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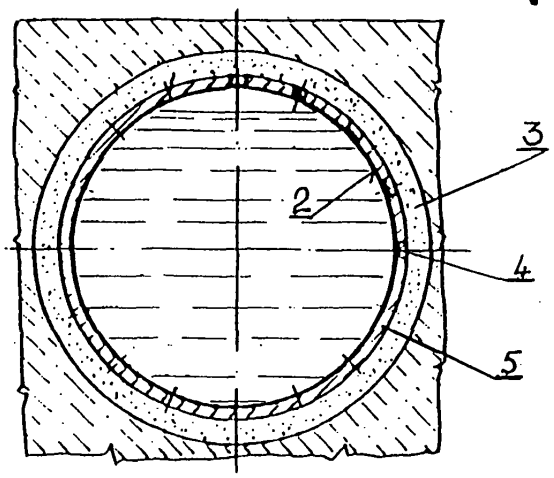
(54) **Tank for the containment of hydrocarbons and liquids of any kind**

(57) Underground tank (tunnel-tank) in the open (sunken or above-ground) for the containment of hydrocarbons and liquids of any kind comprising a metallic structure (2) and a static covering (3) aimed at separating the metallic structure from the surrounding ground, this metallic structure being supported inside the static covering by means of an anchoring structure (4) fixed to said external covering, between the metallic structure and the static covering at least one layer of filler material (5) is envisaged, said metallic structure comprising a plurality of metallic elements (6) joined one to another at their transversal sides by means of flat sections (7, 8), the metallic elements being linked one to another on the external surface, namely the part that is in contact with the static covering (3), by means of a plurality of flat sections (7) which are welded on the edges of the metallic elements (6), joining them one to another and having the function of stiffening of the metallic structures as a whole and, on the opposite surface, by means of a covering sections (8) placed longitudinally and transversally to the ferrules, so that, between the two structurals and the sides of the metallic elements (6) small transversal and longitudinal ducts are formed, perimetral to each plates constituting the metallic element for the storage, said ducts serving for monitoring, recovering and localization of any possible leaks.

Fig. 1



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Description

[0001] This invention deals with high-capacity metal tanks for the storage of hydrocarbons and other liquids of any nature whatsoever, built underground (tank-tunnel) or sunken in the open or above ground.

[0002] Such tanks are generally cylindrical in shape with a horizontal or vertical axis and envisage an internal metallic structure for storage, an external covering, made of simple or reinforced concrete and a filler material interposed between the metallic storage structure and the static facing.

[0003] The construction of said large tanks takes place, as is known, by means of rectangular metallic elements, with small perimetric, calendered ducts, called "ferrules" of considerable size. Generally they are welded on the short sides onto omega-shaped channel irons which make up the hollow of the main duct (in general transversal) and on the long sides to a flat section, separated from one another, to form the hollow of the longitudinal duct with a rectangular cross-section. Both hollows are then covered with flat sections to form the tubular ducts for monitoring, localisation and recovery of any possible leaks. The omega-shaped ducts also serve the function of stiffening of the metallic storage structure.

[0004] This invention is based on the devising of the main duct obtained, instead of with the omega-shaped channel irons, with a simpler flat section of great thickness, onto which the short sides of the ferrules are welded separated from one another so as to obtain the hollow in the same duct. Therefore, the sections of the hollows of the ducts are thereby unified and all result to have a rectangular cross-section, to the advantage of the simplification in construction.

[0005] Consequently the thickness of the filler material interposed between the metallic storage structure and the static structure, generally made up of oxidised bitumen, results practically halved.

[0006] With this innovation one obtains all the ducts having their bottom made with the flat section which makes up the extension, to all the welded joints of the metallic structure, of the element of double storage of the liquid.

[0007] This last solution is generally preferred in that the calendering of the ferrules, stiffened by the moulding, is somewhat difficult.

[0008] Said metallic elements of large dimensions allow the mounting of the metallic structure placed on the intrados of the static, concrete facing which supports and protects it from the exterior.

[0009] The metallic storage structure is supported by the static, reinforced or non-reinforced concrete facing, by means of specific "U-bolts" and, in the hollow space between the metallic structure and the static facing, a filler material is poured or injected, generally heated oxidised bitumen. A great advantage in the preparation of large underground tanks is obtained if, for their optimal conditions of stability, one conceives the system made up of a metallic storage structure, static facing, filler material and surrounding ground as a unique structural complex interacting, in such way that all the components intervene directly and unanimously for the structural stability of said tanks, thereby configuring a complex according to the "tank-tunnel" scheme. In order to guarantee a better structural stability to the set of the three elements making up the tank and that is the static facing, the metallic plating and the filler material, which as said is heated oxidised bitumen and in order to guarantee the continual and optimal adhesion between the heated oxidised bitumen and the metallic plating thereby creating a uniform structural unit from the three components of the tank, one makes, on the external surface of the single ferrules of the metallic plating, means suitable to increase the adherence between the metallic plating and the heated oxidised bitumen. These means are generally represented by sections of various nature welded externally onto the ferrules.

[0010] The channels that one mentioned above, both longitudinal and transversal ones are then made to converge below the tank in a unique collection channel which in turn is laid out so as to have a termination in correspondence with a collecting vessel.

[0011] This vessel normally supplies an indication of the level of the leaks from the tank and therefore of its degree of hermetic sealing.

[0012] However, the omega-shaped sections used to create the channels require complex calendering operations and determine the formation of channels of excessive dimensions to convey leaks that are almost always of a non substantial magnitude.

[0013] This invention proposes to obviate these inconveniences creating a tank both underground and in the open air, which does not have problems of calendering and with a structure substantially and all together more rigid and whose layer of necessary oxidised bitumen is considerably reduced with a saving of material. The subject of this invention is a tank, both underground and in the open air, for storage of hydrocarbons and liquids in general having the characteristics of the attached claim 1.

[0014] This invention will be illustrated in the following with reference to a form of exemplifying construction illustrated in the attached figures in which:

- in figure 1 one schematically illustrates a transversal cross section of an exemplary sunken tank,
- in figure 2 one illustrates a cross section of a zone of jointing between two ferrules;
- in figure 3 one illustrates a partial cross section of the zone of the tank in which one applies the filler neck for introduction of the filler material;
- in figure 4 one illustrates a further cross section of the zone in figure 3.

[0015] With reference to the above mentioned figures, the tank according to this invention includes a metallic structure 2 and a static covering 3 aimed at separating,

in case of a tank-tunnel, the metallic structure from the surrounding ground made, for instance, of simple or reinforced concrete. The metallic structure is supported internally to the static covering 3 by means of anchoring structures 4 or U-bolts 41 fixed to said static covering 3.

[0016] Between the metallic structure and the static covering 3 at least one layer of filler material 5 is envisaged, which is for instance poured or injected while heated through suitable openings made in the metallic structure. Said filler material must transmit the stresses of the metallic structure to the static facing 3 and vice versa and for this purpose heated oxidised bitumen has proved to be useful.

[0017] Said oxidised bitumen when cold has the necessary plasticity to transmit the stresses, without permanent deformations and without cracks, between the components of the tank. This bitumen is poured into the hollow space at a temperature of about 200-220°C, in such way as to completely fill the interspaces between the metallic structure and the static facing.

[0018] As already said, with the adoption of such filler material, it is possible to guarantee the stability of the combination of the tank with a metallic structure and static covering, which are calculated with lower resistant sections compared to tanks that do not have such a filler layer.

[0019] Naturally what has been expressed with reference to the longitudinal body of the tank is also true for the head of the same tank both with a flat and a rounded surface. This solution, described with regard to cylindrical tanks with a horizontal axis, is also true for tanks of any other shape and arrangement (vertical, sub-vertical, spherical tanks etc.).

[0020] The metallic structure is made up of a plurality of metallic elements or ferrules 6 linked to one another by the transversal and longitudinal sides placed at a distance from one another on flat sections of suitable thickness, able to create the internal structure of the tank.

[0021] Said ferrules are linked to one another on the external surface, or that is the one which is in contact with the static covering, by means of a plurality of flat sections 7 that are welded to the edges of the metallic elements 6 joining them one to another and having the function of stiffening of the metallic structure as a whole. On the surface opposite the ferrules, to which a flat section of high thickness is welded, a further covering section 8 is fixed placed longitudinally compared to the ferrules, in such way as to form small ducts 9 transversal and longitudinal for monitoring, recovery and localization of any possible leaks. These channels, both the longitudinal and transversal ones, are made to converge below the tank in unique collection channel. A small monitoring pipe (not illustrated) may be connected to this collection channel and connected with the exterior of the tank, for instance with a service and monitoring room. The insertion of the small pipe is facilitated by the creation of specific pockets, of adequate size, created in the static structure or static facing of the tank. From this small pipe one can therefore have an indication of the level of the leaks from the tank and thus of its degree of hermetic sealing.

[0022] The oxidised bitumen that is inserted between the metallic structure 2 and the static facing 3, as mentioned above, is placed when heated and this, in certain zones of the metallic structure, might provoke expansions that are able to compromise the stability and the hermetic sealing.

[0023] According to this invention, pre-established points are envisaged for insertion of the bitumen created through holes 10, on the flat section 7, created in the position as close as possible (see figure 4) to the anchoring structures 4. In this position, before positioning the covering section 8 to form the channel, a nipple 11 is inserted to which one can connect an adduction hose for the bitumen. When the pouring is complete, the nipple 11 is removed and the hole 10 is blocked with a specific disc of plating, with a diameter corresponding to the section.

Claims

1. Underground tank (tunnel-tank) in the open (sunken or above-ground) for the containment of hydrocarbons and liquids of any kind comprising a metallic structure (2) and a static covering (3) aimed at separating the metallic structure from the surrounding ground, this metallic structure being supported inside the static covering by means of an anchoring structure (4) fixed to said external covering,
between the metallic structure and the static covering at least one layer of filler material (5) is envisaged, said metallic structure comprising a plurality of metallic elements (6) joined one to another at their transversal sides by means of flat sections (7, 8),
characterised by the fact that the metallic elements are linked one to another on the external surface, namely the part that is in contact with the static covering (3), by means of a plurality of flat sections (7) which are welded on the edges of the metallic elements (6), joining them one to another and having the function of stiffening of the metallic structures as a whole and, on the opposite surface, by means of covering sections (8) placed longitudinally and transversally to the ferrules, so that, between the two structurals and the sides of the metallic elements (6) small transversal and longitudinal ducts are formed, perimetral to each plates constituting the metallic element for the storage, said ducts serving for monitoring, recovering and localization of any possible leaks.

2. Underground tank (tunnel-tank) in the open (sunken or above-ground) according to claim 1, wherein the metallic storage structure is **characterized by** the double element of hydraulic sealing extended to all the welded joints pratically constituting the double

skin for the storage of the liquids.

3. Underground tank (tunnel-tank) in the open (sunken or above-ground) according to claim 1, wherein the metallic storage structure is naturally protected from the electrochemical corrosion created by the ground in consequence of the layer of filler material interposed between the static structure and the metallic storage structure.

4. Underground tank (tunnel-tank) in the open (sunken or above-ground) according to claim 1, **characterized by** the fact that these ducts, both the longitudinal and transversal ones, converge below the tank in a unique collection channel to which is connected a monitoring pipe which is connected with the exterior of the tank.

5. Underground tank (tunnel-tank) in the open (sunken or above-ground) according to claim 4, **characterized by** the fact that the insertion of the monitoring pipe is facilitated by the creation of specific pockets, of suitable size, created in the static structure or in the static facing of the tank.

6. Underground tank (tunnel-tank) in the open (sunken or above-ground) according to claim 1, **characterized by** the fact that pre-established points for insertion of the filler material are envisaged, formed by holes (10) on the flat sections (7), in the position as close as possible to the anchoring structures (4), in which, before positioning the covering section (8) to form the channel, a nipple (11) is inserted to which it is possible to couple an adduction hose of the filler material.

7. Underground tank (tunnel-tank) in the open (sunken or above-ground) according to claim 6, **characterized by** the fact that, when the pouring is complete, the nipple (11) is removed and the hole (10) is blocked by a suitable disk of plating, with a diameter corresponding to the section.

Fig. 1

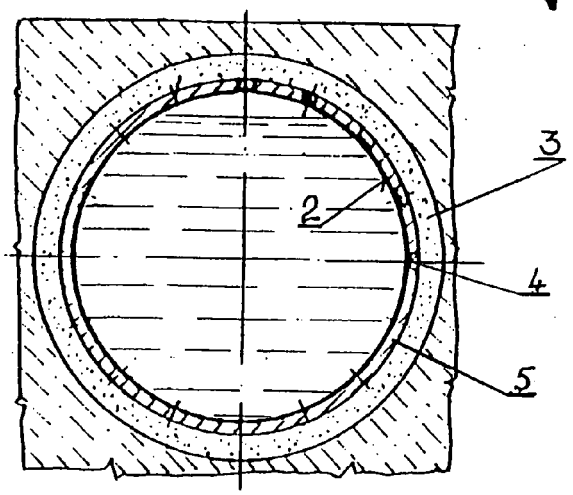
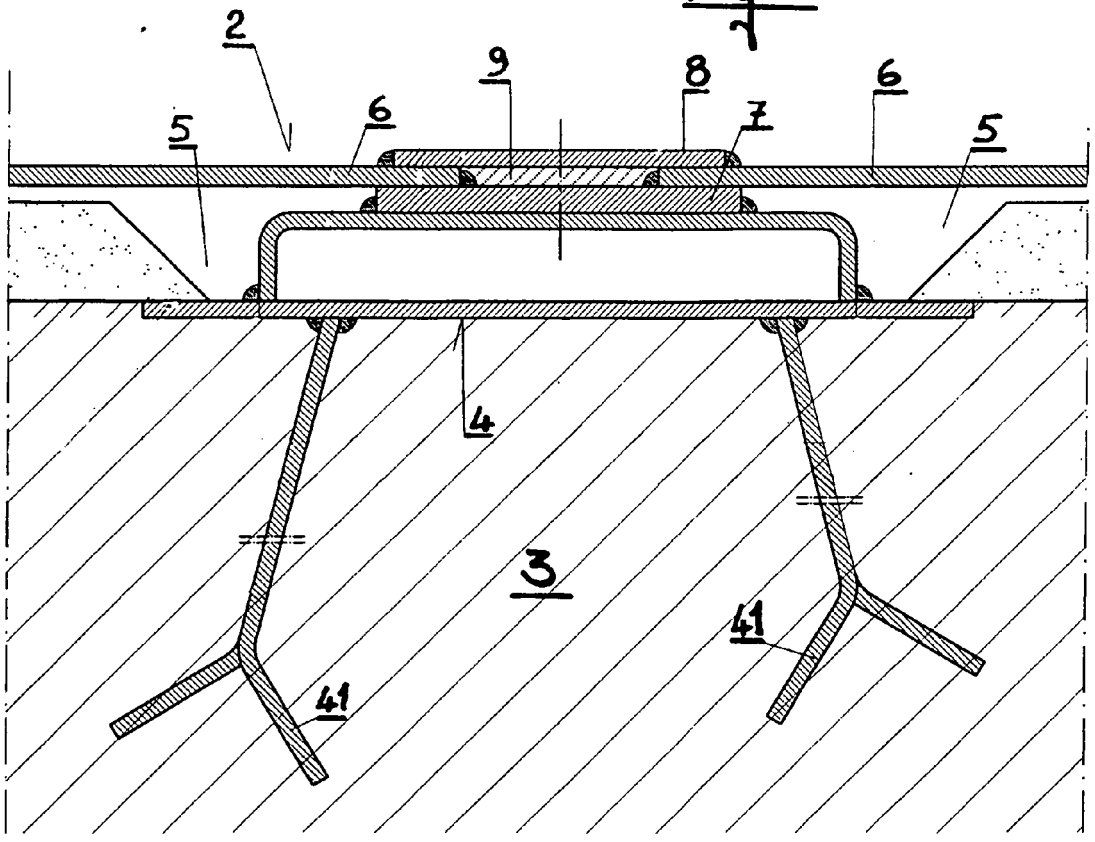


Fig. 2



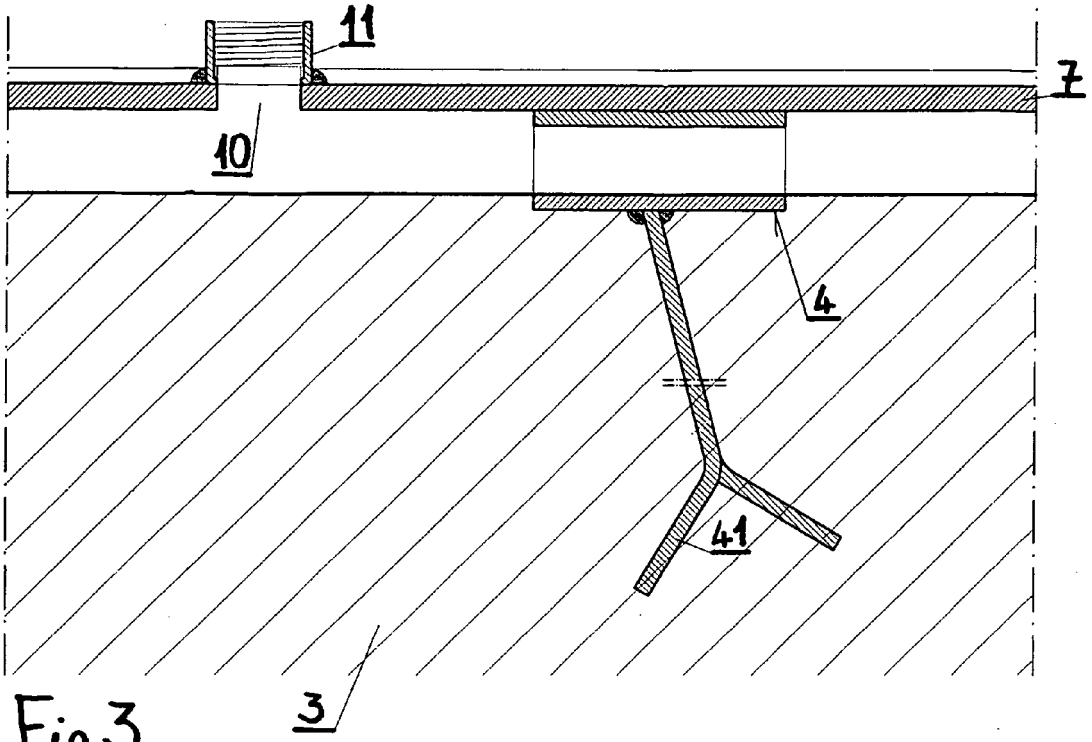
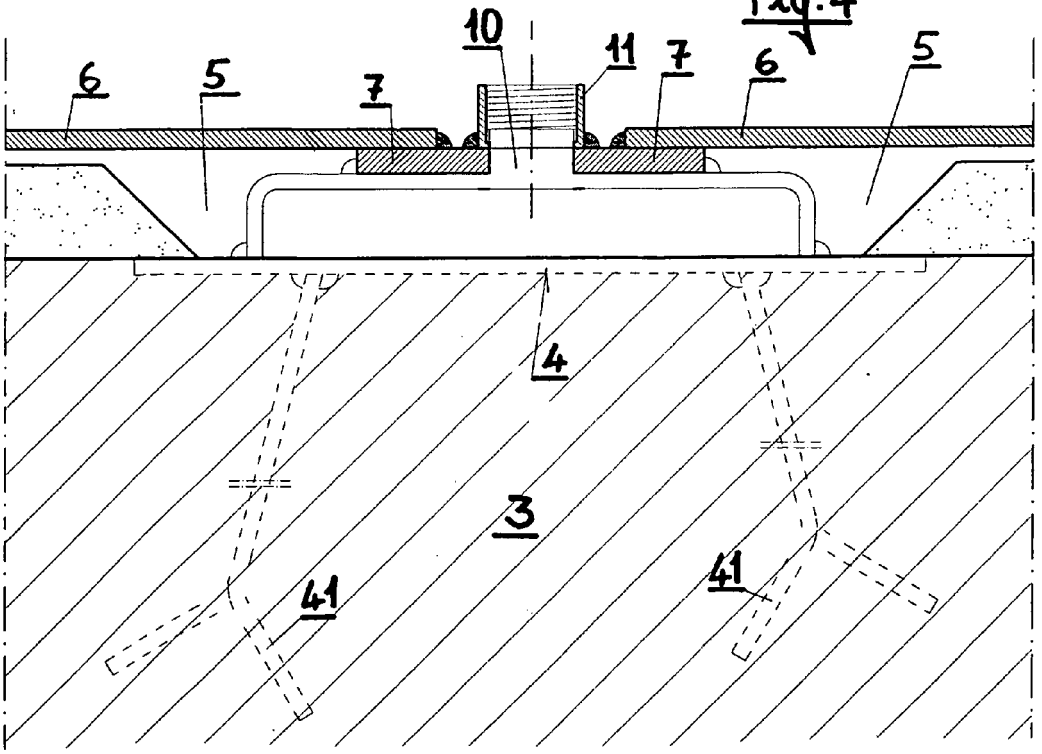


Fig.3

Fig.4



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EUROPEAN SEARCH REPORT

Application Number
EP 10 00 3519

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	21 June 2010	Zanghi, Amedeo

CATEGORY OF CITED DOCUMENTS

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