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(54) Protective container with a fluid-tight seal for the underground installation of tanks containing pressurised liquefied gas.

(57) A protective container (1) with a fluid-tight seal for the underground installation of a tank (10) containing pressurized liquefied gas. The container (1) comprises a cylindrical peripheral wall (2) which can surround the tank (10) and form a space (17), a base (4) on which the tank (10) rests in the vertical position, and a top (6) for closing the container when the tank (10) has been introduced.

The top (6) is provided with a hatch (7) through which access to the connector (13) for charging the tank (10) is provided.

The hatch (7) is closed by a cover (8) which can be travelled over and is fire-resistant.

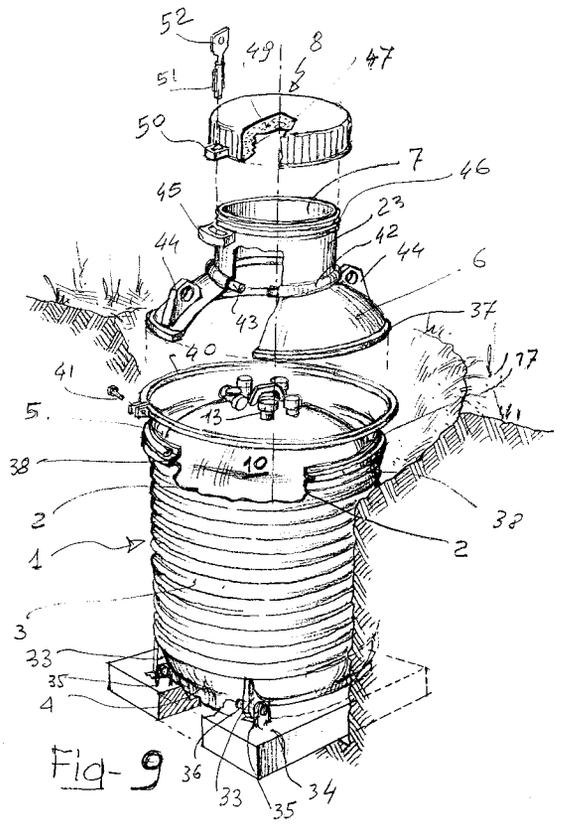

Fig- 9

EP 0 624 752 A1

The present invention relates to a protective container with a fluid-tight seal for the underground installation of tanks containing pressurized liquefied gas.

The invention also relates to underground installations obtained by the use of protective containers of this type with fluid-tight seals.

As is known, tanks containing pressurized liquefied gas are usually installed above ground close to the places where the gas is to be used, which may be factories, restaurants or private houses.

In the latter case, particularly when it is in a garden, the overground installation of the tanks is unattractive from the aesthetic point of view since it is not always possible to conceal them adequately.

In order to overcome this disadvantage, it is already known to install tanks underground; however, in this case, in accordance with current technology and in order to satisfy safety standards, when the excavations have been carried out, a concrete pit has to be provided and made impermeable in order to prevent the surrounding land being contaminated if the tank is damaged.

One example of this technology is illustrated in European Patent application EP-A-0 251 917.

However, producing cisterns made of concrete requires the establishment of a building site, however small, the presence of masons and a protracted level of inconvenience in addition to the necessary inconvenience involved in excavating the land.

In accordance with further current technology illustrated, for example, in the journal "GPL ACTUALITE" of December 1992, the underground installation of tanks occurs with the latter disposed in a horizontal position in a sealed, high-density polyethylene shell which can only be inspected by remote control using a telecamera.

This known technology, whilst enabling the production of concrete containment cisterns to be avoided as far as possible, nevertheless requires the occupation of a large area of the garden or locality where the tank is to be installed.

Furthermore, this becomes somewhat complex and expensive, particularly when it is a matter of installations for domestic use.

The object of the present invention is to overcome the above disadvantages and to allow tanks containing pressurized liquefied gas to be installed underground such that they occupy as small a space as possible, in accordance with the dimensions of the tank, which can easily be concealed, in such a way that the aesthetic aspects of the installation location can also be satisfied and a greater level of safety and control of the operating conditions of the tank can be ensured as can the easy supplying of the tank.

This object is achieved by the invention set forth in the appended claims.

The invention will now be described in greater detail with reference to non-limiting embodiments illustrated in the appended drawings, in which:

- Figure 1 shows a view in section of a first embodiment of a protective container with a fluid-tight seal in accordance with the invention, installed in the excavated ground and without the top;
- Figure 2 shows the container of the preceding Figure with a first type of tank containing a pressurized liquefied gas, installed in the container;

Figure 3 shows the container of Figure 2 with the top in the closed position;

Figures 4, 5, 6, 7 and 8 show structural details of the protective container of the preceding Figures on an enlarged scale;

Figure 9 shows an exploded perspective view of a second embodiment of the protective container according to the invention containing a second type of tank;

Figure 10 shows the container of Figure 9 in position in an open cavity, partially in cross-section;

Figure 11 shows the container of the preceding Figure in the buried position;

Figure 12 shows a detail of the top of the container according to the embodiment of Figure 9 with the cover on the hatch, in section;

Figure 13 shows a partial section of the cover;

Figures 14 and 15 show the means for connection between the top and the peripheral wall of the container in the embodiment of Figure 9, in section.

With reference to Figures 1 to 8, the protective container with a fluid-tight seal according to the invention is indicated 1.

A container of this type, which is preferably made of plastics material, although the use of metal or prefabricated concrete is not excluded, comprises a peripheral wall 2 with stiffening ribs 3 and a base 4.

Whilst a base of this type is rigidly connected to and is preferably integral with the peripheral wall 2, the upper part of the container has an opening 5 which is closed by a top 6 which is in the shape of a conical roof in the embodiment illustrated in Figure 2. A top 6 of this type comprises a hatch 7 provided with a cover 8 which can be secured in position by means of conventional bolts 9.

In the example shown in Figures 3 and 4, the hatch 7 is provided in alignment with the longitudinal axis X-X of the container 2.

As can be seen from Figures 1 and 2, the protective container 1 is installed in a cavity in the ground and is disposed along the longitudinal axis X-X in the vertical position, leaving the top 5 open in order to allow the gas tank 10, which is likewise in the vertical position, to be introduced.

The tank 10 is provided with feet 11, which are integral with the base 12, and a filler connector 13 disposed in correspondence with the upper cap 14.

The conventional safety valve 15 and a gauge 16 for checking the internal pressure are provided adjacent the connector 13 on the tank 10.

The connector 13, the safety valve 15, the maintenance assembly with the checking pressure gauge 16, as well as level indicators and outlet connections for the liquid phase and any other parts necessary for the operation, are assembled on the cap 14 of the tank 10 in a position such that they are accessible through the hatch 7 when the tank 10 is disposed inside the container 1.

The transverse dimensions of the protective container 1 are larger than the transverse dimensions of the tank 10 such that a space 17 is produced around the tank.

This space 17 is preferably filled with inert material 18, such as, for example, sand, to form ballast for the container and to reduce the volume which may possibly be occupied by the gas in the event of an accidental loss from the tank 10.

Alternatively, instead of sand, non-corrosive anti-freeze liquid can be introduced which can be heated by a heater 181 which can consist of an electrical resistance or a tube through which hot water or steam passes by conventional supply systems.

By controlling the temperature in the space 17 and the pressure in the tank 10 in this way, the degree of vaporization of the liquefied gas can be regulated and maintained constant.

A reduction of this type in the volume also reduces the possibility of explosive air / gas mixtures forming, increasing the safety of the installation.

In correspondence with the edge 19 of the container 1, tie rods 20 for anchoring the tank 10 such that the latter is stably positioned against the base 4 of the protective container are provided about the top opening 5.

The tie rods 20 can be secured to the tank by means of corresponding studs 21, integral with the cap 14 of the tank, and nuts 22 (Figure 4).

The top 6 is provided with a collar 23 which is disposed about the hatch 7 and extends towards the interior of the container 1 and thus towards the tank 10 when the latter is positioned inside the container (Figure 6).

Similarly, on the cap 14 and about the maintenance assembly, the tank 10 is provided with a collar 24 which is rendered integral with the cap 14 itself, for example by means of welding, and which is disposed coaxially with the collar 23 of the wall 6.

A seal 25 is provided between the facing ends of the collars 23 and 24 and the connection components in the form of eccentric tie rods are schematically indicated 26.

Also, in correspondence with the edge 19 of the container 1 and the corresponding edge 27 of the top 6, there are provided a seal 28 and a series of coupling members 29, also of the eccentric type, distributed about the periphery of the container 1.

As can be noted from the above description, when the tank 10 has been placed in position, the container 1 is closed by the top 6. Action on the anchorage means 26 and 29 produces above the cap 14 a space 30, which is connected to the space 17 and is completely sealed from the exterior.

The space formed by the space 17 and the space 30 together can, if necessary, be used to control any losses from the tank 10 containing pressurized liquefied gas.

For this purpose, a sensor 31 held on the wall 6 and connected to a signalling and warning apparatus 32 is located inside the space 30.

A possible variation of the pressure inside the spaces 17 and 30, detected by the sensor 31, can be indicative of incorrect sealing of the tank 10 and thus initiates the operation of the signalling and warning device 32.

With reference to the embodiment illustrated in Figures 9 to 15 and in which the elements corresponding to those of the embodiment in Figures 1 to 8 are indicated by the same reference numerals, it can be seen that the base 4 of the protective container 1 is provided with a plurality of eye-bolts 33 for connection to a ballast plate 34 for holding the container 1 in position in the cavity and to balance it against any hydrostatic forces which would tend to force it out of the cavity.

The eye-bolts 33 are to engage, in known manner, rings 35 countersunk in the concrete of the ballast plate 34 by means of bolts 36.

In accordance with the latter embodiment of the protective container 1, the top 6 is provided with a flat radial lip 37 to be superimposed on a corresponding radial lip 38 provided on the edge of the opening 5 defined by the peripheral wall 2. An annular seal 39 is interposed between the lip 37 and the lip 38 and the connection means consist of a clamp 40 with a screw coupling 41.

As can be seen in particular in Figure 12, the top 6 is provided with a housing 42 in which an annular seal 43 is disposed by means of which the top 6 rests on the upper cap 14 of the tank 10.

From the above, it will be appreciated that action on the screw coupling 41 causes the clamp 40 to tighten the lips 37 and 38 relative to one another, at the same time determining the adherence of the seal 43 against the cap 14 of the tank 10.

In this way, as in the embodiment described in Figures 1 to 8, a space 17 with a fluid-tight seal is determined about the tank 10 containing the liquefied gas.

In this embodiment also, the space 17 can be filled with non-corrosive anti-freeze liquid which may possibly be heated by a heater 181 using the method and advantages described above.

Again, the top 6 is provided with a pair of eyebolts 44 used for moving the assembly during its installation.

Referring in particular to Figures 9 and 12, it can be seen that the collar 23 disposed about the hatch 7 is provided with a radial appendage 45 and an external thread 46.

The latter thread is to engage a counter-thread 47 on the cover 8.

The latter is provided with an internal cavity 48 which extends axially over a portion along the collar 23 where the thread 46 is provided, and which is filled with fire-resistant material, indicated 49 in Figure 9.

For example, this material may consist of cement lightened with expanded clay or verniculite.

Alternatively, fire-resistant charged expanded polyurethanes can also be used.

The cover 8, which can in turn be made from self-extinguishing plastics material such as, for example, high-density polyethylene (945 g/l), is provided with a radial appendage 50 to be superposed on the appendage 45 when the cover has been screwed onto the thread 46.

A locking member 51, which can be actuated by a key 52, is used to lock the appendage 50 on the appendage 45 and thus to prevent the cover 8 from being unscrewed and removed by unauthorized persons.

The engagement between the locking member 51 and the appendages 45 and 50 is produced so as to resist possible tampering but nevertheless can be unscrewed if a greater thrust at a predetermined load, for example, a pressure of between 0.35 and 0.45 bar, should be produced below the cover 8, following possible losses of gas.

In this case, the engagement between the thread 46 and the counter-thread 47 would not even be capable of resisting and the cover 8 would be automatically expelled, giving vent to the gas and avoiding dangerous explosions.

A further advantage connected with this cover structure, in addition to being fire-resistant, is that even agricultural equipment can travel over it without risk of damage to the buried tank.

Once installed, the tank 10 can be repeatedly refilled via the charging connector 13 after the cover 8 has been removed from the hatch 7 without the latter impairing the sealing conditions of the space 17.

The underground installation according to the invention is thus hardly visible above the ground since in practice only the cover 8 of the hatch 7 remains in view and at the same time it adequately satisfies the safety standards.

It is therefore easy to conceal the installation if necessary, for example by means of a bush or by installing a parapet in the form of a false well or even by other aesthetically pleasing constructions which are in keeping with the surrounding environment.

From the above description, it becomes clear that the inherent advantage is in the rapid preparation of the location of the tank 10 as a result of the presence of the protective container 1 which is self-supporting and is hardly larger than the transverse dimensions of the tank itself which can thus be transported together with the latter.

Claims

1. A protective container (1) with a fluid-tight seal for the underground installation of tanks (10) containing pressurized liquefied gas, comprising a peripheral wall (2) which can surround the tank (10), forming a space (17), a base (4) for supporting said tank (10), and a top (6) provided with a hatch (7), a cover (8) and means (29, 40, 41) for releasable connection to said peripheral wall (2), characterized in that said top wall (6) has a collar (23) aligned with the hatch (7), the collar (23) having and axial end supported at the front on the pressurized liquefied gas tank (10) when the latter is in position, sealing means (25, 43) being provided between the end of the collar and the tank.

2. A protective container according to Claim 1, characterized in that the base (4) is associated with a ballast plate (34).

3. A protective container according to Claim 1, characterized in that said peripheral wall (2) and said top (6) are both provided with respective radial lips (38, 37), adjacent and opposite one another with the interposition of a seal (39).

4. A protective container according to any one of Claims 1 to 3, characterized in that said means for connecting the top (6) to said peripheral

wall (2) consist of tie rods (29).

5. A protective container according to any one of Claims 1 to 3, characterized in that said means for connecting the top (6) to the peripheral wall (2) consist of an annular strip with a screw coupling (with eye-bolts), the annular strip being in engagement with the radial lips (37, 38) of the edges of the top and the peripheral wall.

6. A protective container according to any one of Claims 1 to 5, characterized in that said hatch (7) is provided with a cover (8) shaped with an internal cavity (48) containing a fire-resistant material (49).

7. A protective container according to Claim 6, characterized in that the cover (8) extends over an axial portion of the collar (23), engaging the latter by a thread (46) and a counter-thread (47) provided respectively on the outer surface of the collar (23) and the inner surface of the cover.

8. A protective container according to Claim 7, characterized in that the cover (8) and the collar (23) are provided with respective radial appendages (45, 50) which are superposed on one another when the cover (8) is screwed into the closure position on the hatch (7), a locking member (51) with a key (52) being interposed between the radial appendages (45, 50).

9. A protective container according to Claim 8, characterized in that the locking member (51) with a key can be automatically disengaged from the radial appendages (45, 50) when it overcomes a predetermined axial load on the cover (8) acting from the interior of the collar (23).

10. A protective container according to Claim 1, characterized in that it comprises anchorage means (20) for holding the pressurized liquefied gas tank (10) stably when it is disposed inside the container (1).

11. A protective container according to Claim 1, characterized in that it comprises a sensor (31) which measures the pressure inside said space (17, 30) and a warning signal apparatus (32) actuated by said sensor (31) when the pressure conditions inside said space (17, 30) do not correspond with the preset conditions.

12. A protective container according to any one of Claims 1 to 11, characterized in that the space (17) contains a non-corrosive anti-freeze liquid and is provided with a heater element (181).

13. An underground installation of a tank (10) containing pressurized liquefied gas, characterized in that it comprises a self-supporting underground container (1) with a fluid-tight seal and provided with a peripheral wall (2) surrounding the tank (10), forming a space (17), with a base (4) on which the tank (10) rests, with a top (6) which is movable relative to the peripheral wall (2), said top (6) being provided with a hatch (7) with a cover (8) and means for releasable connection (29, 40, 41) relative to said peripheral wall (2) and said tank (10), said container (1) being associated with a ballast (18, 34) and the cover being made of fire-resistant material.

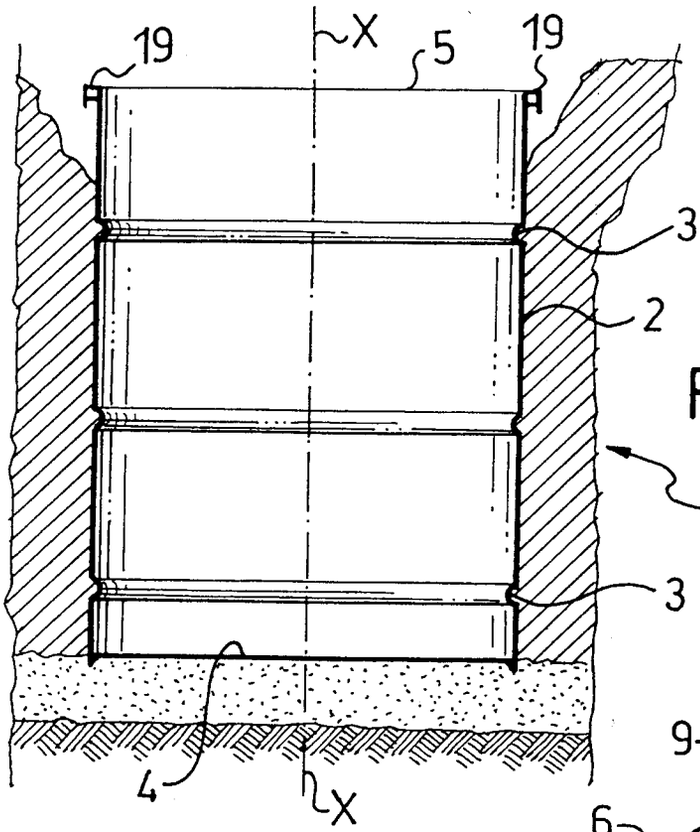
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FIG.1

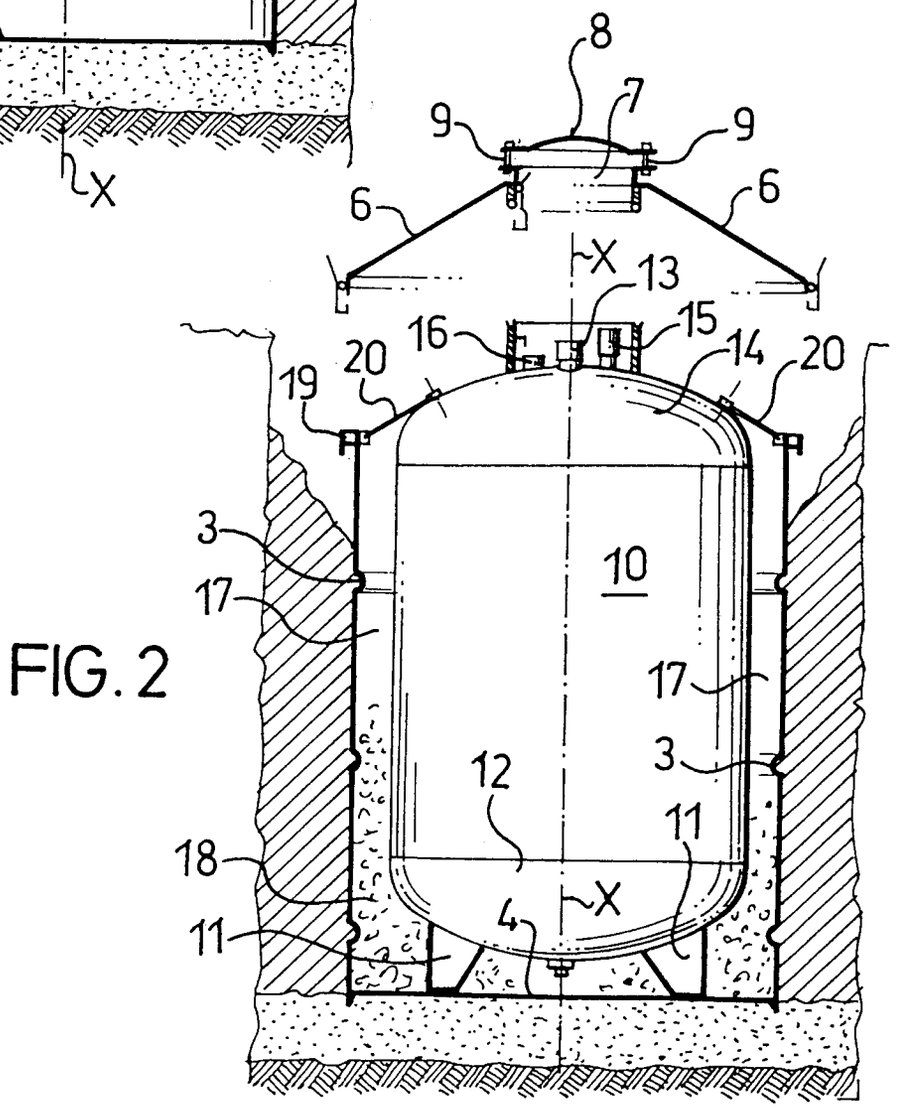
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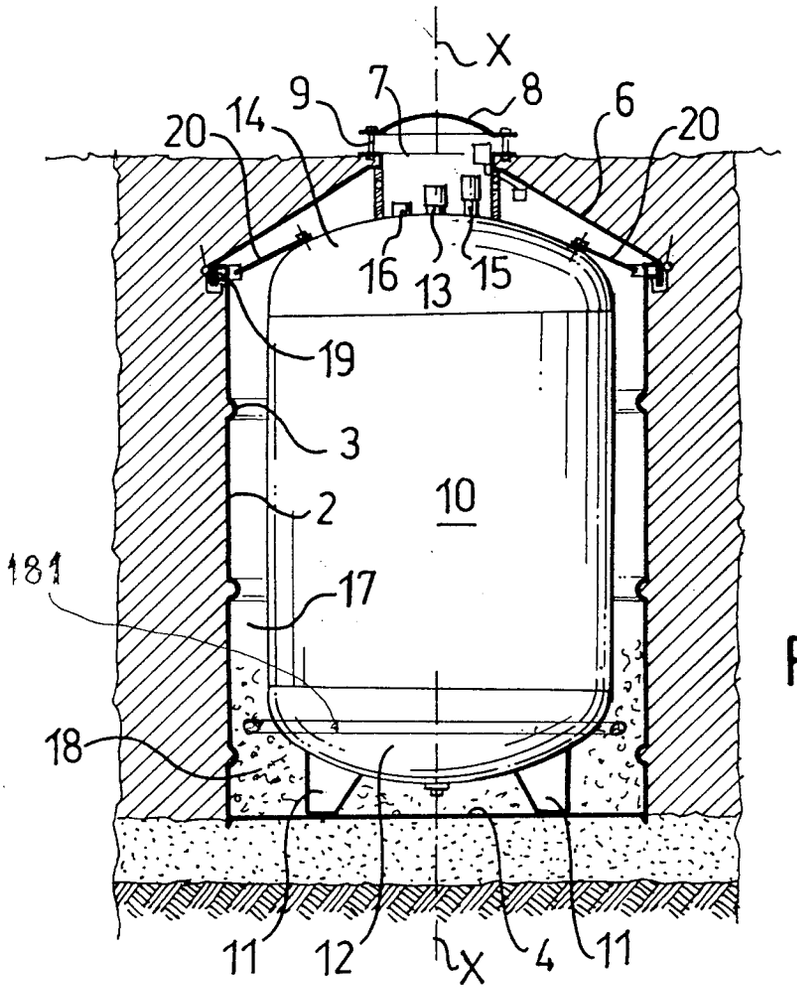
FIG. 2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X
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FIG.3

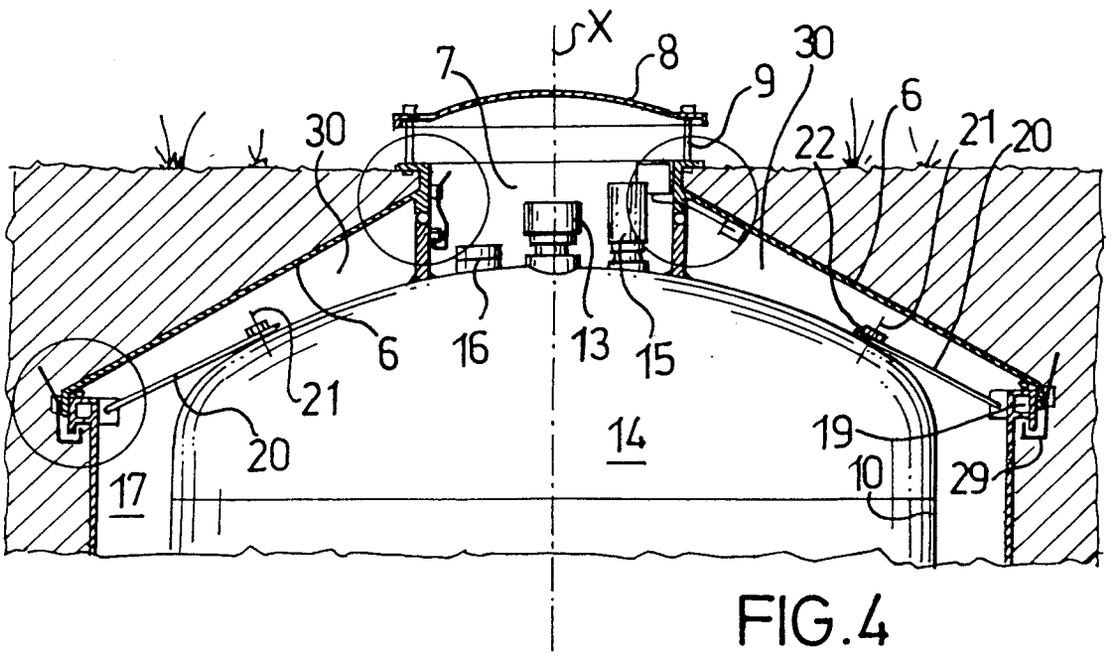
X
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FIG.4

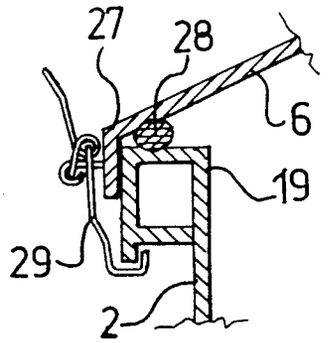

FIG.5

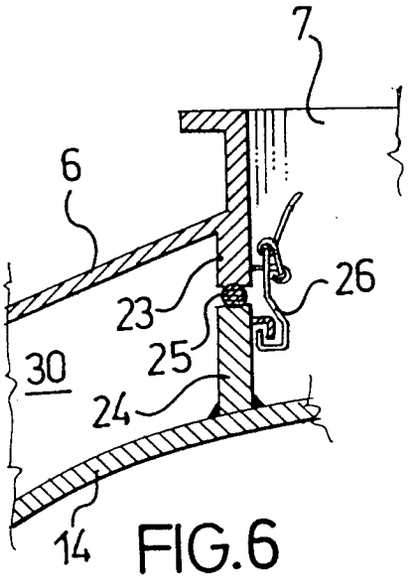

FIG.6

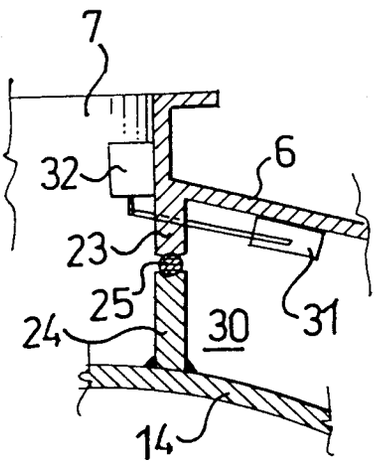

FIG.7

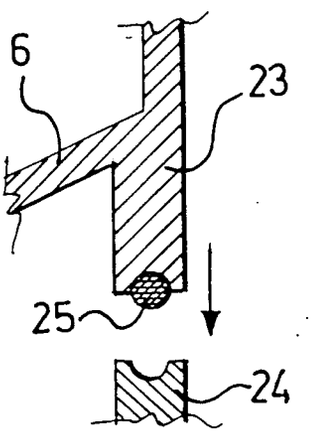

FIG.8

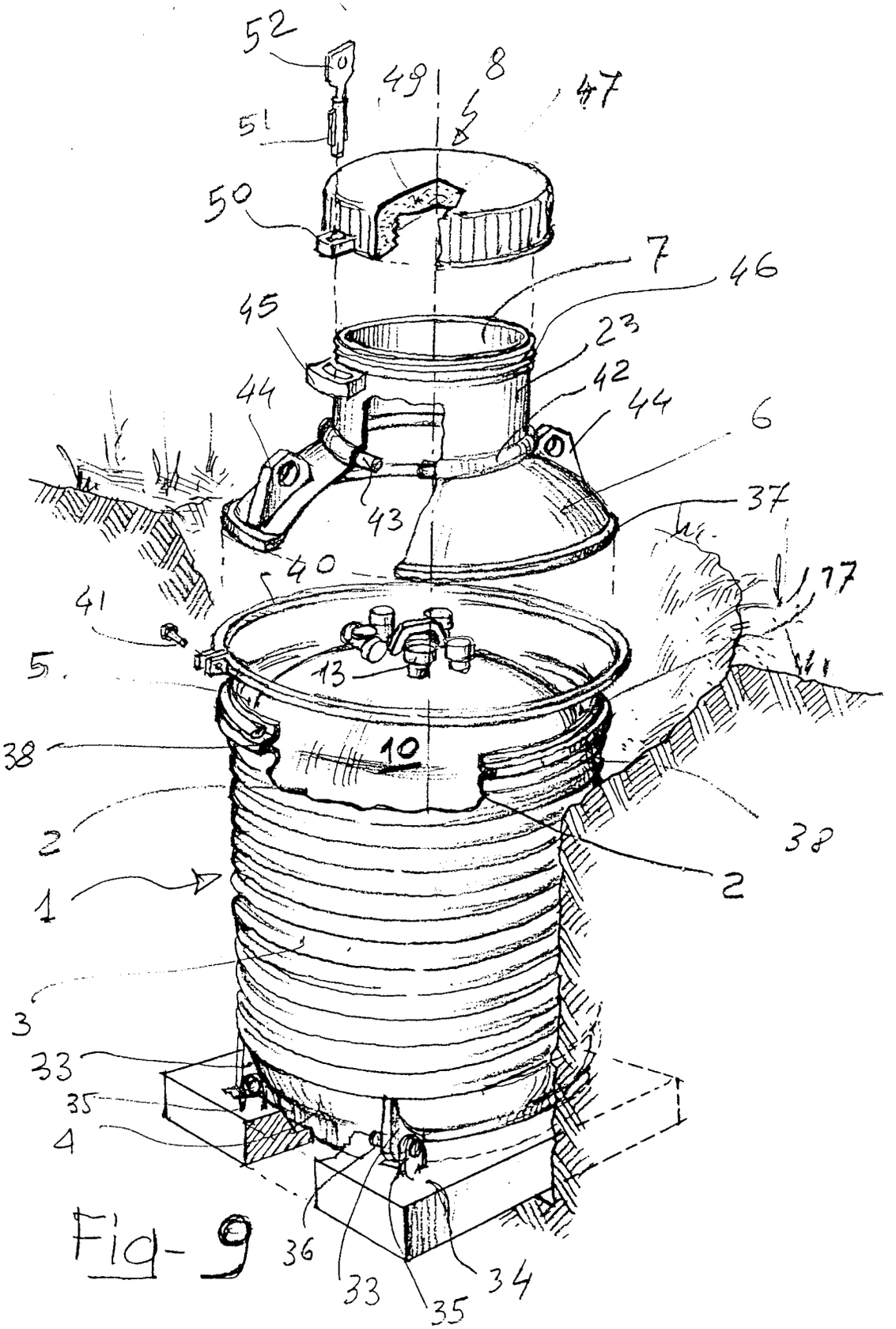
52
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Fig-9

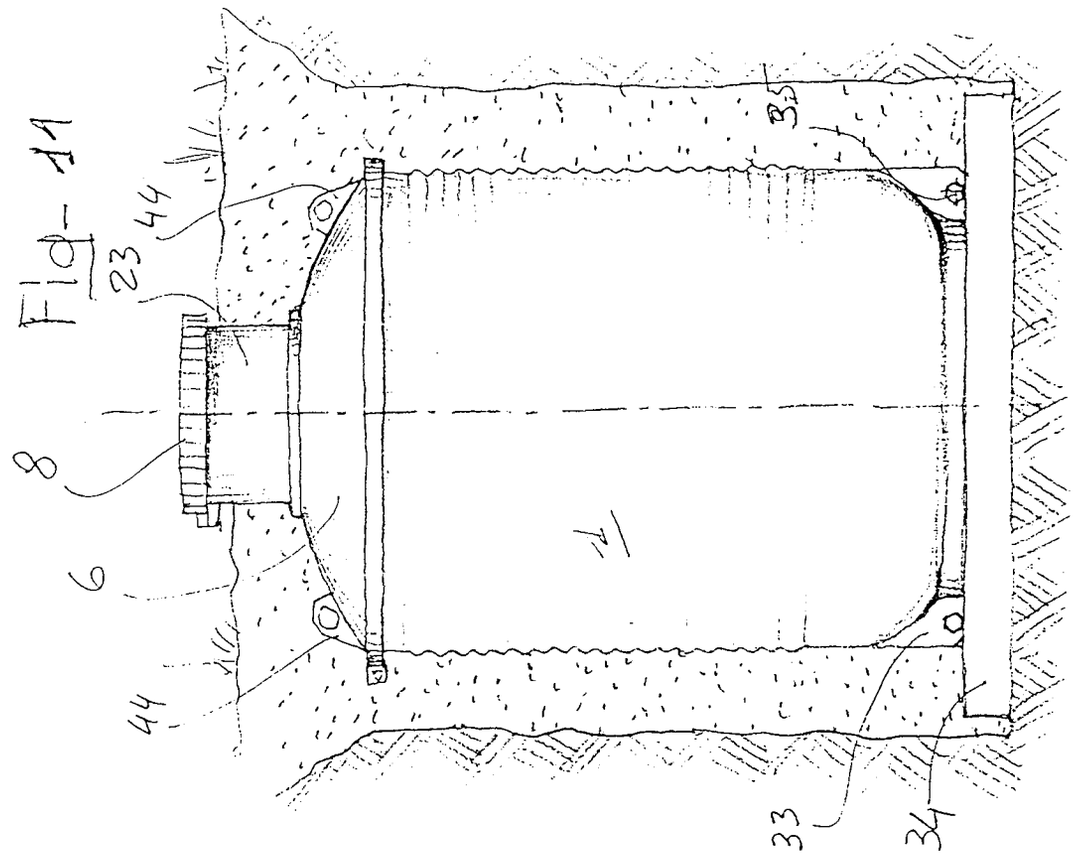
Fig- 11
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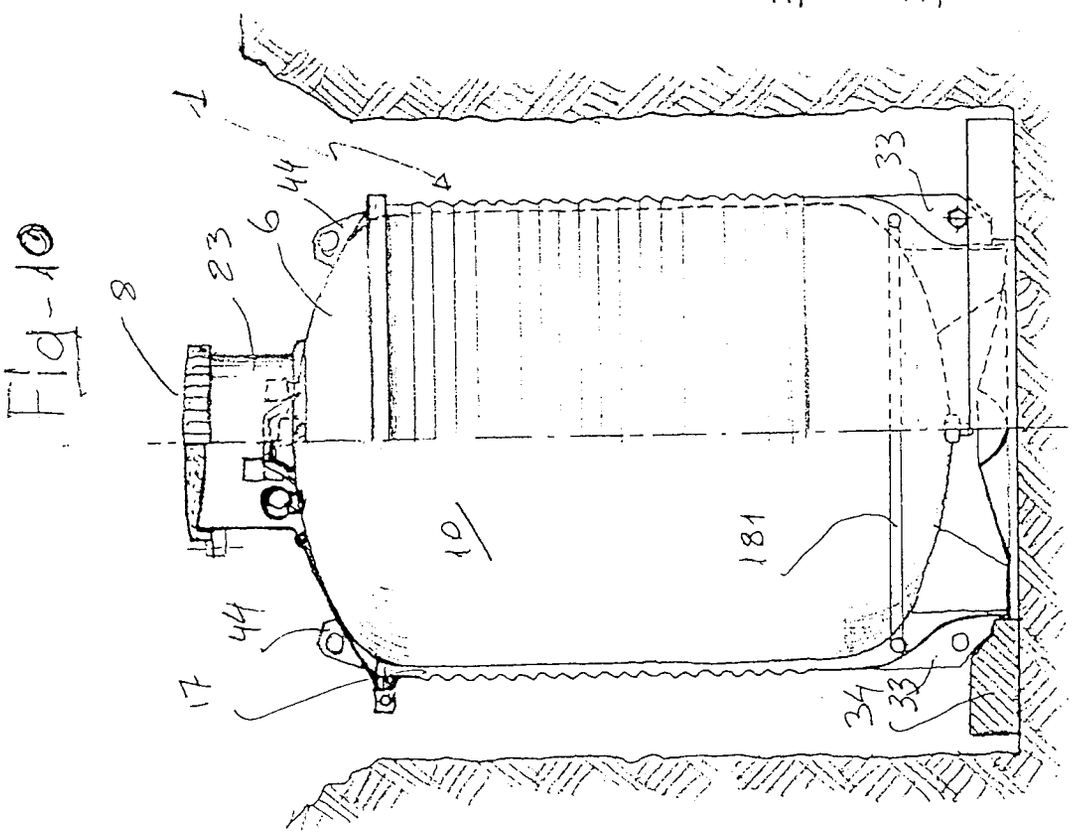
Fig-10
1
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10
181
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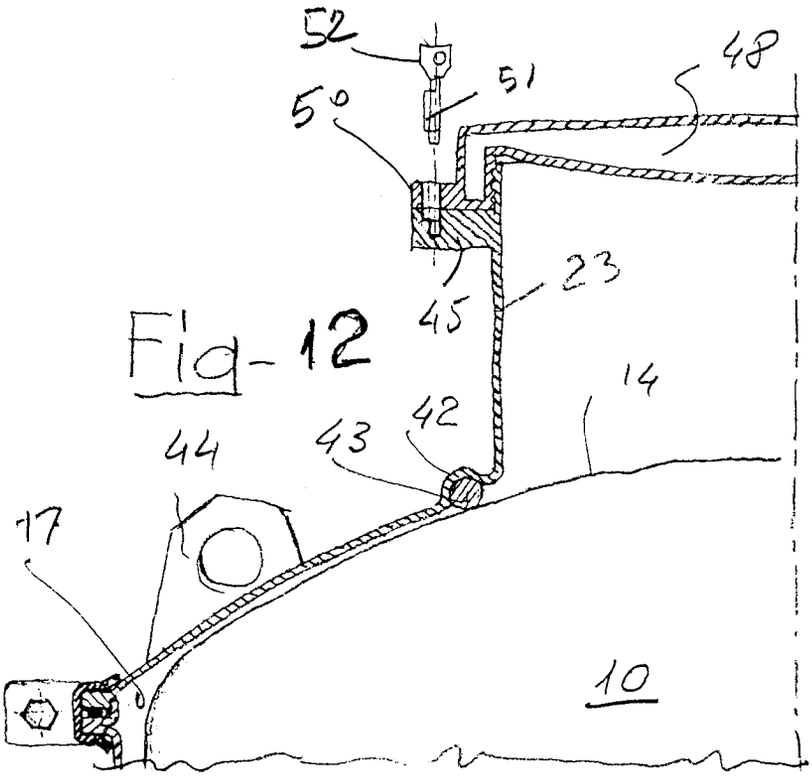

Fig-12

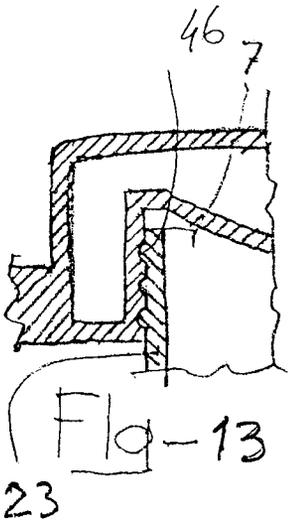

Fig-13

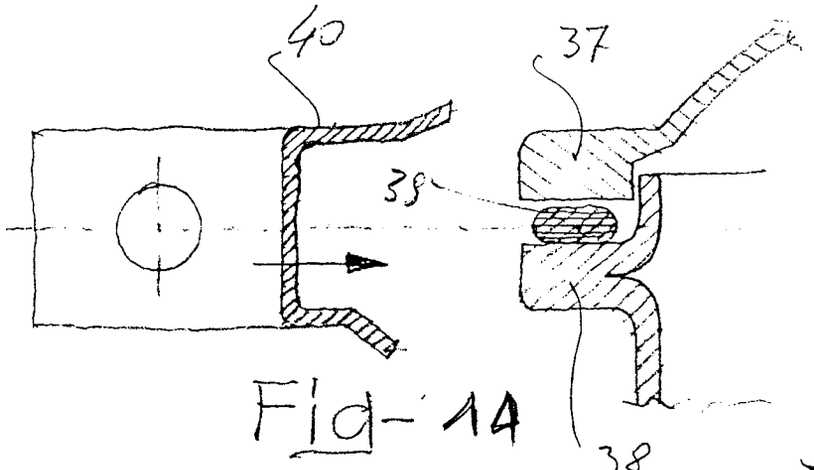

Fig-14

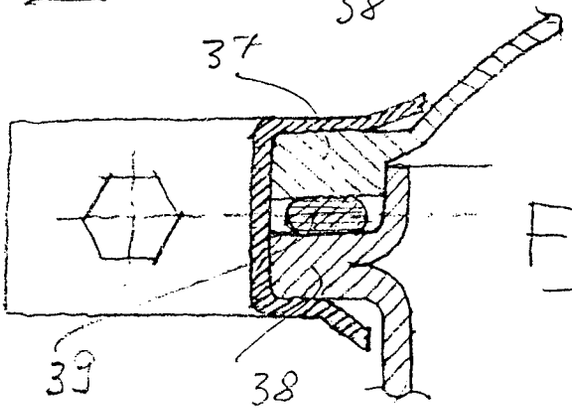

Fig-15

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 94 20 1327

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)
D,A	EP-A-0 251 917 (SOCIÉTÉ FRANÇAISE DE STOCKAGE GÉOLOGIQUE) * abstract * * page 4, line 10 - page 7, line 2 * * figure *	1,10,11, 13	F17C1/00 F17C13/12 B65D88/76 B65D90/10
D,A	PETROLE INFORMATIONS/GPL ACTUALITÉ, no.1690, December 1992, PARIS FR pages 46 - 51, XP334866 'LA CITERNE ENTERRÉE DE PRIMAGAZ: ETERNELLA' * the whole document *	1,7,10, 11,13	
A	FR-A-748 880 (J. BASSET) * the whole document *	1,13	
A	US-A-5 076 456 (STEEL TANK INSTITUTE, INC.) * column 3, line 54 - column 6, line 51 * * figures *	1,13	
A	US-A-1 459 327 (O.S.FLATH) * column 1, line 48 - column 3, line 45 * * figures 1,3 *	1	TECHNICAL FIELDS SEARCHED (Int.Cl.5) F17C B65D
A	FR-A-2 122 127 (METALLWERK AG BUCHS) * page 4, line 9 - page 5, line 27 * * figure 1 *	1	
A	FR-A-2 108 630 (METALLWERK AG BUCHS) * page 3, line 4 - page 4, line 4 * * figures *	1,5	
A	US-A-3 465 527 (R.H.ROHMER) * the whole document *	1,2,13	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	22 August 1994	Stevnsborg, N

CATEGORY OF CITED DOCUMENTS

- X : particularly relevant if taken alone
- Y : particularly relevant if combined with another document of the same category
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- 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

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