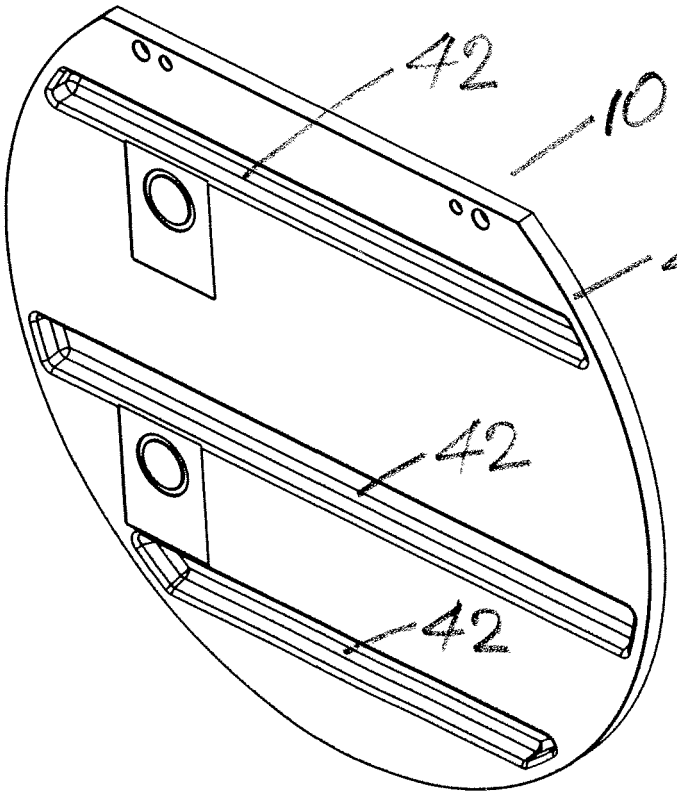

FIG8

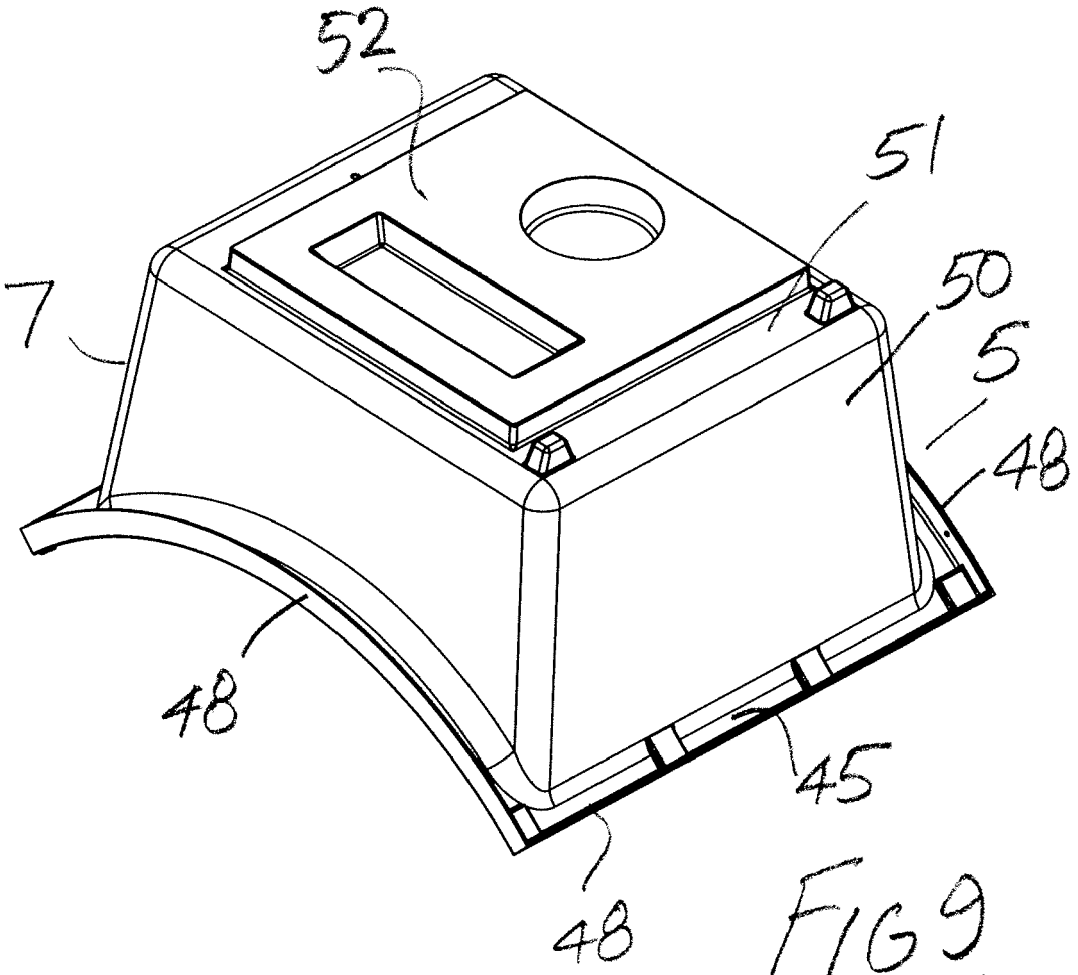

FIG 9

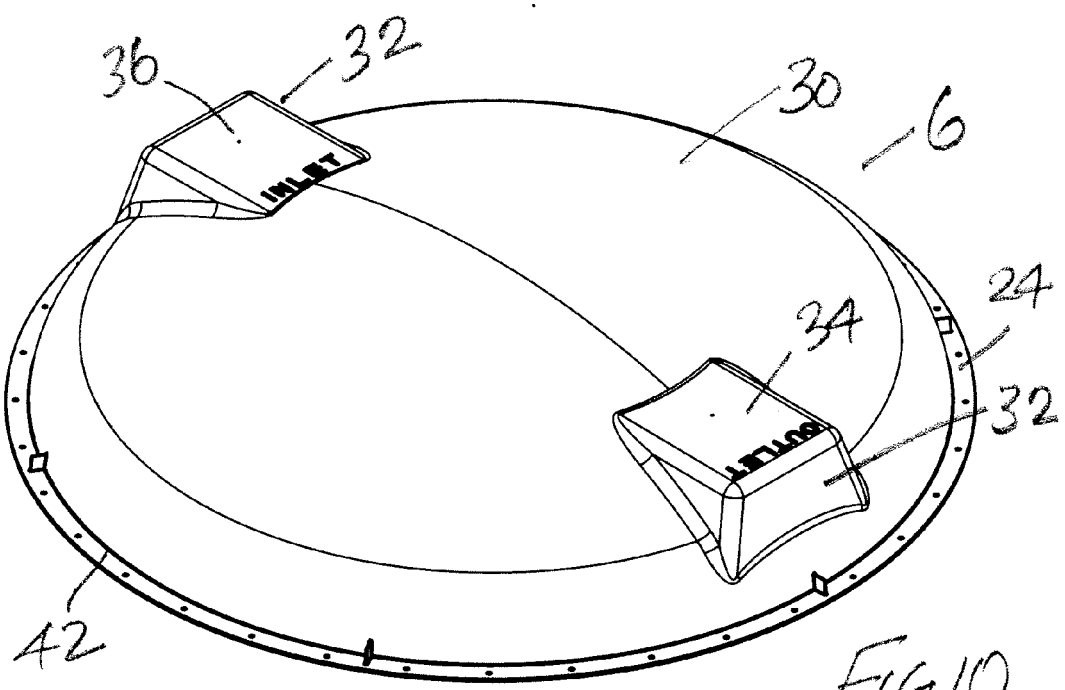

FIG 10

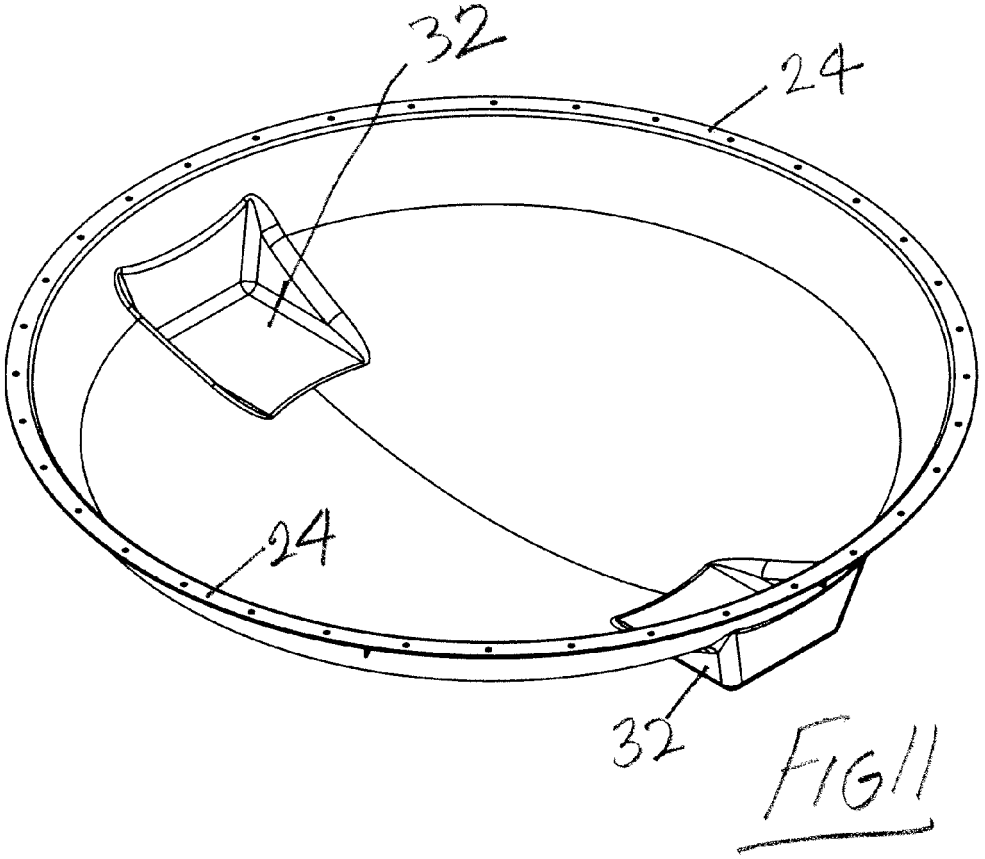

FIG 11

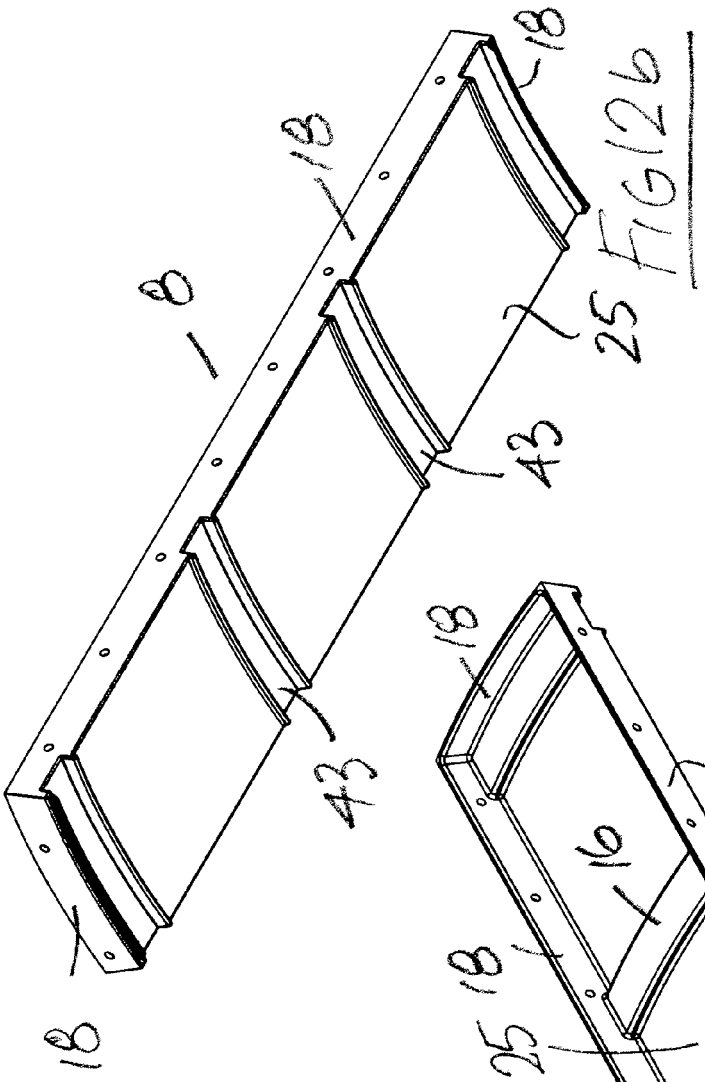

FIG12b

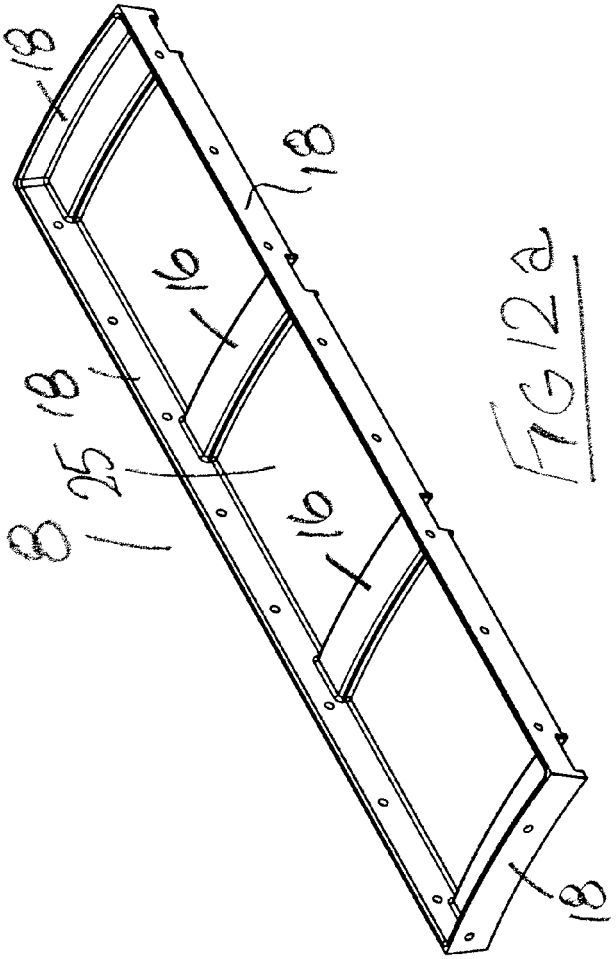

FIG12a

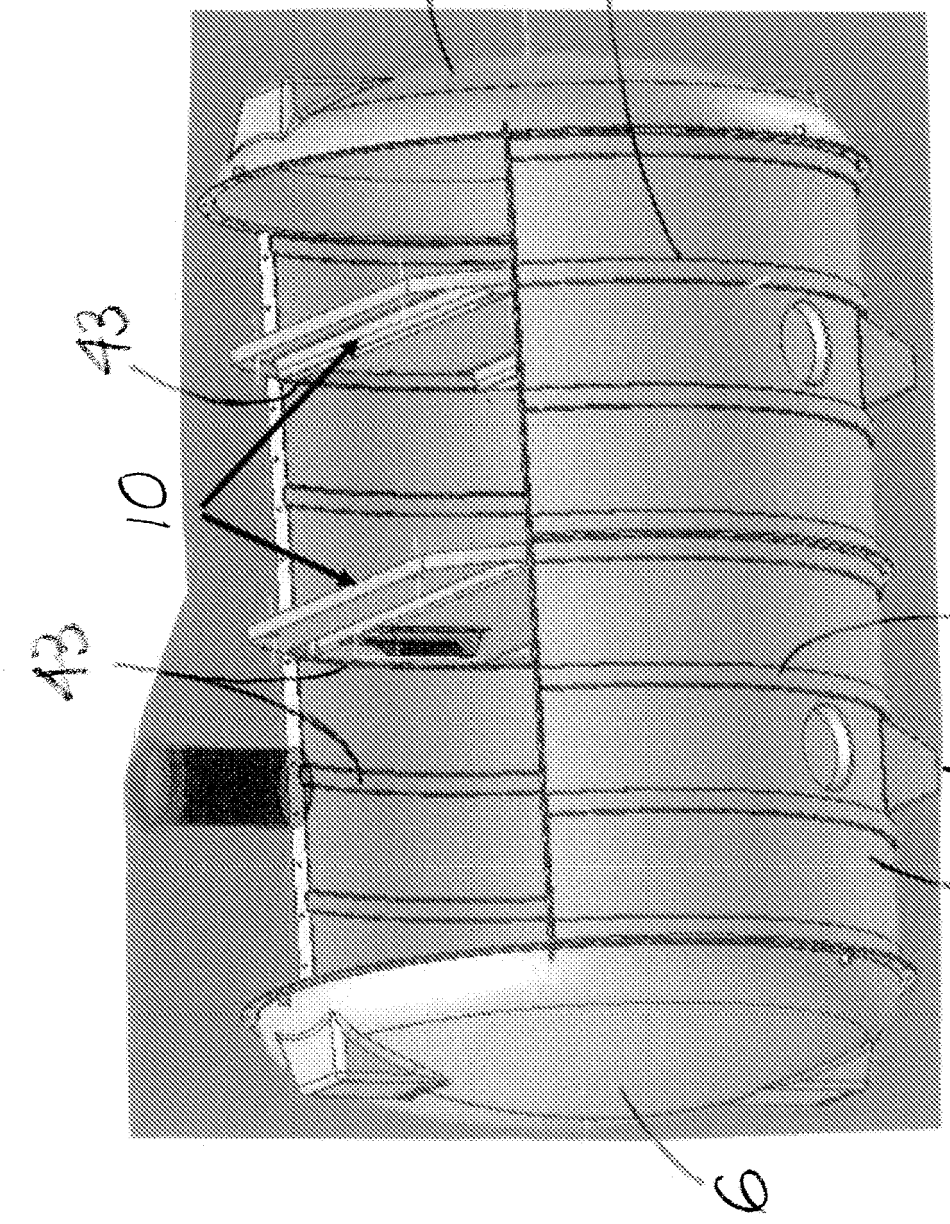

FIG 13

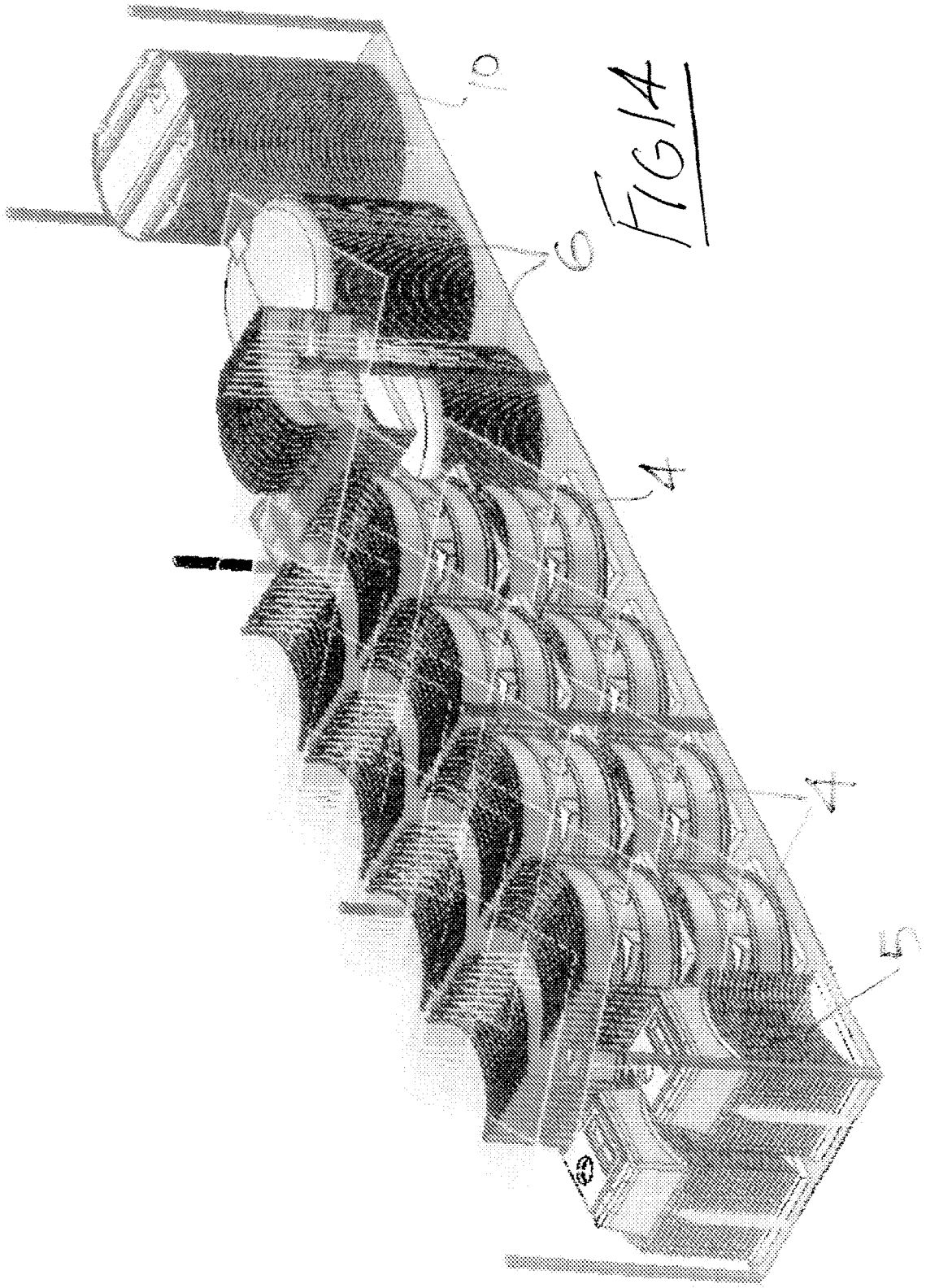

FIG 14

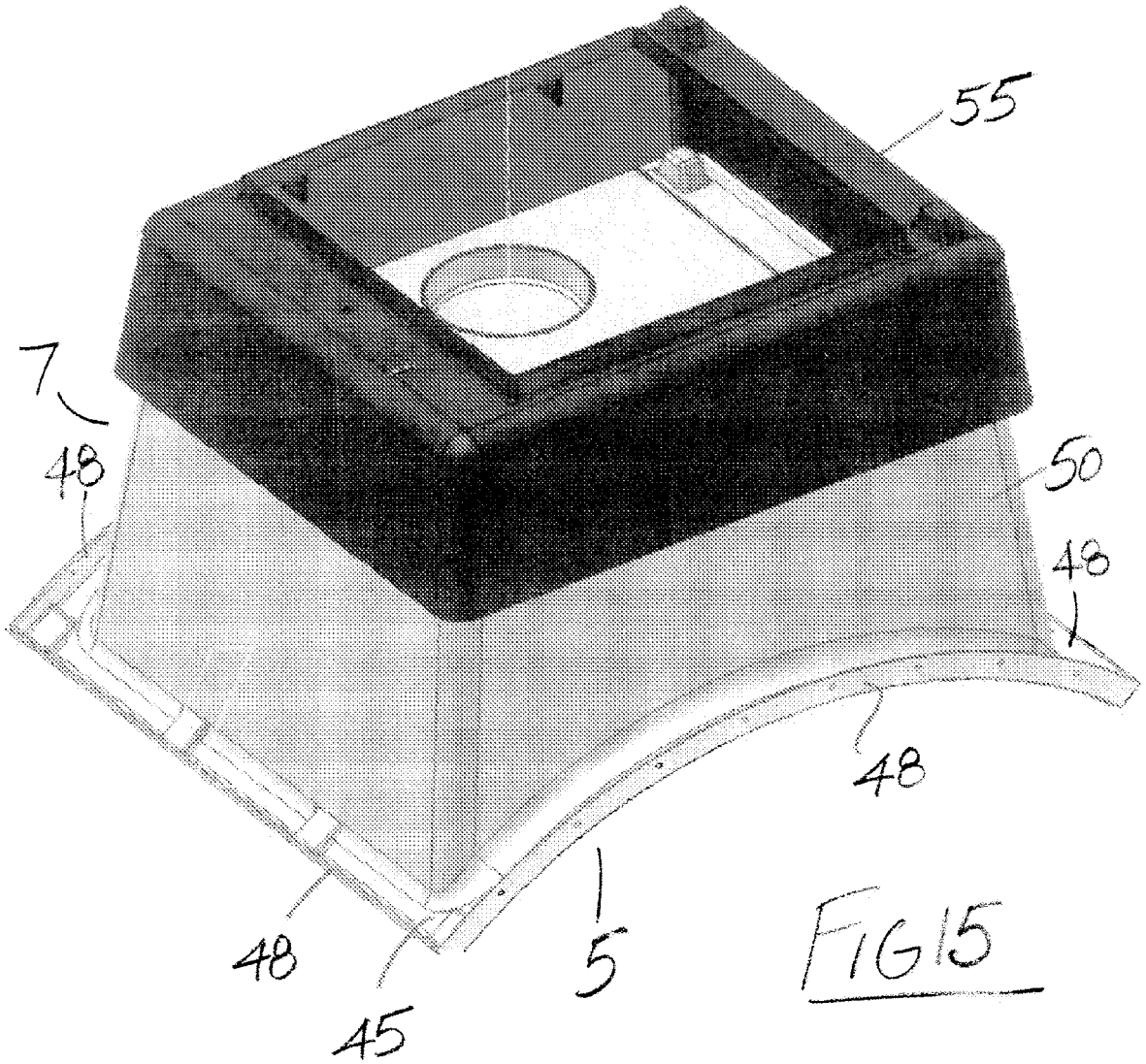

FIG 15

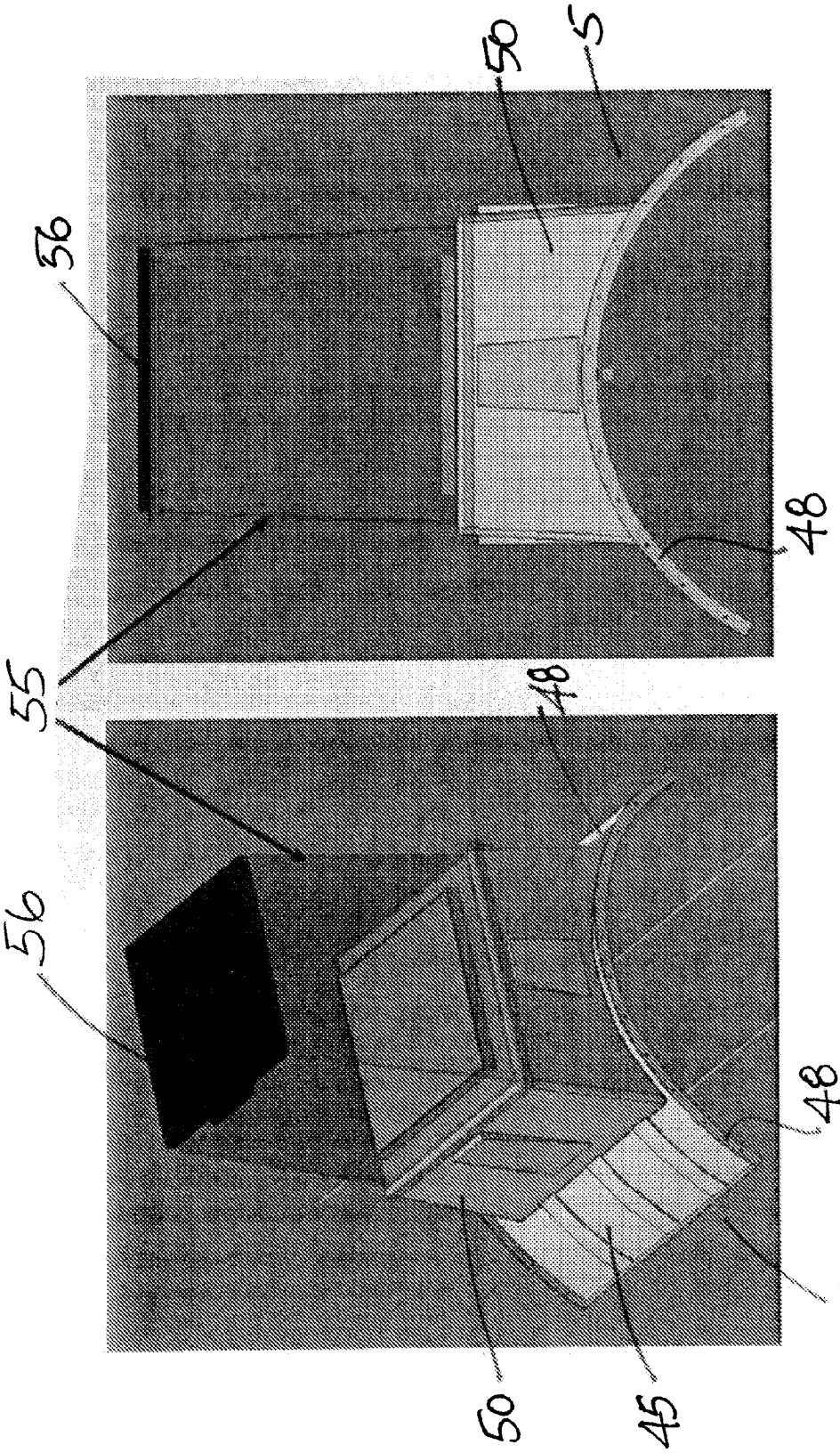

FIG 17

FIG 16

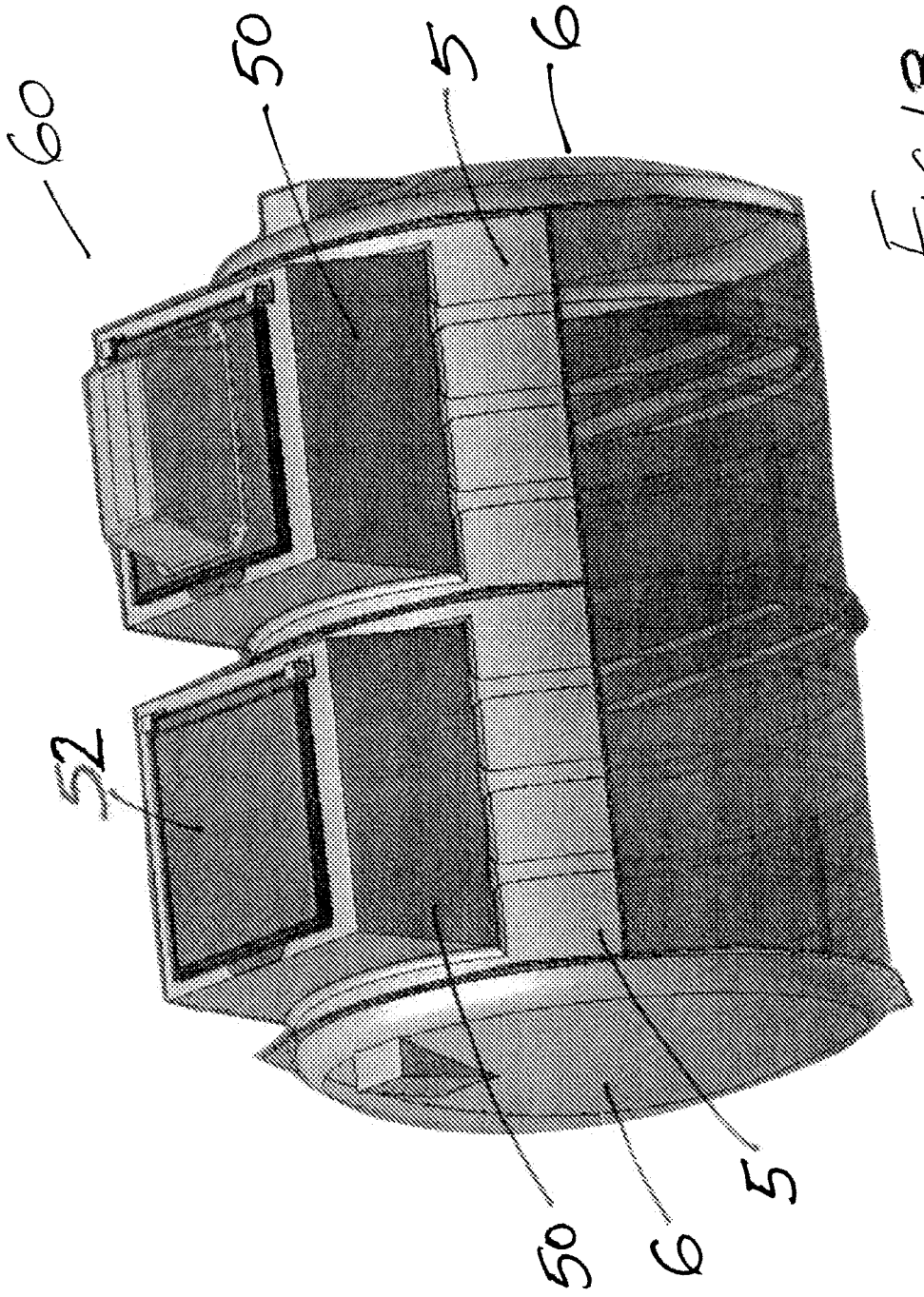

FIG 18

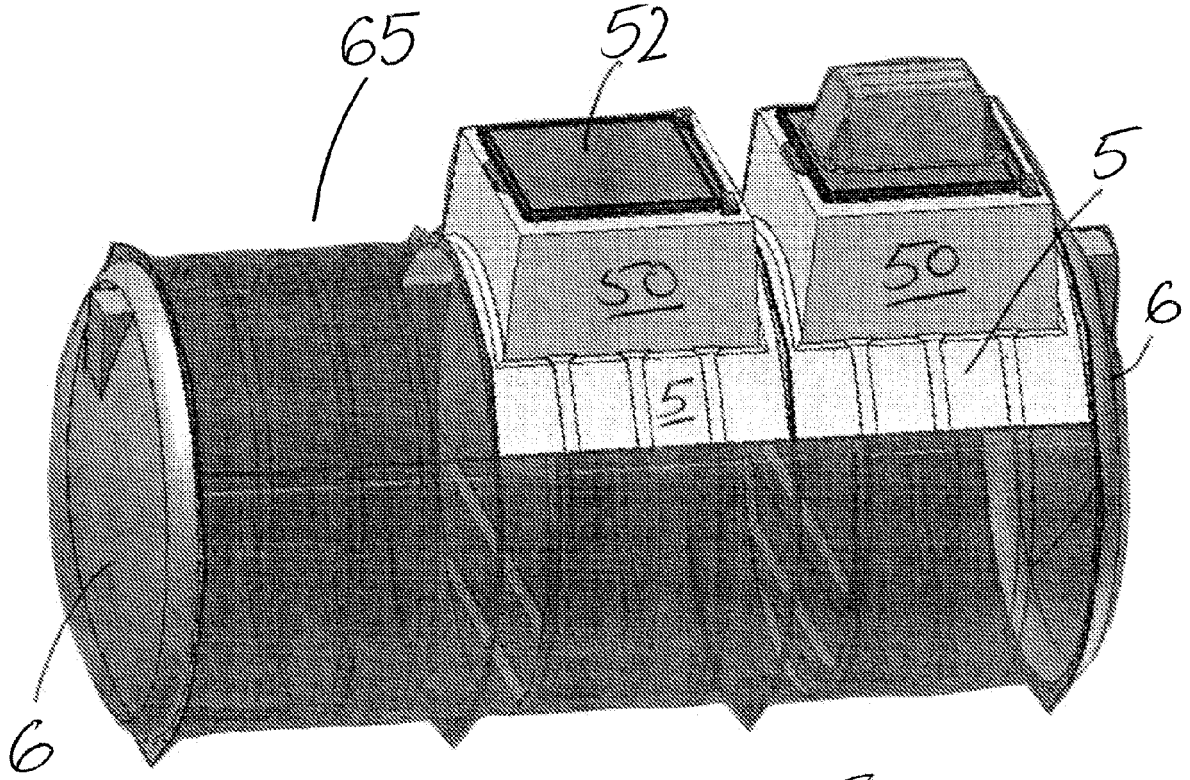

FIG19

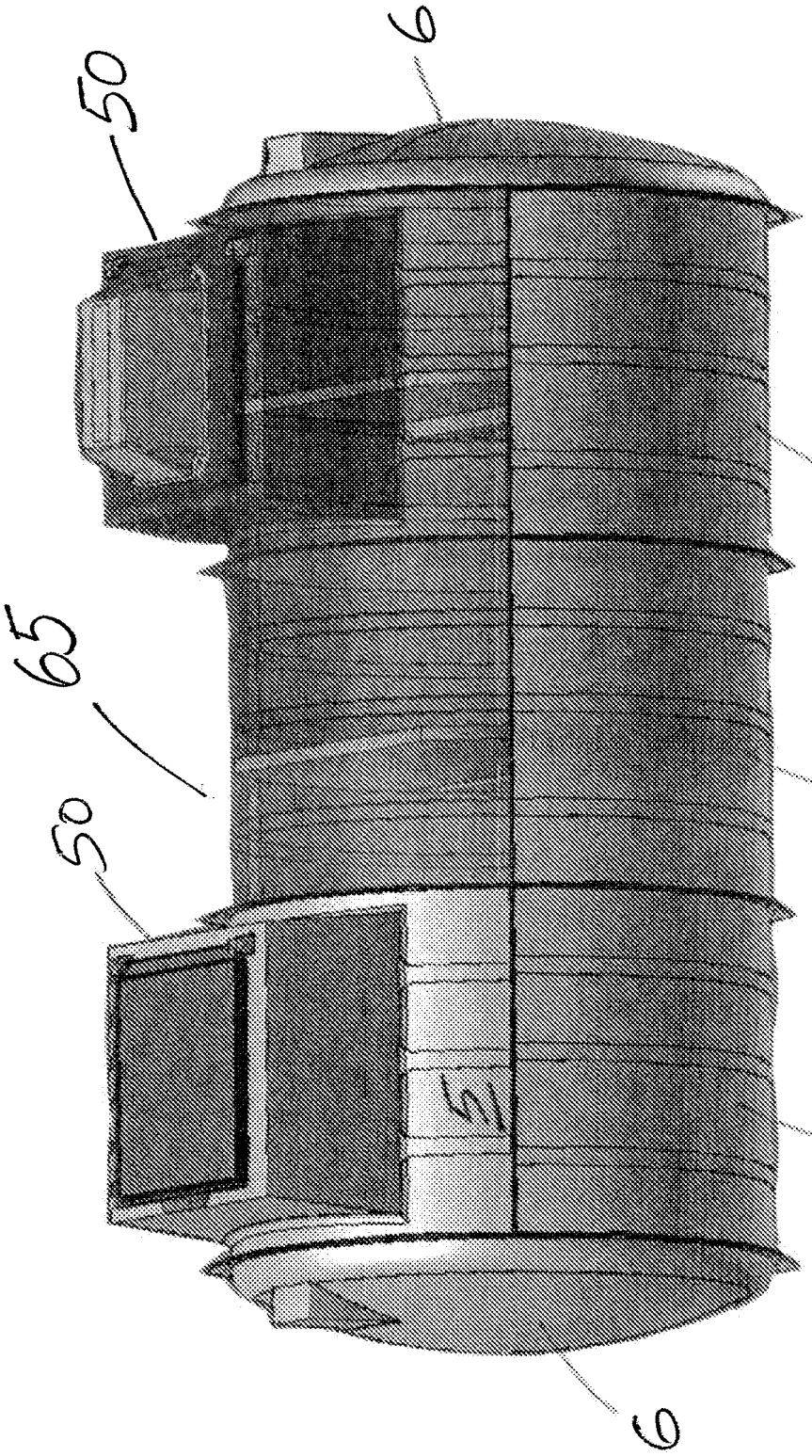

FIG 20

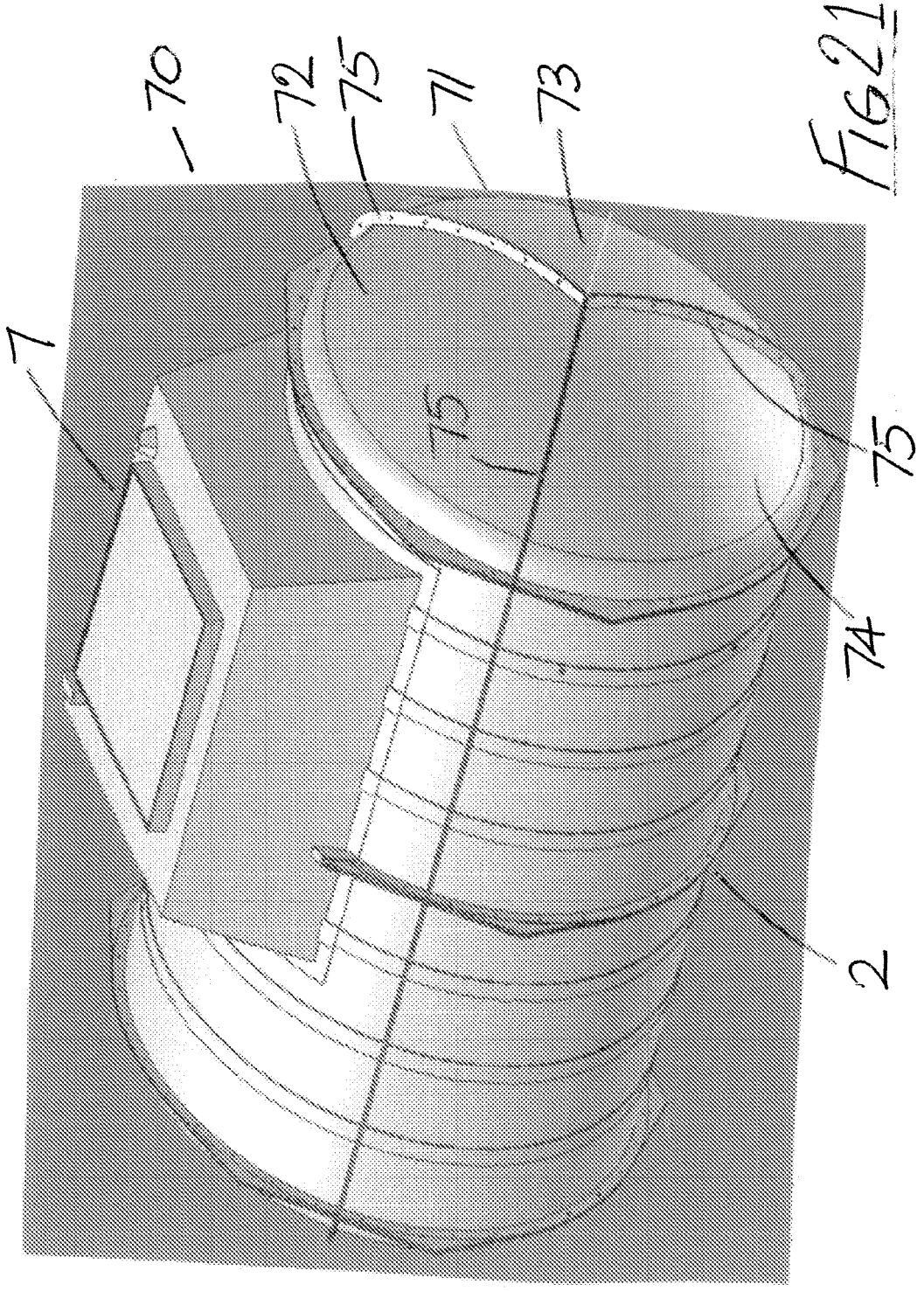

Fig21

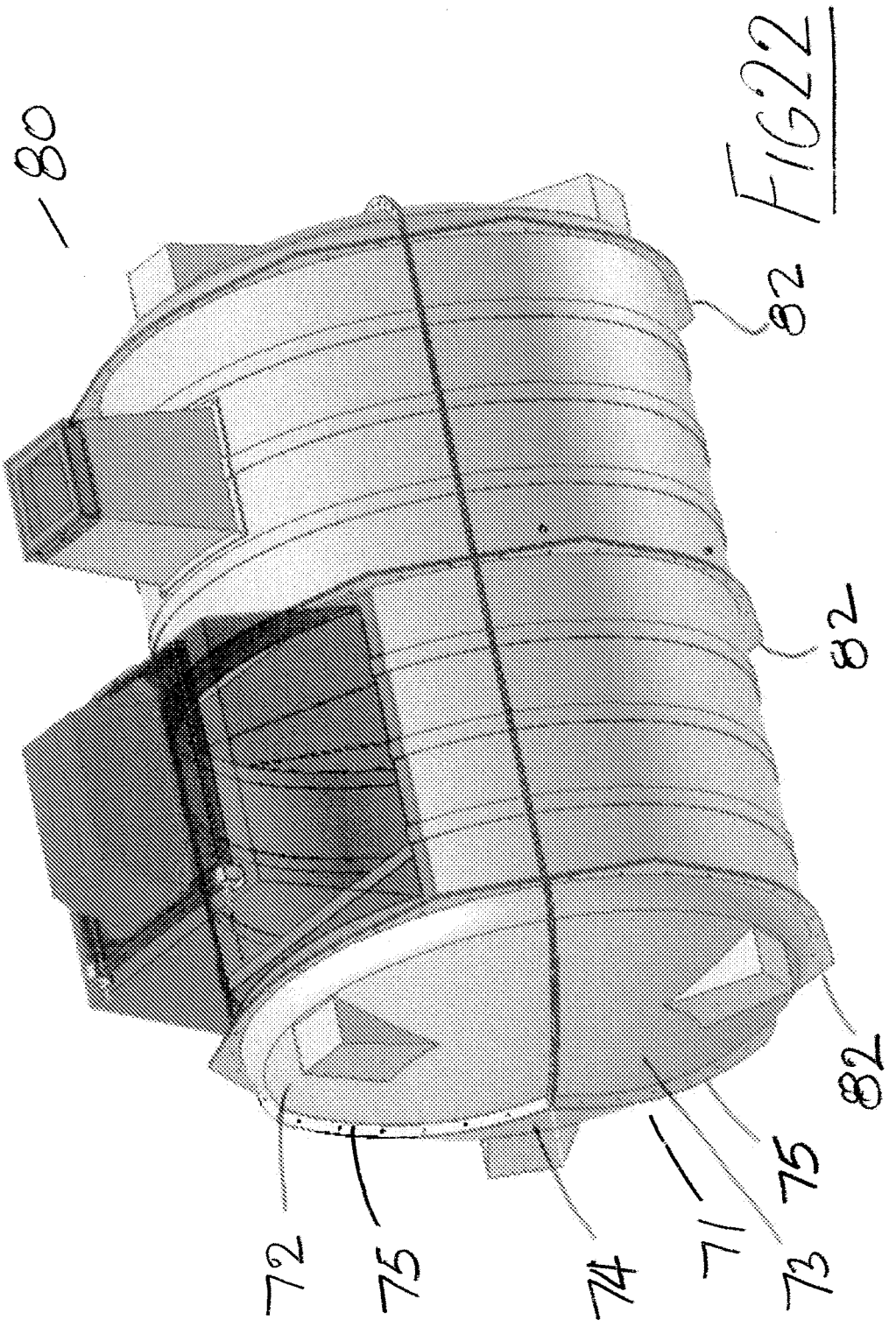

FIG22

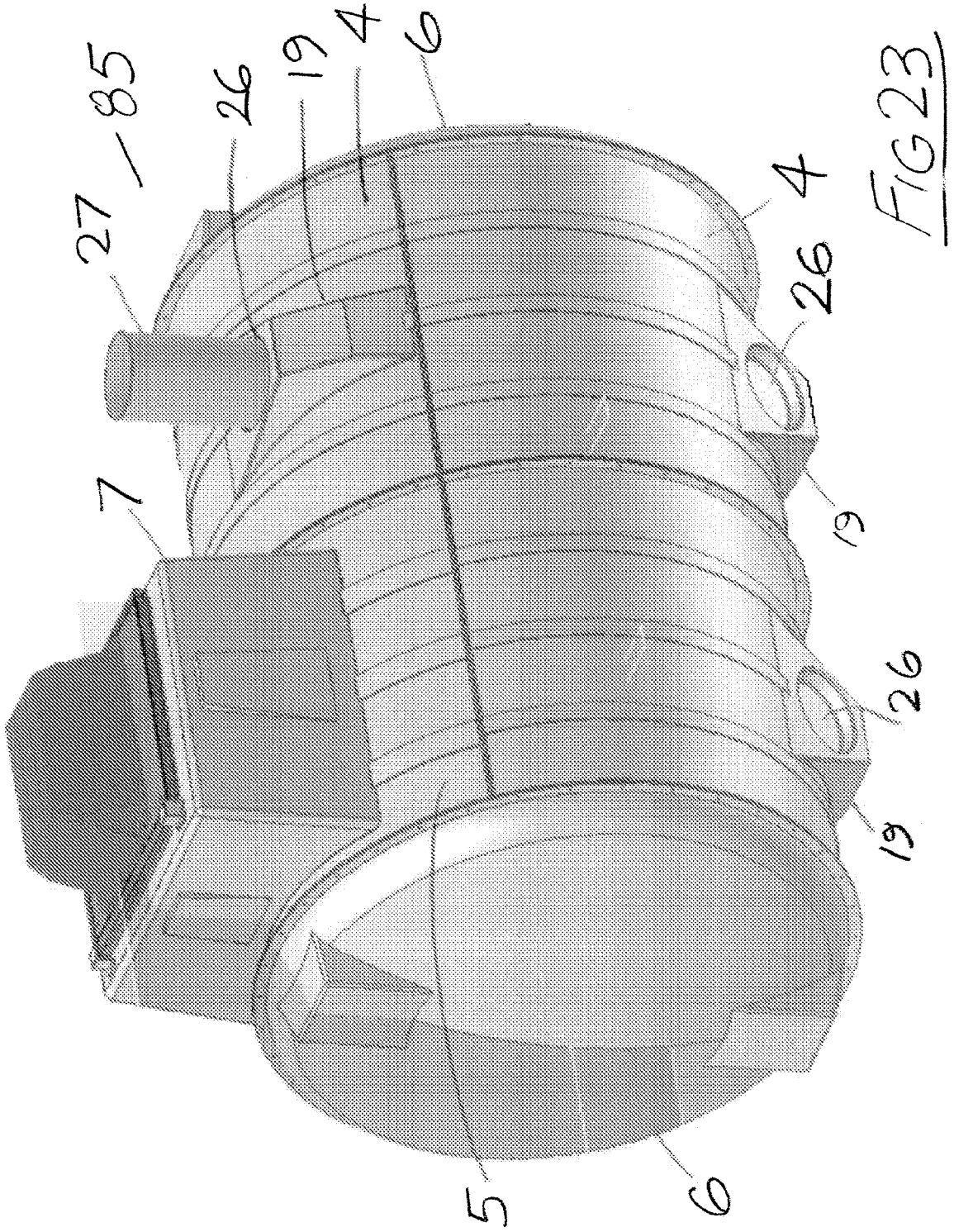

FIG 23

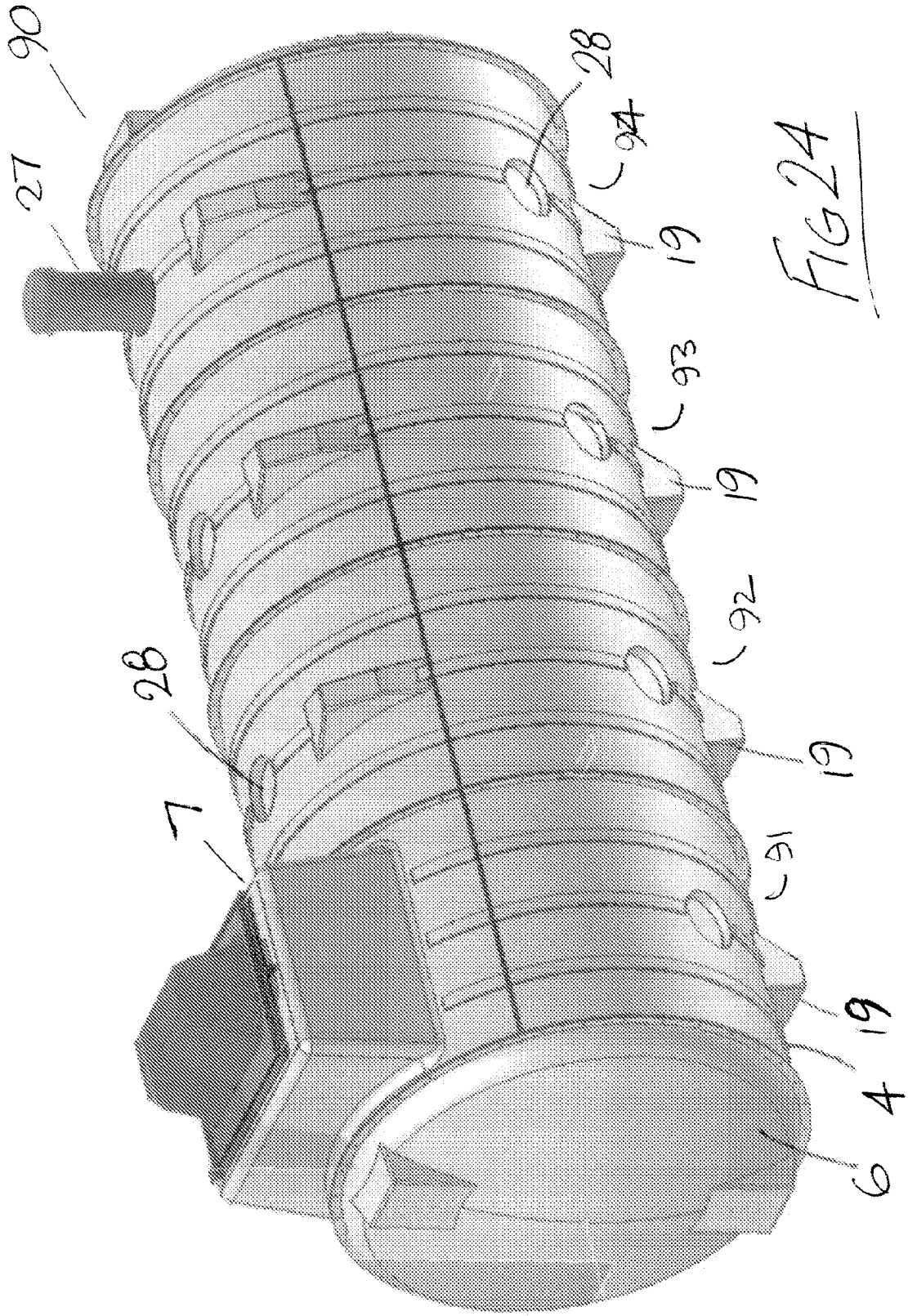

FIG 24

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EUROPEAN SEARCH REPORT

Application Number
EP 10 16 7995

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Place of search	Date of completion of the search	Examiner
Munich	7 September 2010	Piolat, Olivier

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