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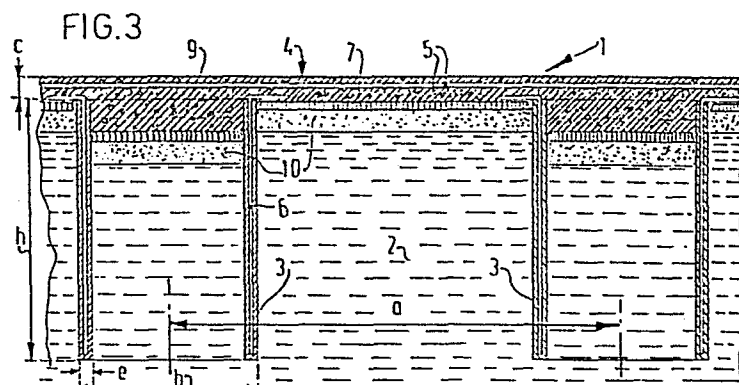
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54 Ground plate.

57 A ground plate (1) of reinforced concrete can be used as a road, airport runway or foundation of a building. In order to lay it on very soft ground (2), it is provided with tubes (3) at its lower side.



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#### Ground plate.

The invention relates to a ground plate of reinforced concrete, for instance a road construction, an airport runway or a foundation for a building, said ground plate having a slab and tubes of reinforced concrete, said tubes being rigidly attached to the lower side of said slab and being spaced from each other. Such a ground plate is disclosed in NL-A-134.497 to be laid on soft ground with a pressure resistance of 0,2-0,3 kgf/cm<sup>2</sup>.

The present invention provides a ground plate which can be laid on even softer ground. To this aim the uninterrupted great area of the slab and the other dimensions of the slab and the tubes as well as their reinforcements are selected based on design-loads at the order of magnitude of 1-0,5 ton/m<sup>2</sup>. This is particularly for airport runways. Roads are according to present invention constructed with such great area that design-loads of the magnitude of 0,5 ton/m<sup>2</sup> are achieved. The problem of shrinkage can be solved with dummyjoints or with a cover layer. The present ground slab is laid on such soft ground that the machines can not easily be supported by it. Therefor the soft ground is covered with a layer of sand and/or lean concrete.

The invention will be illucidated with reference to a drawing. The drawing shows in:

Figure 1 a plan view of a ground plate according to the invention,

5 Figure 2 on larger scale section II-II of Figure 1 concerning an airport runway,

Figure 3 a section corresponding with Figure 2 concerning a road-construction,

Figures 4 and 5 on larger scale two variants of a 10 section over line IV-IV of Figure 2, and

Figure 6 a load diagram.

The ground plate 1 comprises a slab 4 of concrete reinforced with reinforcements 5 and a plurality of tubes 3. The tubes 3 have a length  $h$ , a wall thickness  $e$ , a diameter 15  $f$ , a pitch distance  $g$  and reinforcements 6 which are embedded in the concrete 9 of the slab 4 for rigid connection of the tubes 3 to the lower side of the slab 4.

The ground plate 1 of Figure 1 has an area  $d \times g$  which is so great that the maximum total weight resting 20 thereon results in a ground load, which is less than the maximum permissible ground pressure of the soft ground. The dimensions of slab thickness  $c$  and the dimensions of the reinforcements 5 thereof as well as the dimensions of the tubes 3 and their reinforcements are selected based on design-loads 25 of the order of magnitude of  $1-0,5 \text{ ton/m}^2$ .

In the airport runway construction of Figure 2 based on design-loads of  $1 \text{ ton/m}^2$ ,  $c = 20 \text{ cm.}$ ,

$h = 200 \text{ cm.}$ ,

$e = 8 \text{ cm.}$ ,

30  $b = 120 \text{ cm.}$ , and

$a = 250 \text{ cm.}$

In Figure 2 a layer of sand 8 covers the soft soil 2. Lean concrete 7 covers the layer of sand 8.

In the road construction of Figure 3 based on 35 design-loads of  $0,5 \text{ ton/m}^2$ ,  $c = 10 \text{ cm.}$ ,

$h = 200 \text{ cm.}$ ,

$e = 8 \text{ cm.}$ ,

$b = 120 \text{ cm.}$ , and

$a = 350 \text{ cm.}$

In Figure 3 the soft soil 2 is covered with a thin layer of subbase 10 and a thin layer of lean concrete 7.

The tubes 3 are only interconnected by the slab 4.

The invention concerns with the construction of highways, which are so permanent and so rigid in construction, that for a bus-station, for instance, the parkinglots and the bus-terminal foundation can be executed by applying the invention. Same can be said about runways, taxiways and aprons of airports, included the foundations for the terminal, godowns and hangars.

The dimensions of the concrete components as well as of the reinforcement are based on design-loads of  $1 \text{ ton/m}^2$  for airport runways and -aprons and of  $0,5 \text{ ton/m}^2$  for highways. Never before have such small design-loads been used for airport- and road pavements. This is due to the ability of the invention to support cooperatively the load put on it.

The runway as well as the highway slab consists of one continuous reinforced concrete slab without any expansion joints in both direction (longitudinal and transversal), what is not the normal practice in the previous concrete pavements. This will give an extra convenience for driving on it.

The concrete pipes firmly attached underneath the slab will also prevent the upheaval of the slab in case of the presence of uplift forces. The slab is kept completely level.

Whereas the road pavement should be permanent and without or almost without maintenance, no shrinkage- and expansion-joints should be applied in the whole length of the pavement, which makes shrinkage and expansion by change of temperature possible.

This can be obtained in two ways:

According to Fig. 4: Applying the so called dummy-joints on the pavement on certain distances if the pavement be made of bare concrete.

According to Fig. 5: Applying a thin layer of sand-asphalt or concrete-asphalt on the concrete pavement to make the shrinkage-cracks (if any) invisible and free from moisture.

For the expansion of the concrete pavement by temperature increase no special expansion-joints are needed, due to the fact that the expansion of the concrete slab will be prevented by the passive soil-pressure against the reinforced concrete pipes 3 under the slab 4.

To prevent cracks in the concrete road-pavement by frost and thaw, the allowable calculated soil-pressure under the concrete slab should have at least the same value as the maximum frost pressure, namely  $0,35 \text{ ton/m}^2$ .

10 To prevent the harmful effect of excessive water under the concrete slab caused by thaw or flood, the allowable calculated soil-pressure under the slab should not exceed  $500 \text{ kg/m}^2$  or  $0,5 \text{ ton/m}^2$  for highways and  $1000 \text{ kg/m}^2$  or  $1 \text{ ton/m}^2$  for airport runways.

15 Taking the very small design-load in consideration, it will be clear that the invention is very useful and economical to be applied on soft soil, where the conventional system will need expensive preparations for its application.

The load diagram of Figure 6 shows a vehicle with weight  $Q$  resulting in a ground counter pressure  $q$  on the slab 4 and side pressure on the tubes 3 for obtaining the required bending moments from the tubes 3 on the slab 4. The mutual relationship between dimensions of the slab 4 and tubes 3 is as follows:

25 
$$b \cdot h^3 = k a^3 \times y ; y = f(q, r, m), \text{ where}$$

$a$  = distance between tubes in meters;

$b$  = the outer diameter of the tube in meters;

$h$  = height of pipe in meters; (pipe = tube)

30  $r$  = the specific weight of the soil;

$m$  = soil constant, dependent on the internal angle of friction;

$q$  = the ground counter-pressure in  $\text{ton/m}^2$ ;

$k$  = the safety coefficient, amounting between

35  $1\frac{1}{2}$  and 2.

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C L A I M S

1. Ground plate (1) of reinforced concrete, for instance a road construction, an airport runway or a foundation for a building, said ground plate (1) having a slab (4) and tubes (3) of reinforced concrete, said tubes (3) being rigidly attached to the lower side of said slab (4) and being spaced from each other, characterized in that the uninterrupted great area of the slab (4) and the other dimensions of the slab (4) and the tubes (3) as well as their reinforcements are selected based on design-loads at the order of magnitude of 1-0,5 ton/m<sup>2</sup>.

2. Ground plate (1) as claimed in claim 1, characterized in that dummy-joints are arranged in the slab (4).

3. Ground plate (1) as claimed in claim 1 or 2, characterized in that the slab (4) is covered by a cover layer for covering shrinkage-cracks.

4. Ground plate (1) of reinforced concrete, for instance a road construction, an airport runway or a foundation for a building, said ground plate (1) having a slab (4) and tubes (3) of reinforced concrete, said tubes (3) being rigidly attached to the lower side of said slab (4) and being spaced from each other, characterized in that the soft soil is covered with a layer of sand and/or lean concrete.

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C L A I M S

1. Ground plate (1) of reinforced concrete, for instance a road construction, an airport runway or a foundation for a building, said ground plate (1) having a slab (4) and tubes (3) of reinforced concrete, said tubes (3) being rigidly attached to the lower side of said slab (4) and being spaced from each other, characterized in that the soft soil is covered with a layer of sand and/or lean concrete.
- 10 2. Ground plate (1) as claimed in claim 1, characterized in that the uninterrupted great area of the slab (4) and the tubes (3) as well as their reinforcements are selected, based on design-loads at the order of magnitude of 1-0,5 ton/m<sup>2</sup>.
- 15 3. Ground plate (1) as claimed in claim 1 or 2, characterized in that dummy-joints are arranged in the slab (4).
4. Ground plate (1) as claimed in claim 1, 2 or 3, characterized in that the slab (4) is covered by a cover layer for covering shrinkage-cracks.
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FIG. 1

"1/2"

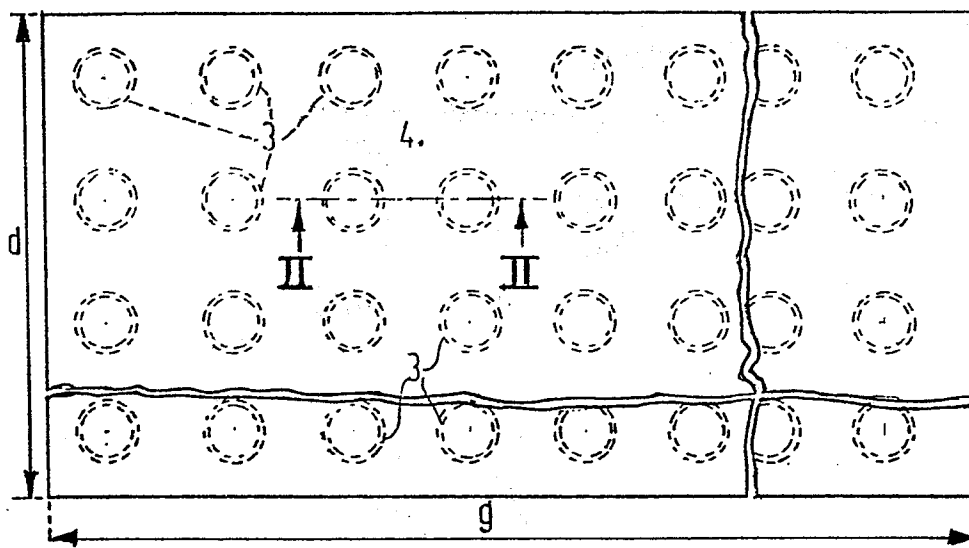


FIG. 2

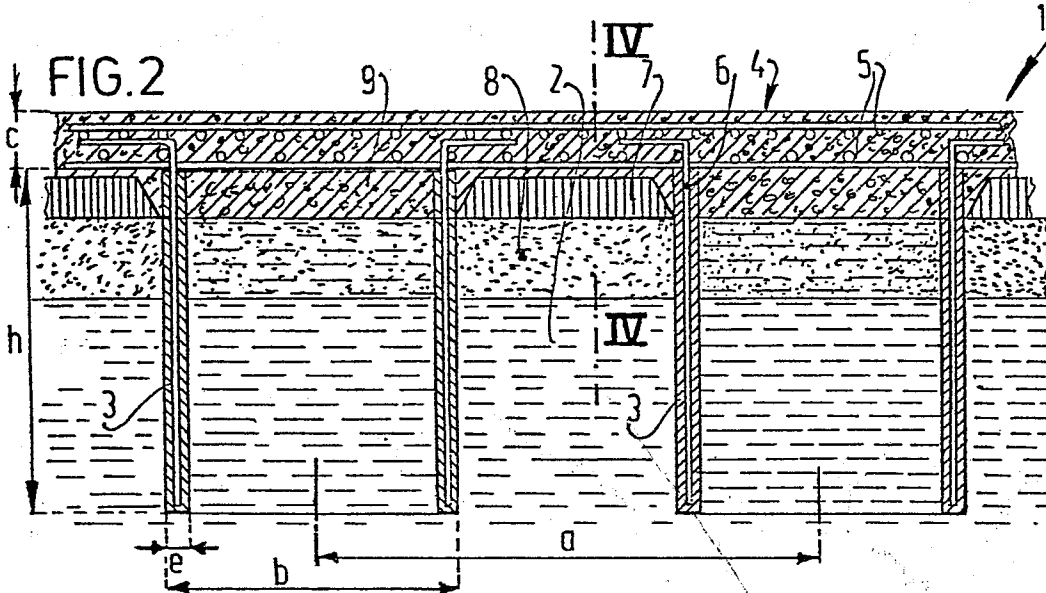
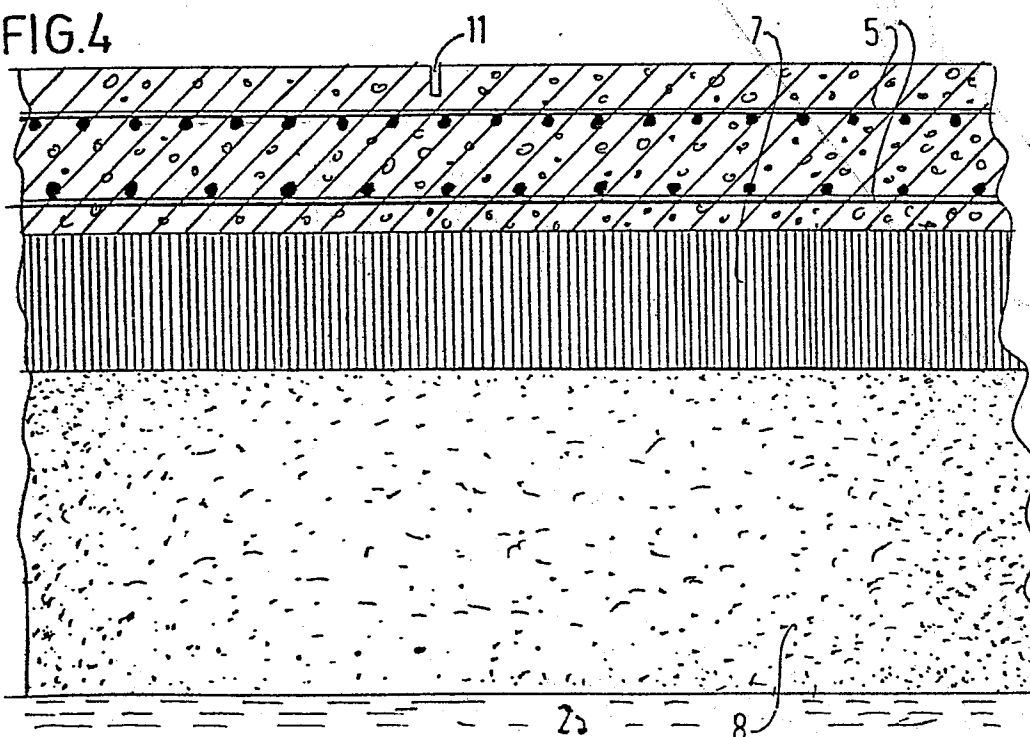


FIG.4



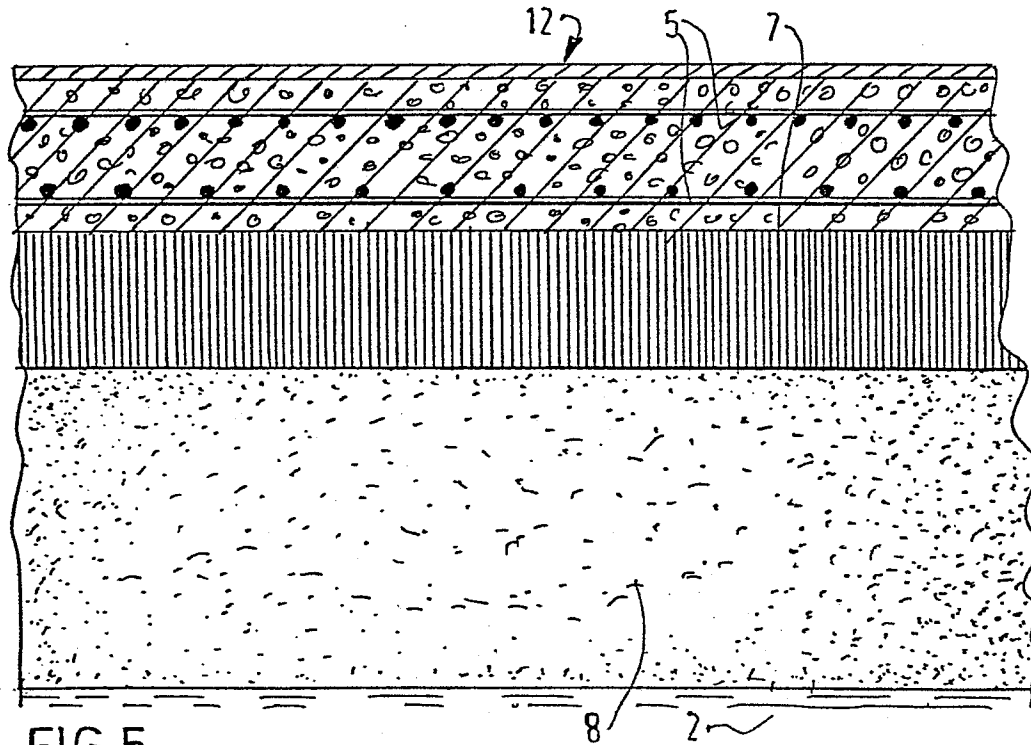
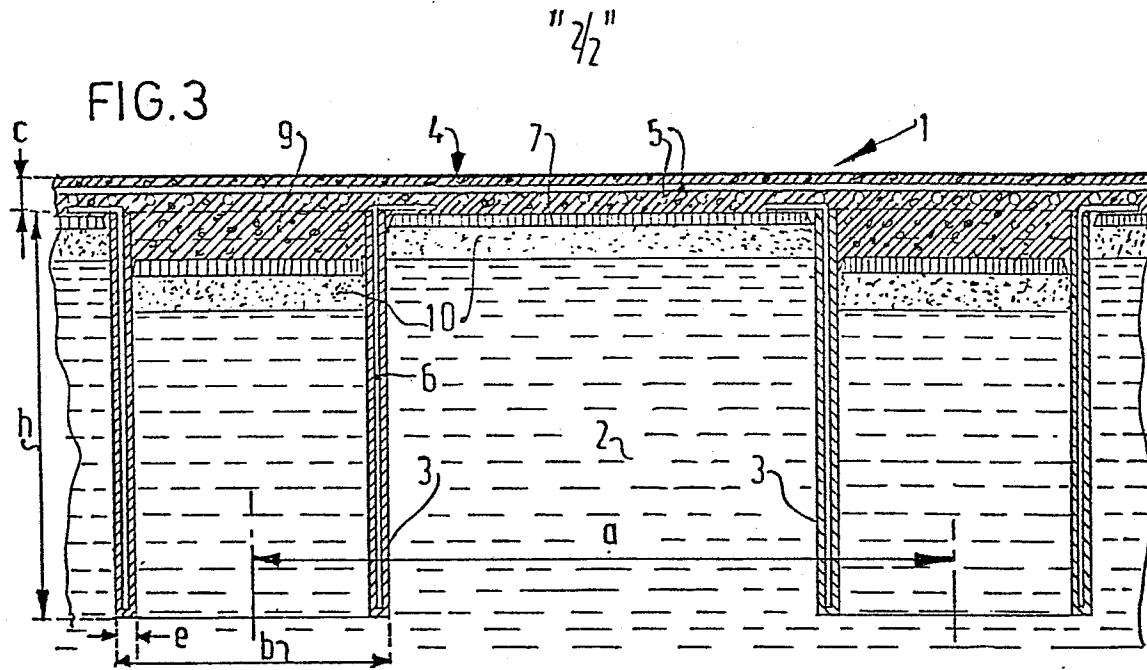
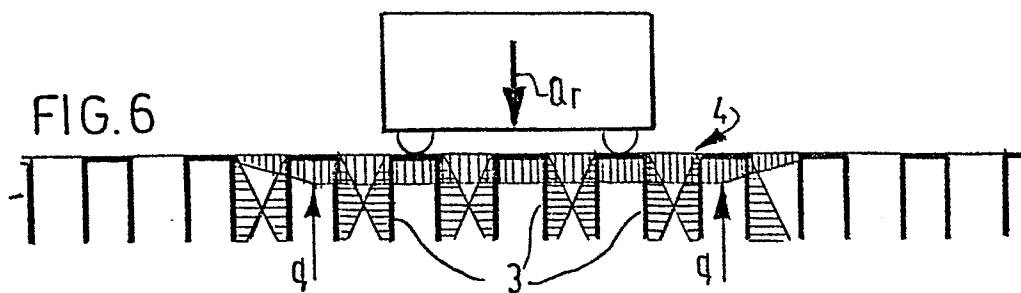


FIG. 5





European Patent  
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# EUROPEAN SEARCH REPORT

**0121003**

Application number

EP 83 20 0470

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. <sup>3</sup> )
X	BOUWKUNDE/WEGEN-EN WATERBOUW-POLYT. TIJDSCHRIFT vol. 35, no. 11, November 1980, Rijswijk R.M. SEDYATMO "Nieuwe bouwwijze voor buigstijve betonverhardingen", pages 683-678 * Pages 683-687 *	1, 3	E 01 C 7/14 E 01 C 3/00 E 02 D 27/02
A	DE-B-1 534 348 (N.V. INTRAPORT AMSTERDAM) * Column 1, line 20 - column 2, line 54 *	1	
A	DE-A-2 639 792 (P. ANDERSON INDUSTRIER AB) * Page 3 - page 6, paragraph 1 *	1	
A	GB-A-1 326 451 (STRABAG BAU-AG) * Claim 5 *	2	TECHNICAL FIELDS SEARCHED (Int. Cl. <sup>3</sup> )
A	US-A-1 570 794 (STUBBS) * Page 1, lines 10-99 *	3	E 01 C 3/00 E 01 C 7/00 E 01 C 9/00 E 02 D 27/00
The present search report has been drawn up for all claims			
Place of search BERLIN		Date of completion of the search 27-10-1983	Examiner PAETZEL H-J
<p><b>CATEGORY OF CITED DOCUMENTS</b></p> <p>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</p> <p>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 &amp; : member of the same patent family, corresponding document</p>			