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(71) Applicant: **VOORBIJ GROEP B.V.**
Herenweg 116-118
NL-3648 CM Wilnis(NL)

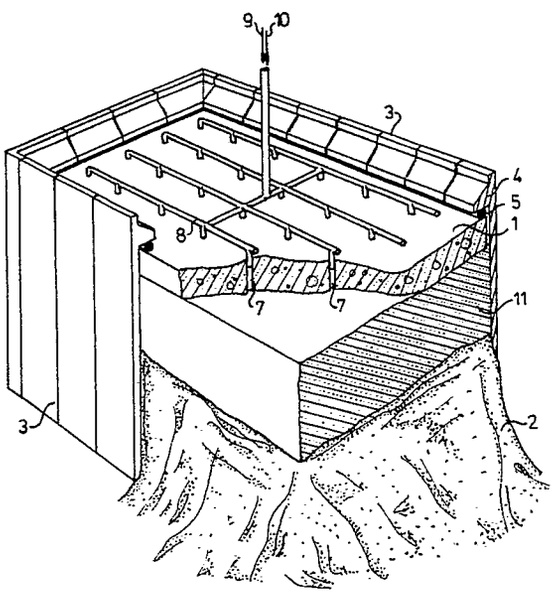
(72) Inventor: **Van Dijk, Simon**
Stationsstraat 72
NL-1421 AA Uithoorn(NL)

(74) Representative: **de Bruijn, Leendert C. et al**
Nederlandsch Octrooibureau
Scheveningseweg 82 P.O. Box 29720
NL-2502 LS 's-Gravenhage(NL)

(54) Method for the displacement of a slab-shaped carrier, and seal therefor.

(57) Method for the displacement of a slab-shaped carrier (1) such as a foundation. In this case openings (7) are provided in the foundation, through which water and a hardening concrete material are introduced in succession. Water is introduced to remove adhesion between the ground lying below the foundation, and the hardening concrete material is used to achieve the displacement between the ground surface and the foundation.

Fig-1



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The invention relates to a method for the displacement of a slab-shaped carrier, such as a foundation, laid on a ground surface, comprising the provision of openings in said carrier, and the introduction of a first, non-hardening fluid through said openings, followed by the introduction of a second, hardening fluid.

Such a method is known from US-A-2,682,750. It describes a method for placing a subsided foundation in the correct position. This subsidence can be caused by sinking ground, for example due to mining. Since the problem with the direct introduction of a hardening fluid, such as concrete, is that it does not enter all cavities, it is proposed according to the US Patent Specification that a thixotropic fluid, such as a mixture of sand and water, should first be introduced between the existing ground surface and the foundation. The introduction of an adequate quantity of thixotropic fluid ensures the displacement between the foundation and the ground surface below. Concrete-type material is then injected and replaces the thixotropic fluid. This means that during the stage of introduction of the hardening material no displacement of the foundation takes place.

Such a method can be carried out successfully in the case of gritty soil such as sandy soil. It has, however, been found that if the soil has sticky properties, such as if clay is present in the soil, the adhesion between foundation and underlying ground cannot be broken by the introduction of a thixotropic fluid, in which case this method cannot be used.

The object of the invention is to provide a method in which it is possible to remove such adhesion and then achieve a displacement of the foundation.

This object is achieved in the case of an above-described method in that the first fluid comprises a nonthixotropic fluid, in that the ground surface is of such a composition that it adheres to the foundation, in that such a quantity of water is introduced that the adhesion between carrier and ground is removed, and in that a greater quantity of second fluid is introduced in order essentially to achieve the displacement. Surprisingly, it was found that through the introduction of a nonthixotropic fluid, such as water, at relatively low introduction pressure a separation between foundation and ground surface can be achieved, extending over the entire surface. The quantity of water introduced is limited here in such a way that the separation between ground and foundation just takes place. The introduction pressure of the water spreads over a large area. A hardening material is then introduced. This hardening material is introduced in a much larger quantity because the displacement between foundation and ground is achieved with it. This contrasts with the above-mentioned US patent specification. If in particular cellular concrete is used as the hardening material, it is important that the introduction pressure of the cellular concrete should not be too high. Too high pressure causes compression of the gas bubbles present in the cellular concrete, with the result that such an increase in pressure is not very efficient. Besides, cellular concrete is a thixotropic material, so that - as stated above - it is not capable of removing the adhesion between adhering ground material and the foundation, due to the rapid drop in the introduction pressure with distance from the introduction opening. In this way it is possible to achieve the desired raising of a carrier by conventional pumping means for cellular concrete and the usual pressure range. High pressure need be used only by the pump introducing the non-thixotropic fluid. Cellular concrete is used in particular where the weight of the material to be introduced and the ease of introduction are important. Ordinary concrete is high in weight and in particular in the case of weaker ground surfaces, which can contain, for example, adhering clay material, a further considerable increase in the weight of the foundation would only lead to quicker subsidence.

It is pointed that Japanese Abstract 63/27628A discloses a method for the placing of a foundation slab.

In this case a relatively large opening is made in the foundation slab concerned, and a nozzle of smaller diameter is introduced through this opening. Thereafter, the space below the slab is emptied by blasting, in which case the discharge can take place through the space between the nozzle and the opening. A grout mixture is then injected. This is not a matter of the removal of adhesion.

The invention also relates to a seal for use with the above-described method. It comprises in particular a number of vertical partitions to be fitted at the boundary of the slab-shaped carrier. The spread of the moving fluid in the horizontal direction is thereby limited, and this fluid is forced to give the slab-shaped carrier an upward movement. In order to ensure that these partitions move along with the slab-shaped carrier, they are provided with projections engaging on the slab-shaped carrier.

According to an advantageous embodiment of this structure, a seal is provided between the projections and the slab-shaped carrier. In this way leaks between the slab-shaped carrier and the vertical partitions are avoided as far as possible.

If a vertical boundary is already present, or the partitions described above have been fitted, and a small distance exists between this vertical boundary and the partitions, according to an advantageous embodiment, an elongated compressible seal is provided in the gap defined between the

slab-shaped carrier and the vertical boundary.

The invention will be explained below with reference to an example of an embodiment shown in the drawing. In it:

Fig. 1 shows a perspective cross-section (not to scale) of a slab-shaped carrier, provided with the seal according to the invention, and in which the method according to the invention is used with vertical partitions; and

Fig. 2 shows a further schematic view in cross-section of the slab-shaped carrier with a seal used in an already present vertical boundary.

Fig. 1 shows a slab-shaped carrier 1 which originally rested on ground surface 2. Through subsidence or the like, it is desirable to displace slab-shaped carrier 1 relative to ground surface 2. For this, partitions 3 provided with projections 4 are fitted. These projections 4 rest on the slab-shaped carrier, and an elongated seal 5 is provided between the projections 4 and the slab-shaped carrier. Openings 7 are produced in the slab-shaped carrier 1, and are connected to a pipe system indicated in its entirety by 8, connected to a source 9 of water and to a source 10 of cellular concrete. Both sources, schematically indicated by arrows, are provided with valves (not shown), while valves which are not shown are also present in the pipe system 8, in order to provide a metered addition of material through the openings 7.

The device described above works as follows:

In order to remove the adhesion between ground surface 2 and slab-shaped carrier 1, water is first introduced from source 9 via pipe 8 through openings 7. After the removal of the adhesion, the infeed of water is ended and a hardening material, such as cellular concrete, is introduced via source 10, pipe system 8 and openings 7 into the space below slab-shaped carrier 1, indicated by 11. Through the metered addition, any local subsidence can be compensated for, so that the slab-shaped carrier returns to the desired position. When the slab-shaped carrier moves upwards, partitions 3 move with it, due to the projecting parts 4.

If a boundary 12, 13 is already present, it is sufficient to provided a seal 14 between said boundary and the slab-shaped carrier, as can be seen from Fig. 2. With the upward movement of the slab-shaped carrier, seal 14 rolls down along vertical boundary 12, 13. The distance covered is half the displacement of the vertical carrier. It must be understood that, for the sake of clarity, the length/breadth proportions in the drawing do not correspond to reality.

With the method described above it is possible to return subsided structures to the desired position through the introduction of a low-weight material, such as cellular concrete. Due to the fact that cellular concrete has a specific weight which is equal to or smaller than the surrounding ground material, no sinking will take place again, such as often occurs when heavier materials are applied. The invention can be used for frameworks, road surfaces and other platforms or foundations.

Example:

The device shown in Fig. 1 was tested with a slab with dimensions of 3 x 2.5 m. First of all, water at a pressure of 15 atm. was introduced until the adhesion was removed. Then cellular concrete material was introduced at relatively low pressure, i.e. lower than 5 atm. This pressure spreads very uniformly below the slab-shaped part, in view of the large number of feed points, and this part can be taken accurately into the desired horizontal position.

Although the invention is described above with reference to a preferred embodiment, it must be understood that numerous modifications which are obvious to anyone proficient in the state of the art can be made to it, without going beyond the scope of the application.

Claims

1. Method for the displacement of a slab-shaped carrier, such as a foundation, fitted on a ground surface, comprising the provision of openings in said carrier, and the introduction of a first, non-hardening fluid through said openings, followed by the introduction of a second, hardening fluid, characterised in that the first fluid comprises a non-thixotropic fluid, in that the ground surface is of such composition that it adheres to the foundation, in that such a quantity of water is introduced that the adhesion between carrier and ground is removed, and in that a greater quantity of second fluid is introduced in order essentially to achieve the displacement.

2. Method according to Claim 1, in which the nonthixotropic fluid comprises only water and/or a fluid with dynamic viscosity corresponding to water.

3. Method according to any of the preceding claims, in which the second fluid comprises cellular concrete.

4. Seal for use with the method according to any of Claims 1 - 3, comprising a number of vertical partitions to be fitted at the boundary of the slab-shaped carrier.

5. Seal according to Claim 4, in which the parti-

tions are provided with projections engaging on the slab-shaped carrier.

6. Method according to Claim 5, in which a seal is provided between the slab-shaped carrier and the projections.

7. Seal for use with the method according to any of Claims 1 - 3, alone or in conjunction with any of Claims 4 - 6, in which a vertically extending part adjoins the slab-shaped carrier, characterised in that the seal comprises an elongated compressible body of revolution, to be fitted in the free space between the slab-shaped carrier and the vertical part.

fig-1

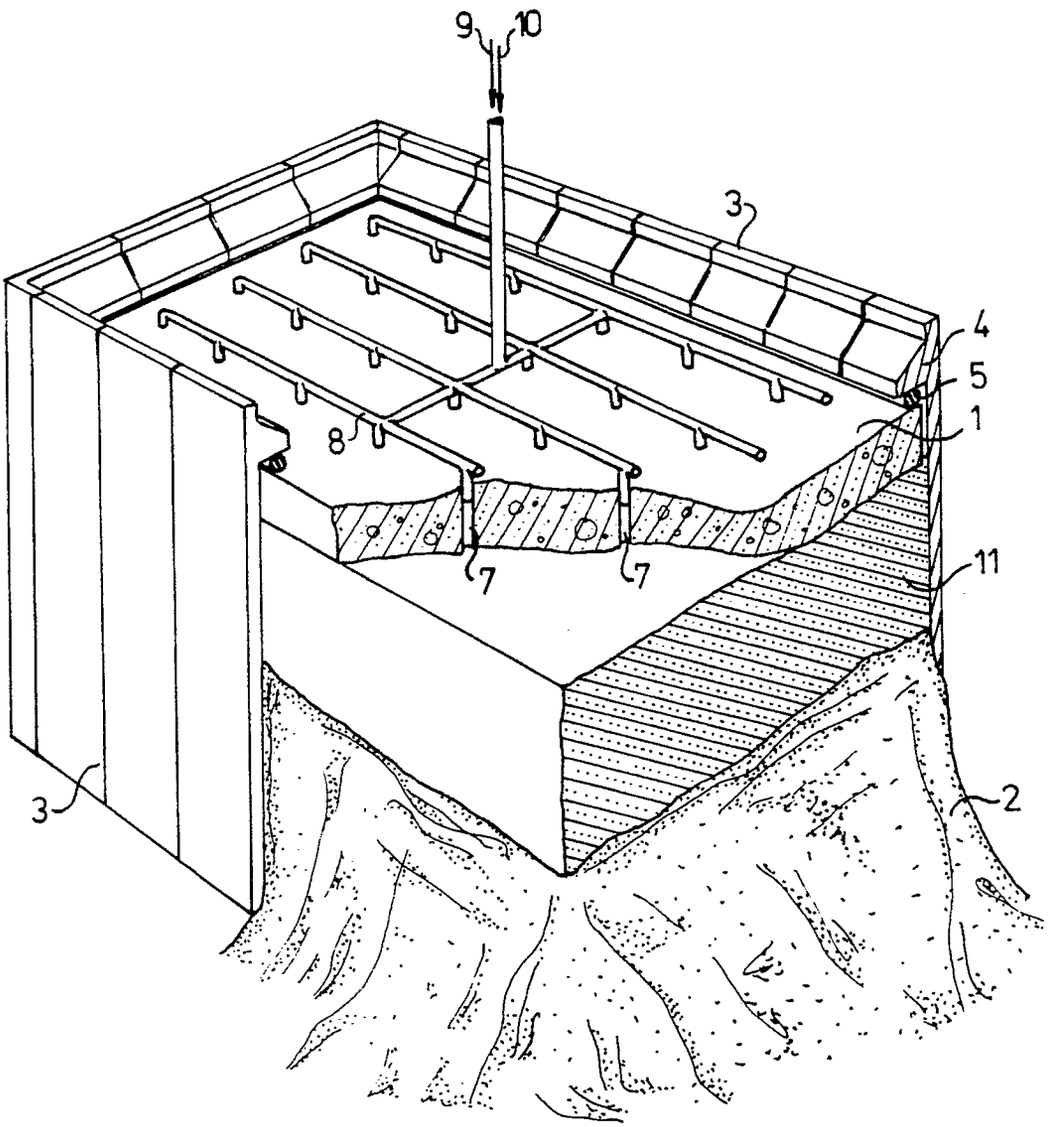
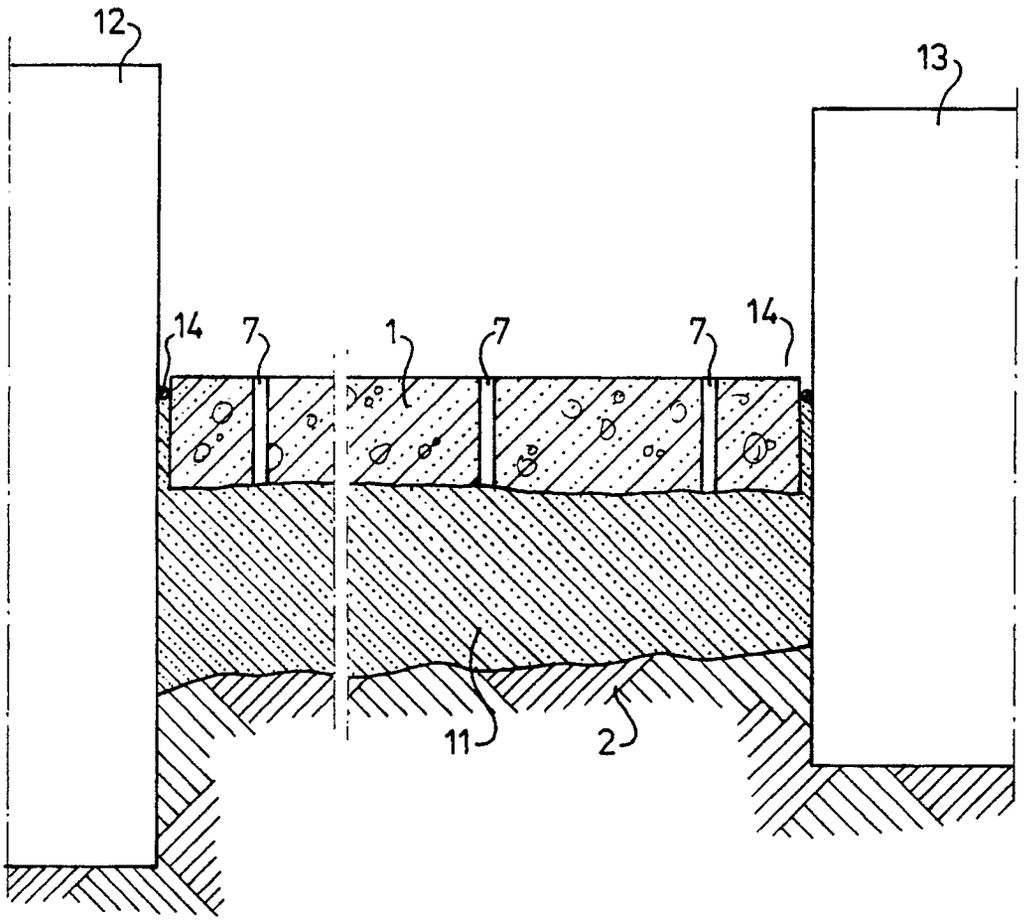


fig-2



European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 91 20 1124

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)
	US-A-2 682 750 (LORENZ)		E02D35/00
D,X	* column 1, line 1 - column 2, line 55 *	4	
D,Y	* column 6, line 70 - column 7, line 31 *	1,5	
D,A	* figure 5 *	6	

	DE-A-2 613 993 (BILFINGER)		
X	* page 4, line 21 - line 32 *	7	
	* figure 1 *		

	US-A-4 092 832 (MATTSON)		
Y	* column 4, line 27 - column 5, line 4 *	1	
	* figure 3 *		

	US-A-3 469 357 (SEIDLER)		
Y	* column 2, line 32 - column 3, line 27 *	5	
	* figures 1,2 *		

	EP-A-0 355 208 (VOORBIJ'S BETON)		
A	* column 2, line 21 - line 28 *	3	
	* figure 2 *		

TECHNICAL FIELDS SEARCHED (Int. Cl.5)
E02D
E04G

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	17 JULY 1991	kergueno

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

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