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(54) Drainage unit

(57) A drainage unit (10) for use on a bridge or other elevated structure has upper apertures (16) for receiving surface water and lower apertures (15) for receiving subsurface water that has accumulated within the layers (6, 7A, 7B) making up the road. Surface water collected in the unit is prevented from entering the road through the lower apertures (15).

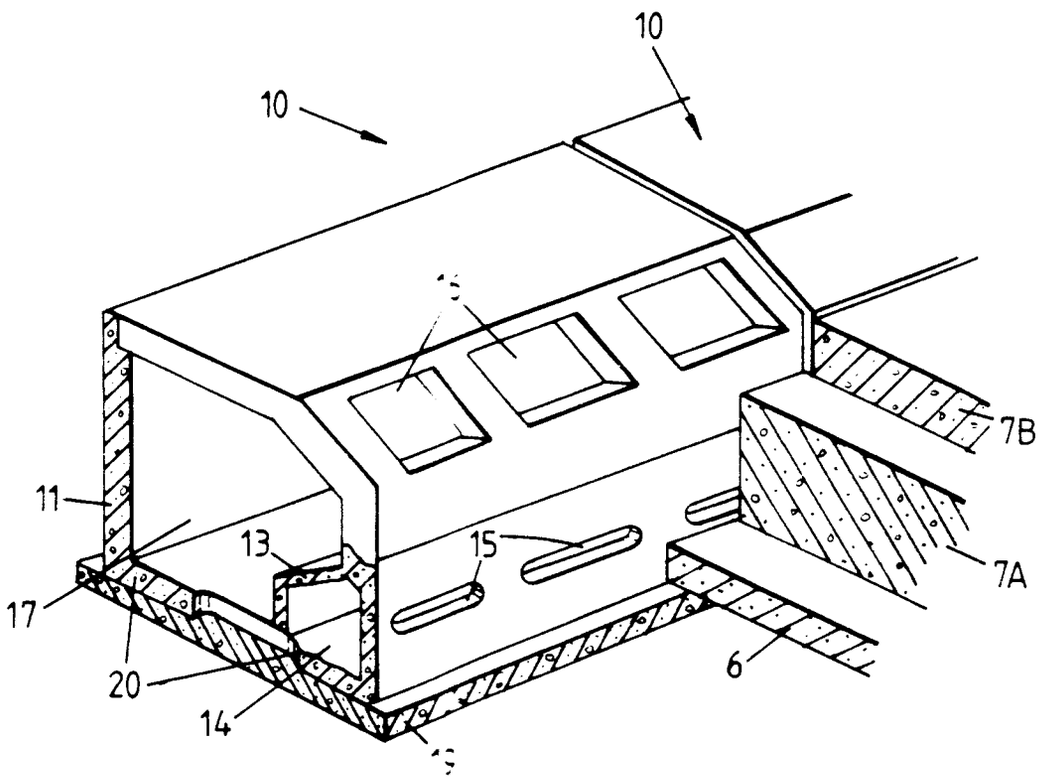

FIG. 4

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Description

This invention relates to a drainage unit suitable for use in an elevated structure such as a bridge or a multi-storey car park. Figure 1 shows a typical drainage unit 1. This is designed to be placed at the side of a road on a bridge so that the road surface at the edge of the road is level with the bottom edge of the holes 2. The camber of the road causes water to run off the road surface and pass into the drainage unit through the holes 2. The hole 3 in the end wall allows water to pass into an adjacent unit. Units are placed next to one another to produce a drain running the length of the bridge.

Figure 2 shows a cross-section through a typical bridge. A concrete deck 4 is covered with a waterproof membrane 5 and a layer of red sand asphalt 6 to protect the waterproof membrane. The road is surfaced with an asphalt base course 7A and an asphalt wearing course 7B. The asphalt layers will not be watertight, and some water will permeate through them. The red sand asphalt layer is less permeable to water than the other asphalt layers, and water will accumulate in the asphalt layers 7A, 7B. This water will hereinafter be referred to as "subsurface water".

If subsurface water continues to accumulate the asphalt layers will eventually become saturated; water will then appear on the road surface, causing a driving hazard. In winter, repeated freezing and thawing of the subsurface water will damage the road. Furthermore, when a vehicle passes along the road the weight of the wheel will cause a "pumping action" on the subsurface water in the road construction. A "bow wave" 8 is pushed through the asphalt layers 7A, 7B towards the side of the road. The water cannot enter the drainage unit 1, and it is deflected upwards by the drainage unit, as indicated by the arrows. This causes rapid deterioration of the road surface, as the water will tend to carry the binding particles contained in the asphalt upwards out of the asphalt layers and deposit them as silt 9 on the road surface. Such deposits of silt form another driving hazard.

It is possible to make some allowance for the relief of subsurface water by leaving small gaps beneath and/or between adjacent edge kerbs or drainage units to provide a drainage path. Although these gaps initially provide a drainage path they quickly silt up and block the passage of water.

Figure 3 shows a drainage unit 1' in which some holes 2' have a V-shaped lower edge. The unit is positioned so that the V-shaped portion of the holes are below the road surface, so subsurface water within the asphalt layers can pass through the holes into the drainage unit.

This drainage unit is not satisfactory. If the V-shape part of the holes is shallow it will not collect all the subsurface water from the asphalt layers. If the V-shaped part extends to the bottom of the drainage unit, however, it will then be possible for water to drain off the road surface, enter the drainage unit through the top part of the holes and pass back into the road through the lower part of the holes.

GB-A-2 257 734 discloses a subsurface bridge drain unit which has a perforated collection chamber. This is buried in the road, so that the perforations in the collection chamber are in the lower part of the asphalt base course 7A. The collection chamber has an outlet which passes through the bridge deck. Subsurface water enters the collection chamber and is drained away through the outlet.

This drainage unit will not drain surface water effectively, so it is therefore necessary to provide conventional drains as well as the subsurface drainage unit. Furthermore, each subsurface drainage unit requires a hole through the bridge deck which will weaken the bridge.

A first aspect of the invention provides a roadway comprising a substantially waterproof base, an asphalt base course and an asphalt wearing course, the asphalt courses being pervious to water, and a drainage unit at a side edge of the asphalt courses, the drainage unit having a side wall facing the asphalt courses and extending above the upper surface of the wearing course, first drainage apertures being provided in the side wall above the asphalt wearing course to receive surface water for passage into the drainage unit, and second drainage apertures being provided adjacent the asphalt base course for passage of sub-surface water into the drainage unit.

A second aspect of the present invention provides a drainage unit comprising at least one aperture for receiving surface water and at least one aperture for receiving subsurface water; wherein the aperture(s) for receiving surface water is/are not in direct fluid communication with the aperture(s) for receiving subsurface water.

This drainage unit is able to collect both surface water and subsurface water from a road. The surface water will pass through the upper aperture(s) into the drainage unit, and will be drained away. It will not pass back into the road construction layers. The subsurface water will pass through the lower aperture(s), and will be drained away.

In a preferred embodiment the two channels are defined within the drainage unit, one channel being in fluid communication with the aperture(s) for receiving surface water and the other channel being in fluid communication with the aperture(s) for receiving subsurface water, the two channels not being in direct fluid communication with one another.

Since the channel for surface water and the channel for sub-surface water do not communicate with one another, surface water cannot pass into the road construction.

Preferred embodiments of the present invention will now be described by way of example with reference to the accompanying Figures in which:

Figure 1 is a perspective view of a known drainage unit;

Figure 2 shows a cross-section of a road;

Figure 3 is a perspective view of another known drainage unit;

Figure 4 is a schematic view of a drainage unit according to one embodiment of the present invention;

Figure 5(a) shows components of another drainage unit of the present invention;

Figure 5(b) shows the drainage unit of Figure 5(a) in its assembled state;

Figure 5(c) shows components of another drainage unit of the present invention;

Figure 6 shows a further embodiment of the present invention;

Figure 7 is a cross-section of a further embodiment of the present invention;

Figure 8 is a cross-section of a further embodiment of the present invention;

Figure 9 is a perspective view of a further embodiment of the present invention; and

Figure 10 is a cross-section of the unit of Figure 9 when installed in a road.

Figure 4 shows a drainage unit 10. The unit is provided with a wall 13 which defines a closed channel 14. Subsurface water passes from the road through the lower apertures 15 into the channel 14, as a result either of natural drainage or of a "bow wave" caused by a vehicle. Surface water passes through upper apertures 16 into the interior 17 of the drainage unit. This drainage unit is able to drain both surface and subsurface water from the road. The surface water cannot enter the channel 14 and so is unable to pass back into the road construction layers.

For ease of construction, the unit is formed of a base 11 and a cover 12. Figure 5a shows an alternative embodiment of the invention, and shows the base 11' separated from the cover 12'. The cover is provided with prongs 22; when the cover is placed on the base an upper aperture is defined by a pair of adjacent prongs, as shown in Figure 5b. Figure 5(c) shows an alternative design for the cover 11' and base 12'.

The cover 12, 12' and the base 11, 11' can be made of any suitable material. In one embodiment the base is manufactured in ductile iron, which is chosen for its good finish and strength. The cover is made from a composite material, and this allows the cover to be produced in any desired colour. The cover is secured to the base by any suitable means.

Figure 6 shows an alternative base unit 11". The channel 14 is provided with a hatch 18 which can be removed to provide access to the channel. This allows the channel to be inspected or cleaned. The cover can also be provided with a removable hatch (not shown), to avoid the need to remove the whole cover to provide access to the base. In use, it would be advisable if inspection hatches were provided every 20m or so.

The drainage unit is installed on a bedding layer of mortar 19 which has a thickness of, for example, 5mm. The end face of the unit is coated with a sealant, and the unit is pushed firmly against the previous unit to make a watertight seal between the two units.

The base is provided with projections 20 at one end, and the other end is provided with complementary recesses. These projections and recesses provide interlocking between two adjacent units, which lessens the chance of a unit being displaced if it is struck by a vehicle.

Figure 7 shows a cross-section of an alternative embodiment of the present invention. The channel 14 is not closed, but is defined by a wall 20 and a ledge 21. The ledge 21 extends beyond the channel, so surface water entering the unit is directed into the interior of the unit and can not enter the channel (unless the depth of water in the interior exceeds the height of the wall 20). The ledge 21 is shown as being part of the base unit in Figure 7, but it could be part of the cover.

Another embodiment is illustrated in Figure 8. The wall 13' defining the channel for subsurface water is horizontal, so that the channel for subsurface water is below the channel for surface water. This embodiment could also be realised by constructing a drainage channel for subsurface water and placing conventional drainage units (as shown in Figure 1, for example) over the channel for subsurface water to form the drainage channel for surface water.

It is not necessary for every drainage unit to have apertures for receiving both surface and subsurface water. For example, it would be possible to manufacture two different drainage units, one having only apertures for receiving surface water and the other having only apertures for receiving subsurface water. The drain would be formed from a combination of both units - for example, with the two units alternating with one another.

A further embodiment of the present invention is illustrated in Figure 9. This unit again has a channel 14, and has lower apertures 15 through which surface water can enter the channel. The unit is also provided with upper apertures 16 for receiving surface water.

The drainage unit of Figure 9 is intended for use on roads for which porous asphalt is specified as the wearing surface 7B. Porous asphalt is used to reduce surface water spray, by allowing water to percolate into the top 50mm of the road construction. Conventional drainage units as in Figure 1 cannot drain this water from the top 50mm of the road construction.

The drainage unit shown in Figure 9 is provided with intermediate apertures 23, provided at a height that is intermediate between the lower and upper apertures. When the drainage unit is installed, the intermediate apertures will be at the same level as the wearing surface 7B of the road construction. Water that has percolated into a porous asphalt wearing surface will drain away through the intermediate apertures into the drainage

unit.

As with the other drainage units of this invention the unit has a base 11a and a cover 12a. The base and cover can be made of any suitable material - for example, the base unit could be made of cast iron or ductile iron, and the cover can be made from a composite material. The intermediate apertures 23 connect with the main interior drainage channel 17. The apertures 23 are made as large as possible commensurate with retaining the structural integrity of the drainage unit 11a, in particular its resistance to impact by vehicles. The front edges 25 of the central bars 24 are pointed and the side walls 26 of the apertures chamfred to reduce resistance to the flow of water.

Claims

1. A roadway comprising a substantially waterproof base, an asphalt base course and an asphalt wearing course, the asphalt courses being pervious to water, and a drainage unit at a side edge of the asphalt courses, the drainage unit having a side wall facing the asphalt courses and extending above the upper surface of the wearing course, first drainage apertures being provided in the side wall above the asphalt wearing course to receive surface water for passage into the drainage unit, and second drainage apertures being provided adjacent the asphalt base course for passage of sub-surface water into the drainage unit.

2. A roadway as claimed in claim 1, wherein the first and second apertures connect with respective first and second drainage channels in the drainage unit, the two channels not being in direct fluid communication with one another.

3. A roadway as claimed in claim 1 or 2, wherein third apertures are provided adjacent the asphalt wearing course.

4. A drainage unit comprising a first aperture for receiving surface water and a second aperture for receiving subsurface water, wherein the first aperture is not in direct fluid communication with the second aperture.

5. A drainage unit as claimed in claim 4, wherein two channels are defined within the drainage unit, one channel being in fluid communication with the first aperture and the other channel being in fluid communication with the second aperture, the two channels not being in direct fluid communication with one another.

6. A drainage unit as claimed in claim 4 or 5, and further comprising interlocking means for engaging with complementary interlocking means on an adjacent drainage unit.

7. A drainage unit as claimed in claim 4, 5 or 6 and further comprising a third aperture, the third aperture being at a height intermediate the height of the first and second apertures.

8. A drainage unit as claimed in claim 7, wherein the third aperture is in fluid communication with the first aperture.

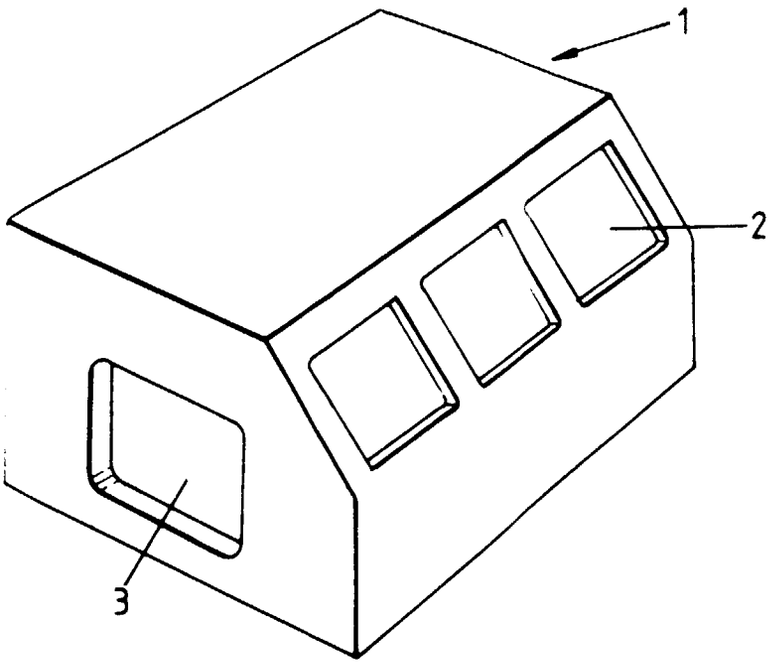

FIG . 1

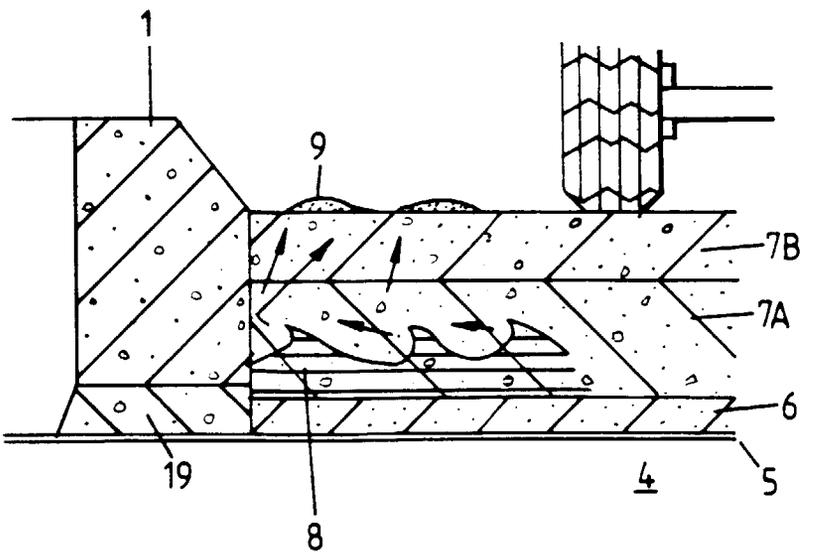

FIG . 2

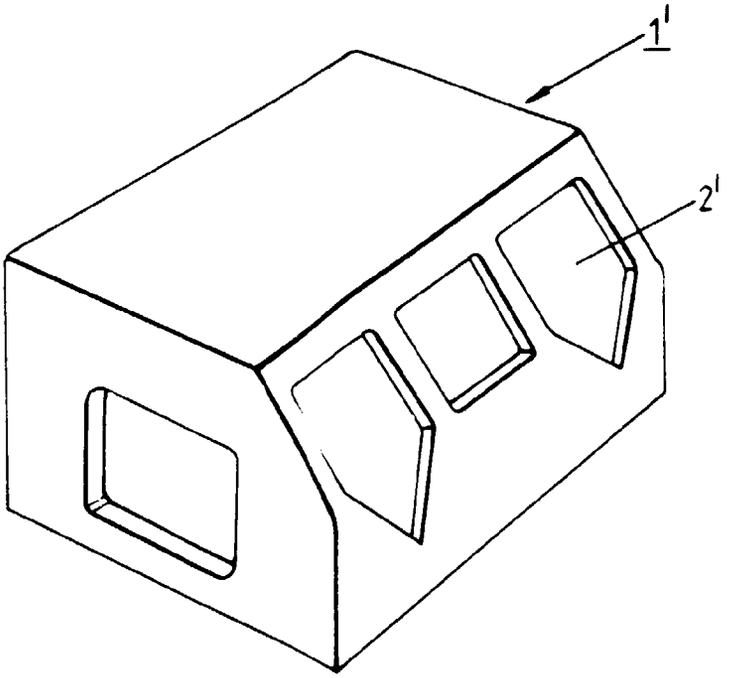

FIG . 3

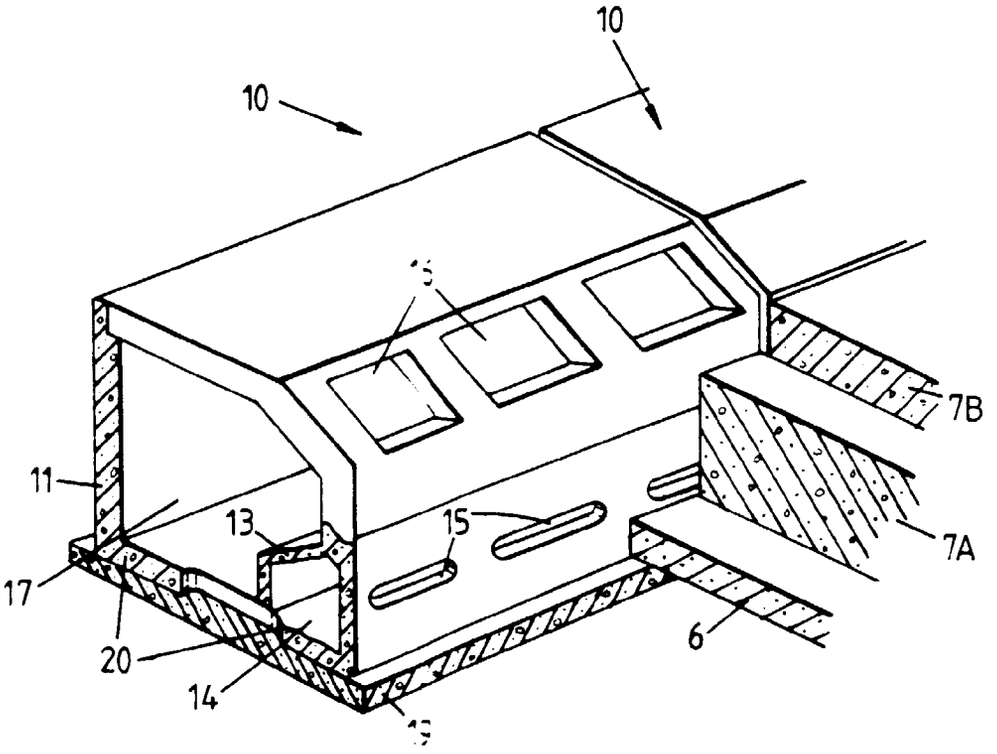

FIG . 4

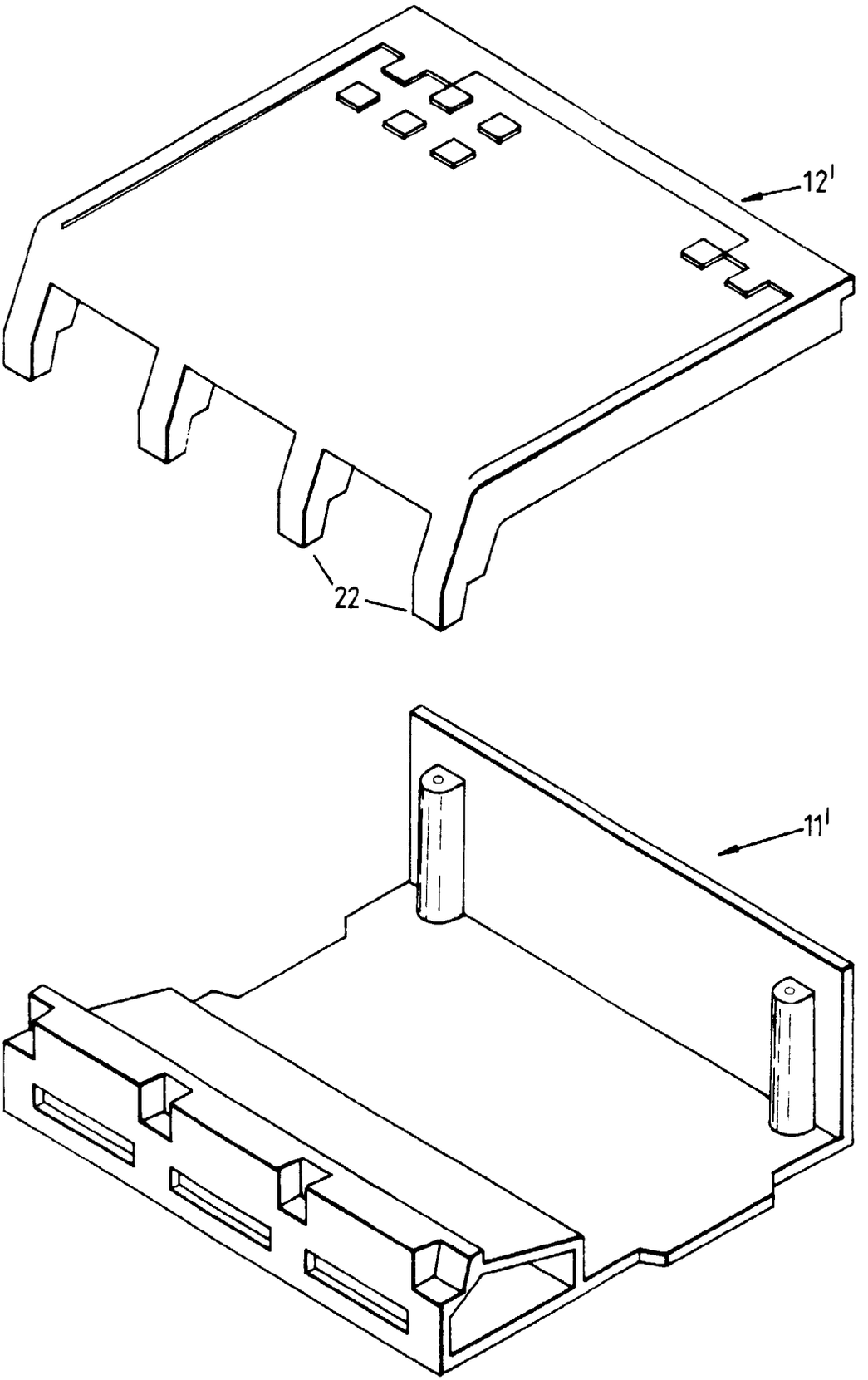

FIG .5a

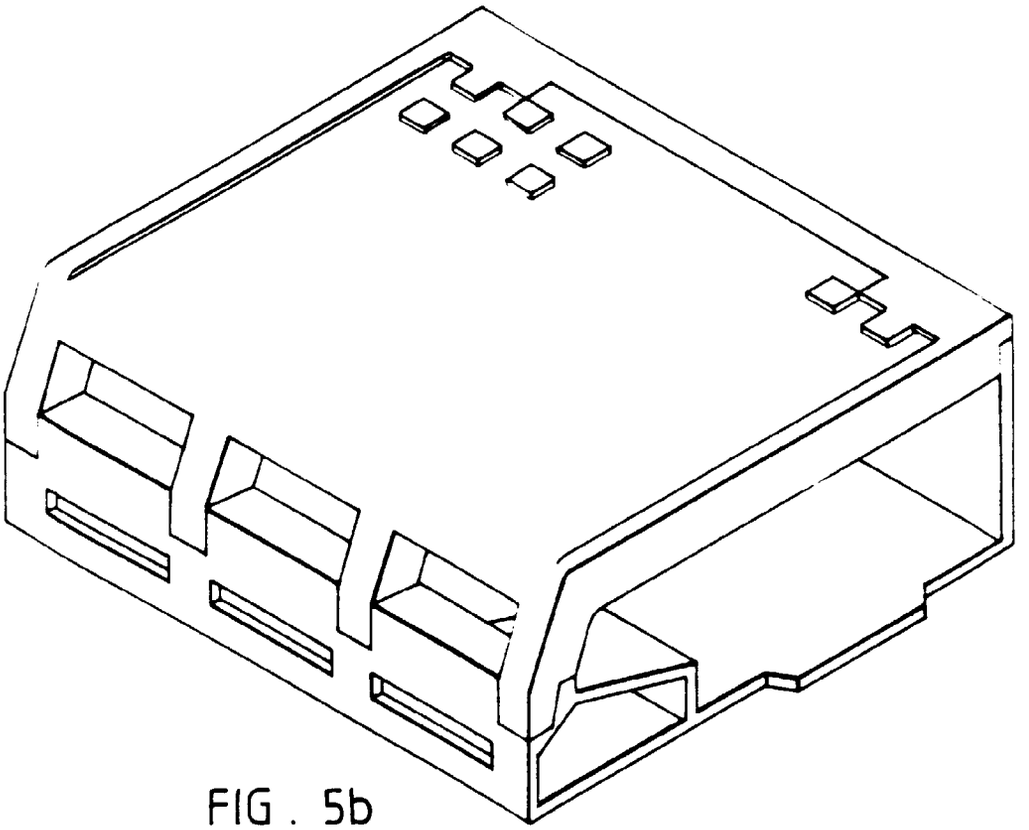

FIG . 5b

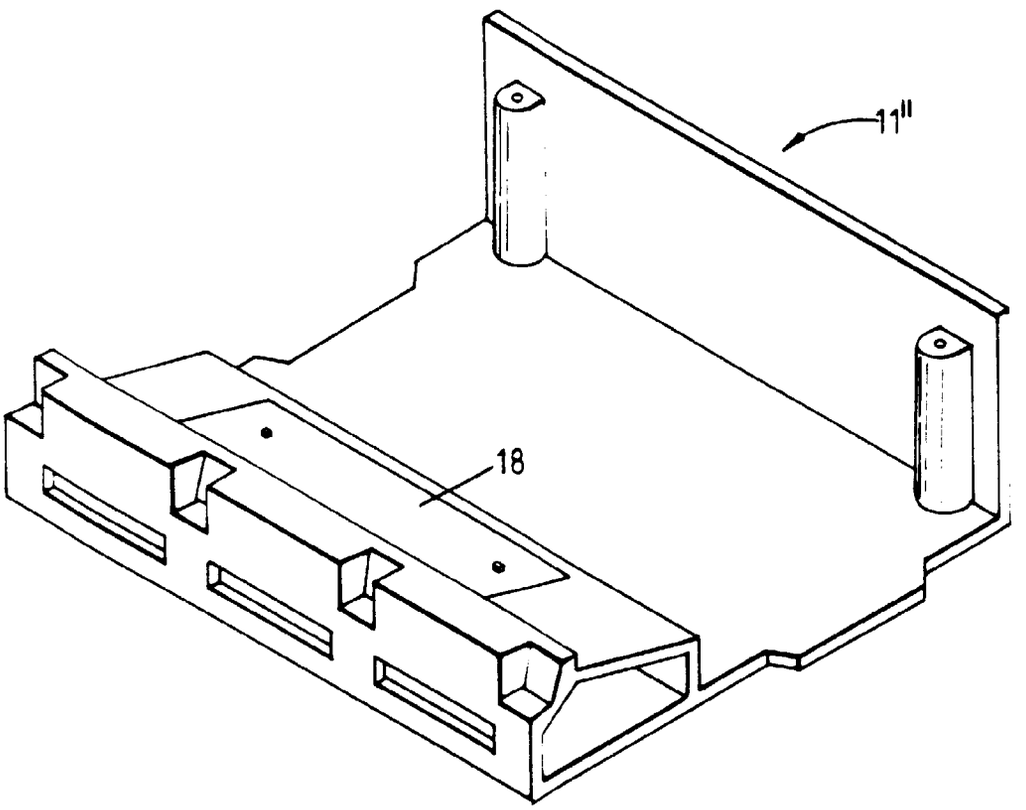

FIG . 6

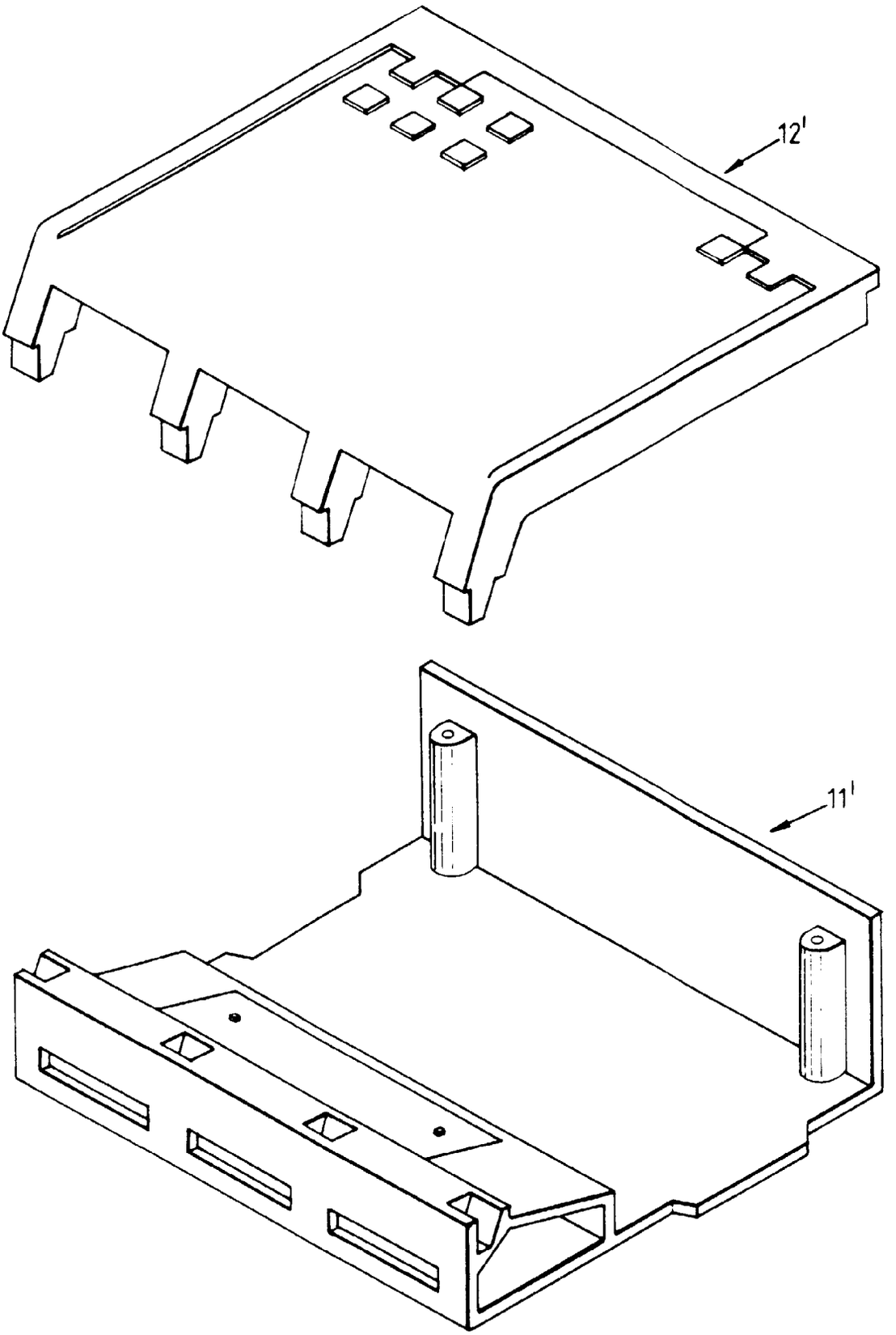

FIG. 5c

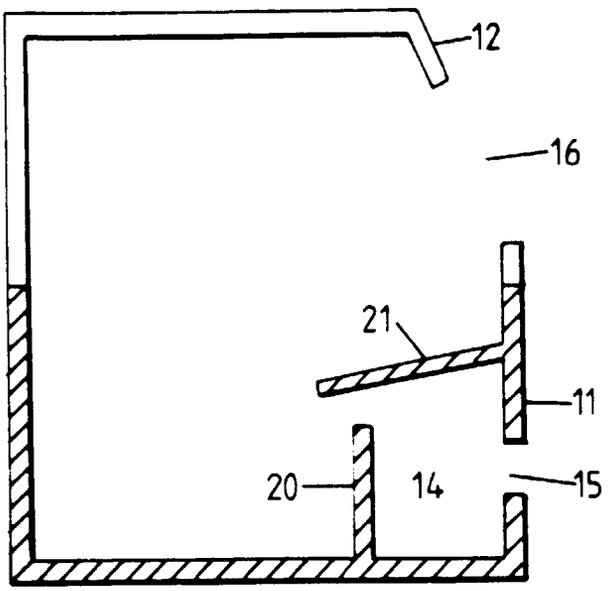

FIG. 7

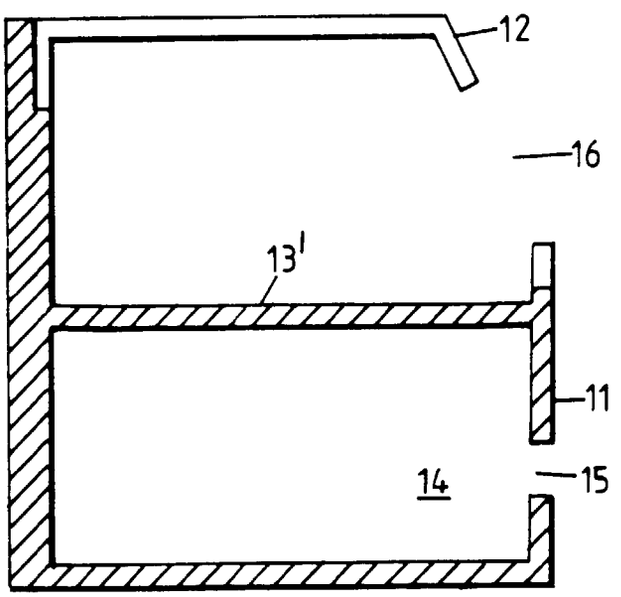

FIG. 8

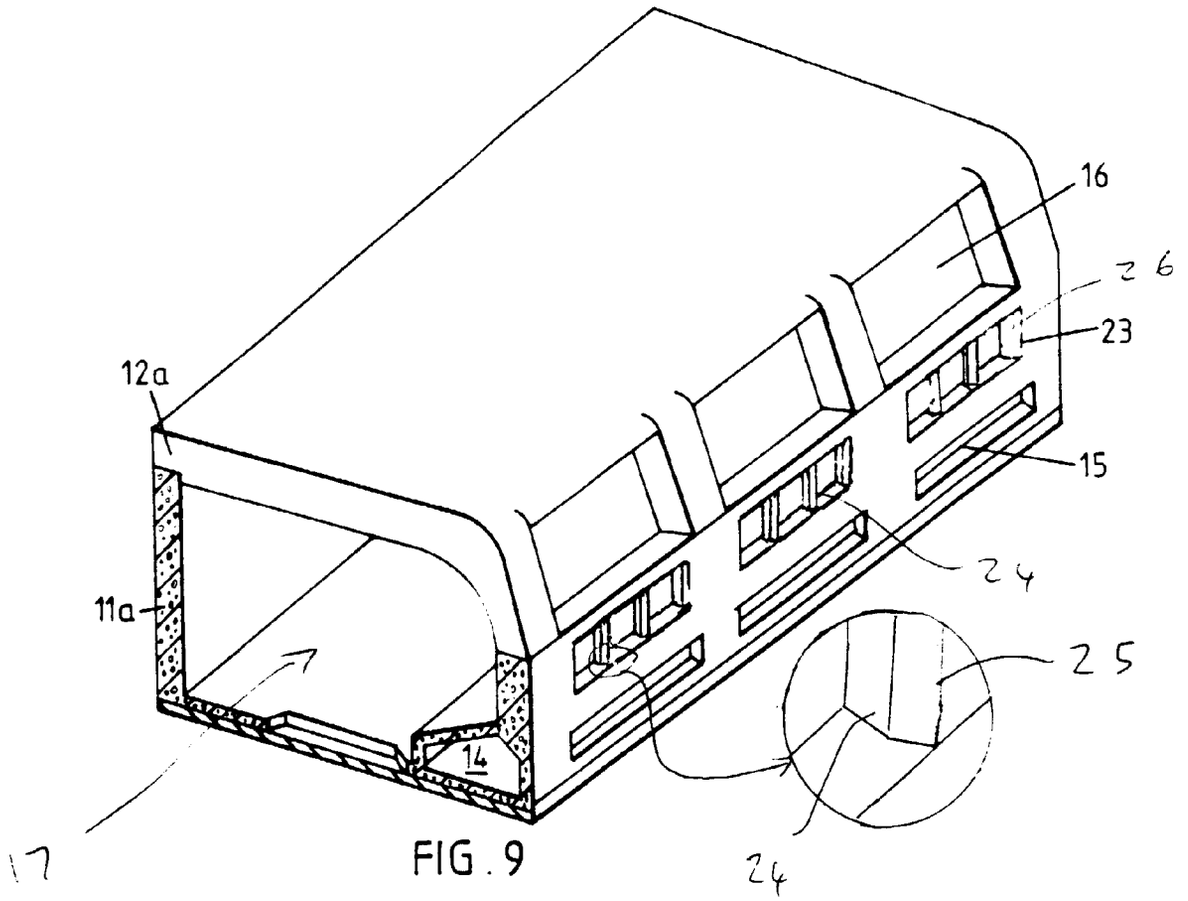

FIG. 9

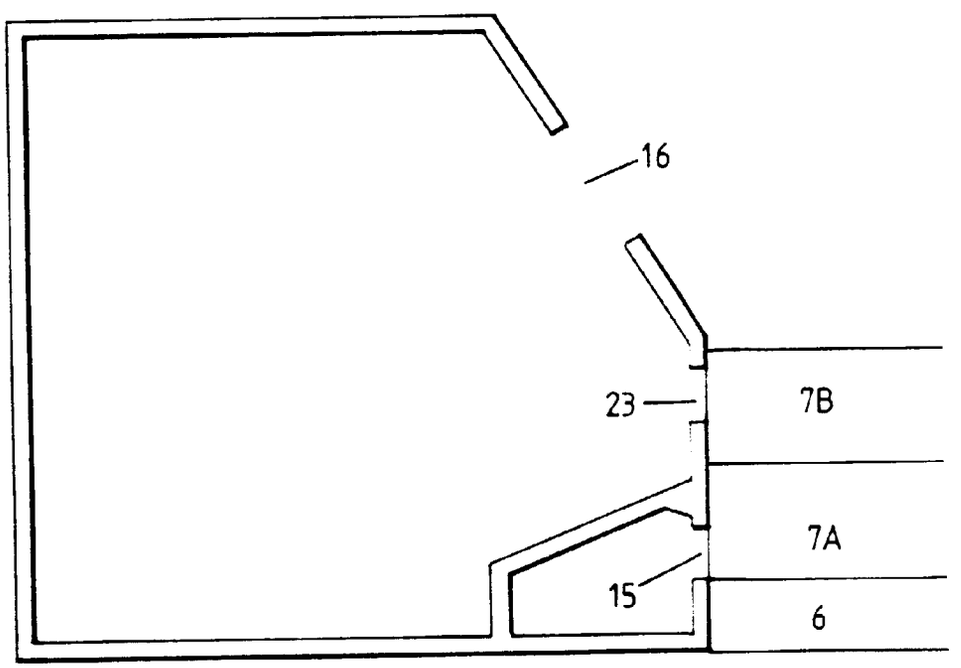

FIG. 10

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 96 30 6649

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.6)
A	NL-A-9 101 642 (STRUYK) 16 April 1993 * the whole document * ---	1,4	E01C11/22 E01D19/08
A	EP-A-0 469 265 (ACO) 5 February 1992 * the whole document * ---	1,4	
P,X	GB-A-2 289 079 (ECC CONSTRUCTION MATERIALS ;CAMAS UK LIMITED (GB)) 8 November 1995 * the whole document * -----	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

E01C
E01D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	9 December 1996	Dijkstra, G

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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