United States Patent [19]

Bolli

[11] **3,891,340**

[45] **June 24, 1975**

[54] **PAVING STONE UNIT HAVING INTEGRAL CONNECTING WEBS**

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[22] Filed: **Feb. 15, 1974**

[21] Appl. No.: **443,093**

[52] **U.S. Cl.** **404/38;** 404/34

[51] **Int. Cl.** **E01c 5/00**

[58] **Field of Search** 404/34, 37, 38, 72, 93; 52/596, 384

[56] **References Cited**

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[57] **ABSTRACT**

A concrete paving stone unit formed of a number of individual spaced paving stones connected together by integral thin webs. The webs constitute predetermined breaking points in the unit, so that when the unit is laid in sand and vibrated, some of the webs can break to allow the individual stones to bed firmly in the sand. If the ground shifts at a later date, other webs may break to allow the stones to conform to the new ground contour.

6 Claims, 6 Drawing Figures

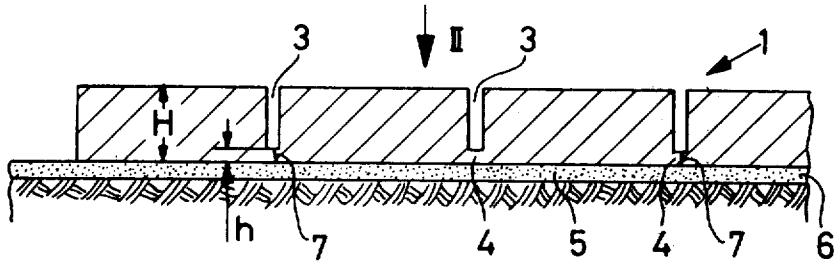
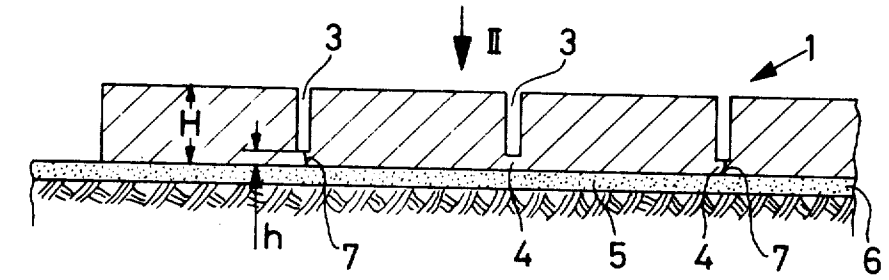


Fig. 1



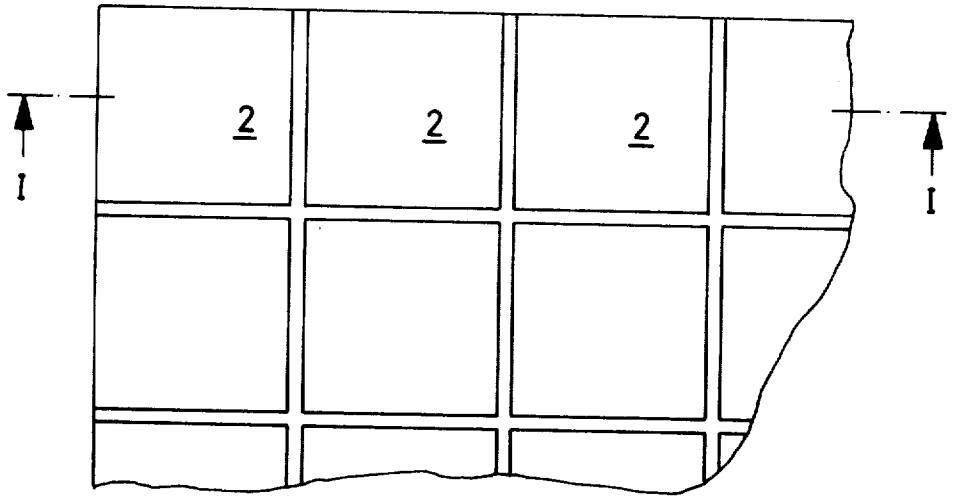


Fig. 2

Fig. 4

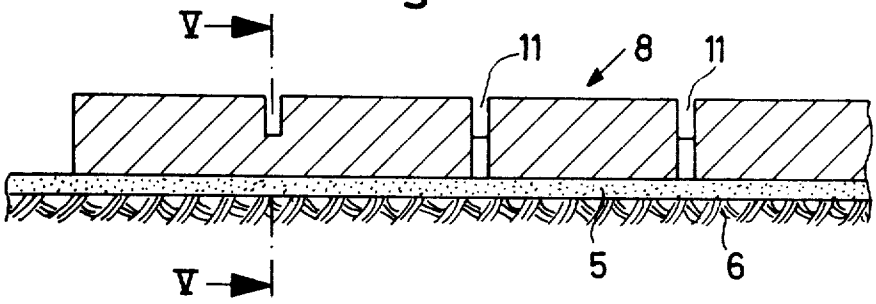


Fig. 6

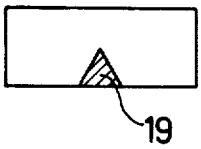


Fig. 5

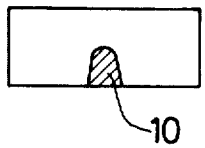
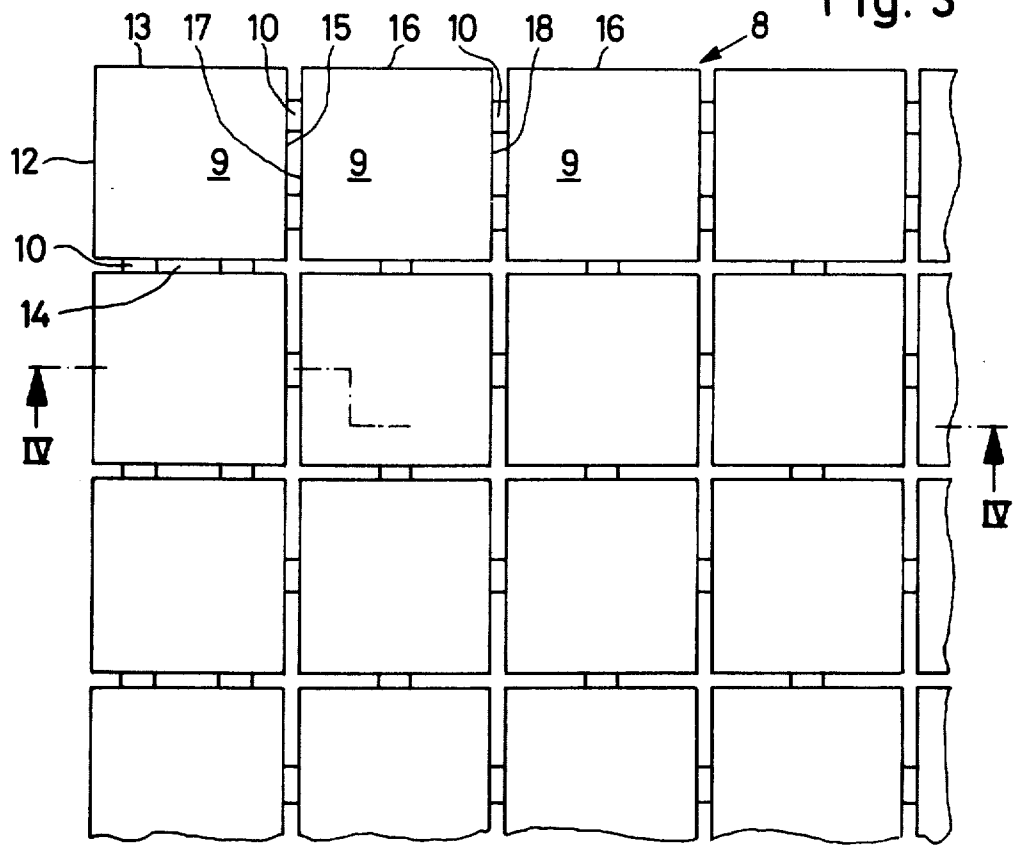


Fig. 3



PAVING STONE UNIT HAVING INTEGRAL CONNECTING WEBS

This invention relates to a paving stone unit. More particularly it relates to a paving stone unit in which a number of stones are joined together in accordance with a predetermined pattern. The stones may be made of any desired mouldable compound, for example, concrete, ceramic, or plastic, the usual and preferred material being concrete.

The laying of individual paving stones, with equally spaced joints between them, requires some experience and skill and takes a considerable amount of time, especially when the stones are of small dimensions. It is not always possible to save labour in laying the stones by using very large stones, since large stones do not always rest with their entire surfaces on the ground and they may therefore subsequently break when loaded. The laying of large slabs therefore requires careful preparation of the sub-soil, and in fact such slabs are usually laid in mortar on a cement foundation.

Covering an area with large slabs also has the disadvantage that there are fewer joints through which rain water can drain away. In many cases, therefore, it is desirable to use small stones for the purpose.

In order to save labour when small stones are used, it is known to glue the individual stones, spaced correctly apart, to a carrier foil, thus providing a unit that can be laid on the ground by mechanical means. After the stones have been laid, the carrier foil must be removed. This foil must naturally be relatively strong and there are considerable quantities of it. Disposing of it therefore raises a problem.

It is the object of this invention to provide a paving stone unit such that the desired arrangement of the stones is achieved without the use of carriers, for instance adhesive foils, requiring subsequent removal. This object is achieved according to the invention by forging the paving stone unit in one piece, the unit having a number of individual paving stones spaced apart and joing by integral webs which constitute predetermined breaking points in the unit.

Since they are relatively heavy, units of this kind are normally laid on the ground by means of mechanical aids, for instance a laying vehicle with a hoisting device. In this way, a large number of individual stones are laid on the ground in exactly correct relative positions to each other. The pavement thus produced may subsequently be vibrated, to ensure that the stones rest evenly on the bed of sand on which the unit has been placed. This vibration will cause some of the webs to break, especially if the sub-soil is not completely homogeneous and flat. Thus the fact that the unit is in one piece does not prevent individual stones from resting properly on the sub-soil. Since no carrier foil is used, there is no disposal problem. The joints between individual stones are filled with sand.

The webs may be of any desired design. They are preferably located in the lower part of each joint, so that after the joint has been filled with sand, they are no longer visible. However, the said webs may be arranged at any desired height.

The webs may extend over the whole entire length of the joints. If they are arranged at the bottom of the channels, the unit consists, as it were, of a relatively thin, coherent sheet resting on the ground, from which the individual stones project.

Also satisfactory is an arrangement in which webs are provided only at selected locations. This arrangement has the advantage of allowing rain water to drain away into the sub-soil between the stones.

It is desirable for corner and/or edge stones in the unit to have more webs, or webs of larger cross section, at least along some of the sides constituting the walls of the joints, than the other stones, since such edge or corner stones have some free edges which are not joined to adjacent stones, so that without these additional, or larger webs, the cross section of the joints with adjacent stones would be smaller than in stones located in the interior of the unit. Webs located at selected locations only may have a cross section tapering upwardly, e.g. a triangular or trapezoidal cross section. An upward taper has the advantage that the webs are easy to remove from the mould.

The stones may be of any desired shape. They may also be so-called interlocking stones engaging positively with each other. This ensures that the said stones hold together well, even after fracture at the predetermined breaking points.

The unit may be of any desired outline, but is preferably rectangular or square, a suitable dimension being 1.00 m × 1.20 m, for example.

Typical embodiments of the invention are illustrated in the drawings, wherein:

FIG. 1 is a vertical section through a paving stone unit according to the invention, along the line I—I in FIG. 2;

FIG. 2 is a plan view of the unit, in the direction of arrow II in FIG. 1;

FIG. 3 is a plan view of a unit according to another form of execution of the invention, in which connecting webs are provided only at selected locations;

FIG. 4 is a section along the line IV—IV in FIG. 3;

FIG. 5 is a part-section along the line V—V in FIG. 4; and

FIG. 6 is a section corresponding to that in FIG. 5, in another form of execution of the invention.

The paving stone unit shown in FIGS. 1 and 2 has individual stones 2 of square shape separated from each other by spaces 3. Located at the bottoms of the spaces 3 are connecting webs 4 which extend over the entire length of the spaces 3. The height *h* of these webs is slight in relation to the overall height H of the unit (typically less than one-quarter of the height H). Up to the level of H, the unit consists of a coherent sheet carrying projections constituting the main mass of the individual stones.

Before the unit is laid, it is a coherent whole, and individual stones 2 are therefore located exactly in their correct positions in relation to each other. After the unit has been laid upon a bed of sand 5 arranged on sub-soil 6, a conventional vibrator is applied in known fashion to the unit, causing some of webs 4 to break. Two such fracture points are indicated at 7 in FIG. 1.

These breaks allow the unit to adapt to the ground, thus ensuring that each individual stone rests snugly upon the sub-soil. When, in the course of time, the subsoil settles, the formation of cavities under individual stones still connected together is prevented in that, when the stones are loaded, other predetermined breaking points fracture, thus allowing the stones to adapt to the ground as it settles.

In the embodiment shown in FIGS. 3 to 5, the unit as a whole is marked 8. Here again, square stones 9 are

shown for the sake of simplicity although, as already indicated, stones of any desired shape, even interlocking stones, may be used. In this case stones **9** are connected together, not by means of continuous webs, but with relatively narrow webs **10** arranged at selected locations in the spaces which are marked **11** in FIGS. **3** to **5.**

As shown in FIG. **3,** each stone located in the interior of the unit has a web **10** on each of its sides, each interior stone **9** being therefore connected to adjacent stones with four webs.

Since the corner stones have free sides **12, 13,** if their remaining sides **14, 15** were provided with only one web each, the overall connecting cross section to adjacent stones would be only half as large as in the case of stones in the interior of the unit. Sides **14, 15** are therefore provided with two webs **10** each. Edge stones, not arranged at corners, also have free sides **16** unsupported by any webs. In order to compensate for this, sides **17, 18** also have two webs each. (Similarly, in the FIGS. **1** and **2** embodiment, the webs **4** connecting corner or edge stones to adjacent stones may be thicker than the webs connecting interior stones to adjacent stones).

The cross section of webs **10** may be seen in FIG. **5,** the said webs tapering upwardly and being rounded off at the top, a shape which makes the webs easy to remove from the mould during manufacture. FIG. **6** shows another shape of web **19,** which is triangular and also tapers upwardly. It will be appreciated that the cross-sections are taken transverse to the direction of their webs as they extend between the stones which they connect.

Unit **8** is also laid as a whole, like unit **1** in FIGS. **1** and **2,** namely on a bed of sand **5** arranged on sub-soil **6.** Here again, individual connecting webs break when the stones are vibrated.

The specific dimensions of the web **4, 10** will depend on the size and weight of the individual paving stones which they connect, and on the number of such stones. Typically the paving stone units according to the invention will range between 0.3 and 1.5 meters in length and in width and will contain between 6 and 40 joined stones. The individual joined stones are typically of the following dimensions:

length -	8 – 25 cm.
width -	8 – 25 cm.
thickness -	4 – 12 cm.
weight -	4 – 12 pounds.

Spacing between the stones, (i.e., the width of spaces **3, 11**) is typically between 0.3 and 2.0 cm.

The webs **4, 10** are proportioned so that the paving stone unit can be picked up by two of its edges for laying, and handled, without the webs breaking, but so that the webs will break well before the stones themselves fracture. Normally the unit will be made of concrete, and the higher strength the concrete, the smaller need be the web. When the unit is installed, a conventional vibrator is used, but it is not necessary at this time that every web need break. Some or all of the webs may break years after installation if the ground moves at that time sufficiently to move support for the individual stones of the unit.

What I claim is:

1. A paving stone unit comprising a plurality of individual concrete paving stones spaced apart from each other in a predetermined pattern, said stones all being of substantially uniform thickness, and a plurality of webs joining said stones together, said webs also being of concrete and being integral with said stones and being of thickness not greater than one quarter of the thickness of said stones the distance by which each stone is spaced from adjacent stones being small relative to the lateral dimensions of said stones, whereby when individual stones in said unit are supported only by said webs and are subjected to normal traffic, the webs connecting such stones to the remainder of said unit will fracture while leaving all said stones intact.

2. A paving stone unit according to claim **1** wherein said webs are located substantially at the bottoms of said stones.

3. A paving stone unit according to claim **1** and being of a length of between 0.3 and 1.5 meters and of width between 0.3 and 1.5 meters, said stones being between 6 and 40 in number.

4. A paving stone unit according to claim **3** wherein the spaces between said stones are between 0.3 and 2.0 cm. in width.

5. A paving stone unit according to claim **4** wherein each said stone is quadrilateral in outline, said unit having exterior stones along its edges and interior stones, each interior stone being connected to each adjacent interior stone by one said web at each of its sides.

6. A paving stone unit comprising a plurality of individual concrete paving stones spaced apart from each other in a predetermined pattern, and a plurality of webs joining said stones together, said webs also being of concrete and being integral with said stones and being of substantially less thickness than that of said stones whereby said webs constitute predetermined breaking points in said unit, said webs being located at selected locations in said spaces between said stones, said unit having exterior stones along its edges and interior stones, the total cross-sectional area of the webs joining each exterior stone to its adjacent stones being at least as great as the total cross-sectional area of the webs joining each interior stone to its adjacent stones.

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