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Method for inspecting and repairing a foil for protecting the ground against contamination in addition to a method for examining the ground.

The invention provides a method for inspecting the integrity of a foil (1) for protecting the ground against contaminants and for testing the foil (1) for damage by admitting a fluid into a system of tubes (2) arranged in or under the foil (1) and having at least one inlet opening (6) and at least one outlet opening (7) and measuring the composition or the pressure of the fluid at the outlet opening (7) and comparing this with the composition or pressure at the inlet opening (6). Damage in the foil (1) can be

localized by arranging openings at certain locations in the tube system (2) and applying the method of claim 1 to the portion lying between the openings. The possibility also exists of repairing a foil (1) arranged under a building for protecting the ground against contaminants and having a system of tubes (2) arranged in or under the foil (1) by introducing a sealing material into tubes located in the vicinity of the damage.

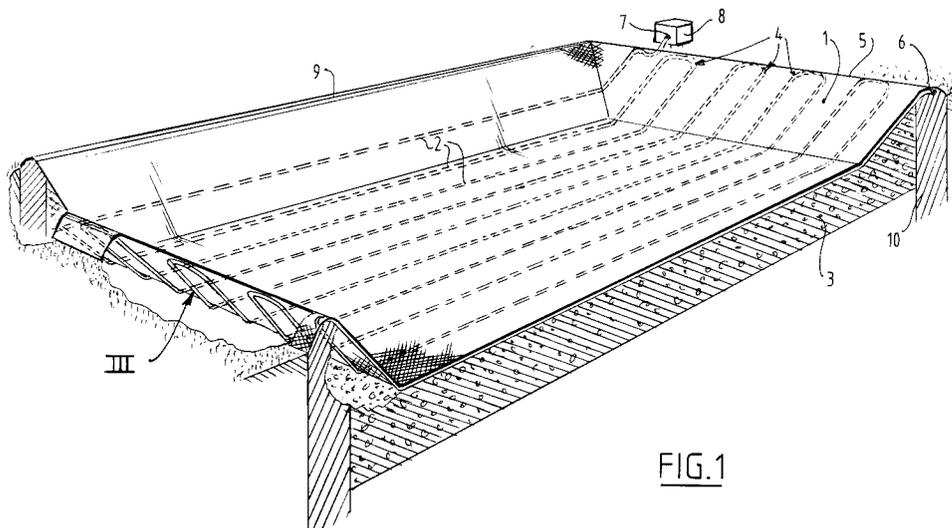


FIG.1

EP 0 531 583 A1

The invention relates to a method for inspecting the integrity of a foil for protecting the ground against contamination and to testing the foil for damage.

At locations such as laboratories, filling stations or dumping sites where work is done involving environmentally harmful substances, a sealing foil is often arranged in order to prevent harmful materials being released into the environment in the case of a disaster. Such a sealing foil is only effective when it is intact. Subsidence of the ground under the foil for example can result in tears and other damage, whereby the foil loses its protective action. A system for inspecting whether or not the foil is sealed is therefore desirable.

The invention has for its object to provide a method with which the foil can be inspected and with which any damage that is detected can be localized and repaired.

This is achieved by the invention by admitting a fluid into a system of tubes arranged under the foil and having at least one inlet opening and at least one outlet opening and measuring the composition and/or the pressure of the fluid at the outlet opening and comparing this with the composition and/or pressure at the inlet opening.

The system of tubes can be formed by porous or non-porous tubes. When non-porous tubes are employed they are preferably integrally formed with the foil so that if the foil is damaged the tube system is also damaged.

There are now a number of possibilities for inspecting the foil. By applying an underpressure at the outlet opening of a non-porous tube system, the leaked harmful substances resulting from a disaster will in the case of damage be released into the tube system and be measured at the outlet opening. In this case the method has a detecting action.

For preventive action, that is, confirming damage before a disaster has taken place, fluid at an overpressure will be admitted at the inlet opening. In the case of damage the pressure of the fluid will have fallen at the outlet opening. When fluid at an ambient pressure is admitted at the inlet opening, the measurement at the outlet opening will only be able to indicate a change in composition.

In the case of a porous system of tubes the pressure measurements cannot be applied. In that case it will however be possible to ascertain a change in composition. A porous tube system enables timely detection of contaminants in the ground caused by a defective foil when the measurements are performed periodically.

Once it has been established that damage has occurred, this can be localized using the method according to the invention. For this purpose openings are arranged at certain locations in the tube

system and fluid is admitted into the portion of the tube system lying between the openings. The pressure or the composition of the egressing fluid is then measured. It can then be determined on the basis of these measurements whether damage has occurred in the tube portion lying between the openings.

In one embodiment of the invention the openings are arranged by cutting through the successive bend pieces of a meander-shaped system of tubes.

In another embodiment the tube system consists of a number of tubes having closable openings and arranged virtually parallel under the foil. In this embodiment the pressure and composition can be measured per tube, thus enabling rapid localization.

When damage has been localized, it can be repaired by introducing sealing material into the damaged tubes or the porous tubes lying at the location of the damage, which material seals off the space beneath a damaged area.

In addition, a porous tube system alone, that is, without foil, can be used for timely detection of contaminants released into the ground. For this purpose a porous system of tubes is arranged in the ground for examination. To examine the ground fluid is admitted into the tube system and the composition of the fluid then determined. If the composition of the fluid coming out of the tube system has altered, contamination will probably have occurred. It is likewise possible to carry the contamination into the tube system by means of an underpressure, whereafter the composition of the fluid in the tube system can be determined.

The invention will be further elucidated with reference to the drawings, in which:

fig. 1 shows a partially broken away perspective view of a first embodiment of a foil with tube system arranged thereunder for use in the method according to the invention;

fig. 2 shows a partially broken away perspective view of a second embodiment of a foil with tube system arranged thereunder for use in the method according to the invention; and

fig. 3 shows an enlarged, partially broken away perspective view according to III of the porous tube interwoven with a foil.

Fig. 1 shows an embodiment of the invention wherein a foil 1 with a system of tubes 2 thereunder is arranged on a drainage layer 3. The tube system 2 is meander-shaped and has bend pieces 4 which can be accessed by folding back the foil edge 5. The tube system is also provided with an inlet opening 6 to which fluid can be supplied. The outlet opening 7 is connected to a measuring device 8 for determining the pressure and/or composition of the fluid in the tube system 2. The foil

edges 5 and 9 of the foil 1 rest on the foundation 10. In order to inspect the foil fluid is carried into the tube system 2 at the inlet opening 6. In a non-porous system of tubes the fluid can be admitted under an overpressure. Damage in the tubes and thereby in the foil will result in a pressure drop. This drop in pressure can be measured at the outlet opening 7. When harmful materials have leaked into the ground the composition of the fluid admitted at the outlet opening 7 will differ from the composition of the fluid admitted at the inlet opening 6. Such changes can be detected by the measuring device 8. It is likewise possible to close off the inlet opening 6 and to create an underpressure in the tube system 2 via the outlet opening 7. In this manner, in the case of a non-porous tube system, only ambient air will enter the tube system when damage has occurred. In the case of a porous tube system ambient air will always enter the tube system when there is an underpressure. In this case a measurement of the composition will indicate whether a contaminant is present in the ground.

Fig. 2 shows a system of tubes 11 consisting of porous tubes 12 running virtually parallel and arranged on a drainage layer 13 under a foil 14. The outer ends 15 of the tubes 12 are closable and can be opened for localizing and repairing damage in the foil 14. The outer ends 16 are joined to a channel 17 in which can be placed a device for measuring the composition of the fluid in the tubes. The edges 18 of the foil 14 rest on the foundation 19 through which the tubes 12 run. A floor with a layer of ground thereunder can be placed on the foundation 19 (not shown). By periodically performing pressure and/or composition measurements at the outer ends 16 timely inspections can be made as to whether contaminants have been released into the ground as a result of damaged foil.

Fig. 3 is an enlarged view of a foil according to the invention. A porous tube 20 is enclosed by the fibres 21 of a braided structure 22 which is encapsulated in a sealing material 23. The tubes can also be non-porous and likewise encapsulated in the sealing material (not shown here). The combination of a porous and a non-porous system of tubes in and/or under the same foil is also conceivable.

The present invention therefore provides a method enabling on the one hand a preventive foil inspection and on the other a timely detection of ground contamination. In addition, damage can be localized and repaired.

Claims

1. Method for inspecting the integrity of a foil for protecting the ground against contaminants and testing the foil for damage by admitting a

fluid into a system of tubes arranged in or under the foil and having at least one inlet opening and at least one outlet opening and measuring the composition or the pressure of the fluid at the outlet opening and comparing this with the composition or pressure at the inlet opening.

2. Method for localizing damage **characterized by** arranging openings at certain locations in the tube system and applying the method as claimed in claim 1 to the portion lying between the openings.

3. Method as claimed in claim 2, **characterized in that** the successive bend pieces of a meander-shaped tube system are cut through and the method as claimed in claim 1 is then applied.

4. Method as claimed in claim 1, **characterized in that** the tube system consists of a number of porous tubes arranged virtually parallel under the foil.

5. Method as claimed in claim 1, **characterized in that** the tube system is formed by a meander-shaped hose integrated with the foil.

6. Method for repairing a foil arranged under a building for protecting the ground against contaminants and having a system of tubes arranged in or under the foil by introducing a sealing material into tubes located in the vicinity of the damage.

7. Foil provided with a porous tube system integrally formed therewith for use in the method as claimed in claims 1-3, 5 and 6.

8. Building with foil as claimed in claim 7 arranged under the foundation thereof.

9. Building with foil arranged under the foundation and a system of tubes arranged under the foil for performing the method as claimed in claims 1-6.

10. Method for examining ground by arranging a porous tube system and admitting a fluid into the tube system and measuring the composition of the emerging fluid and comparing this with the composition of the admitted fluid.

11. Method as claimed in claim 10, **characterized in that** in the admitted fluid an underpressure relative to the ambient pressure prevails for sucking any contaminants present in the

ground into the tube system.

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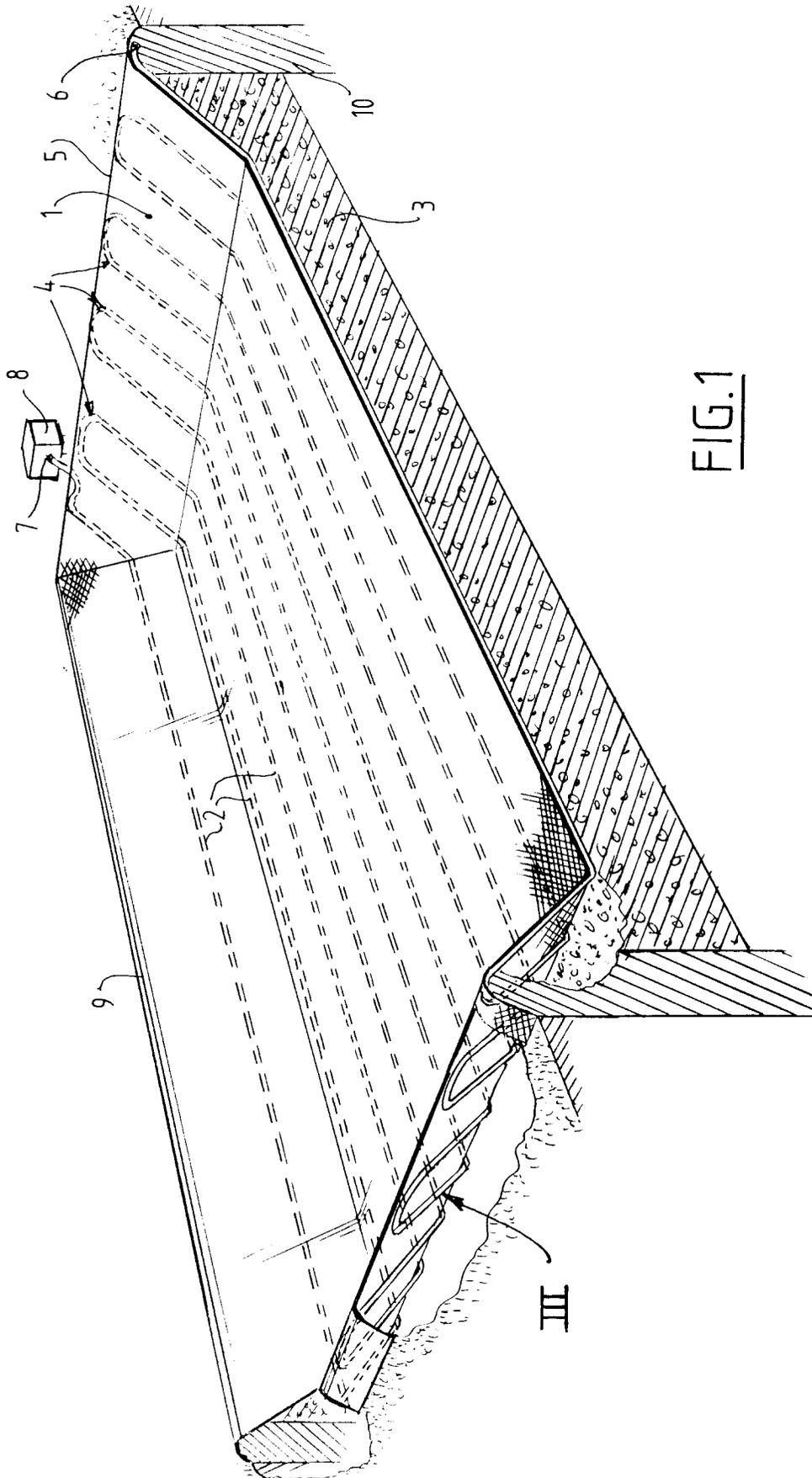
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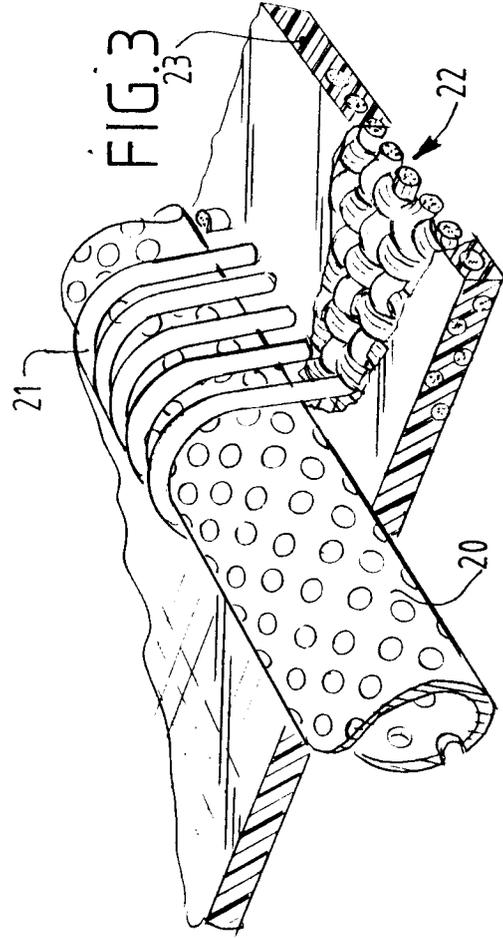
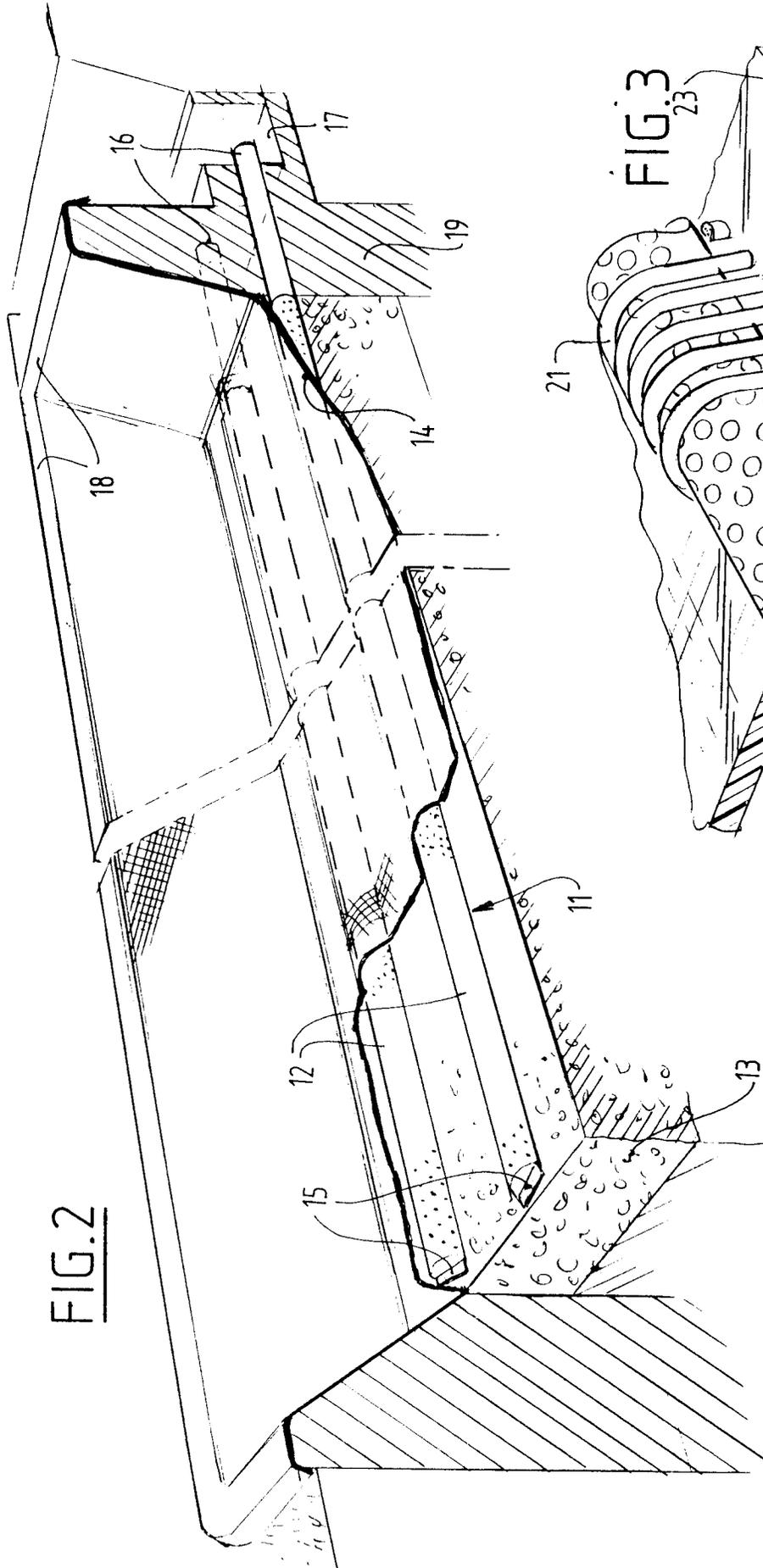
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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	DE-A-3 616 377 (ZÜBLIN)	1, 2, 6, 10, 11	E02D31/00
Y	* column 3, line 40 - line 46 * * column 4, line 20 - column 5, line 56; figures 1, 2, 4 *	5	

X	DE-A-3 831 188 (MC-BAUCHEMIE)	1, 4, 7	
A	* column 2, line 44 - column 3, line 11; figures 1, 2 *	8, 10, 11	

Y	DE-A-3 837 431 (SIMONS + PARTNER)	5	
A	* column 2, line 9 - line 43; figures 1, 2 *	3, 8	

			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			E02D B09B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 08 APRIL 1992	Examiner TELLEFSEN 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			