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(71) Applicant: **M.J. Highway Technology Limited**
Heathfield, East Sussex TN21 0SR (GB)

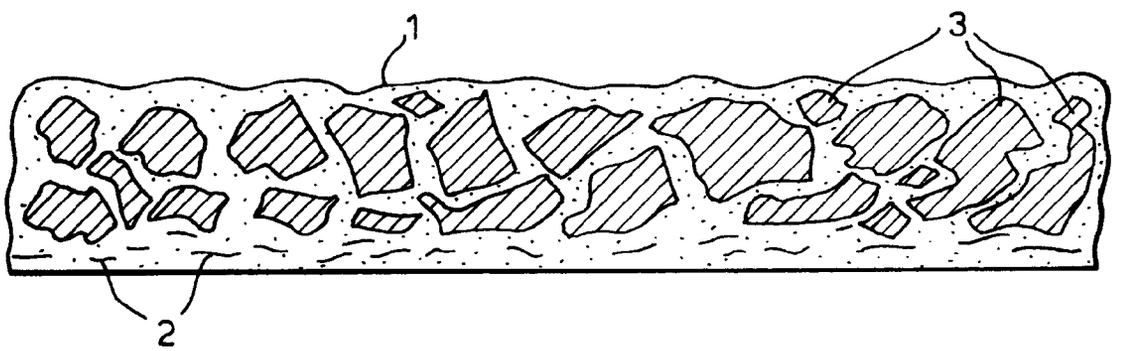
(72) Inventors:
- **McIntosh, James**
  Uckfield, East Sussex, TN22 5RB (GB)
- **Jenkins, Edward John**
  Tunbridge Wells, Kent, TW4 9AJ (GB)

(74) Representative: **Barlow, Roy James**
J.A. KEMP & CO.
14, South Square
Gray's Inn
London WC1R 5LX (GB)

(54) Paving material in sheet form

(57) A paving sheet is formed of a non-opaque, preferably transparent, thermoplastic resin layer 1, optionally reinforced with chopped glass fibres 2 near one surface and having applied thereto a stone effect in the form of stone chippings 3.

Such a sheet can be applied to a substrate, by being heat-softened, for example using a blow torch, and then smoothed on the substrate.



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Description

The present invention relates to a pre-formed sheet which can be used to provide a paving effect on a substrate, for example concrete.

In the past it has been known to provide roofing felt material of bitumen, and to lay such a material on a roof surface using a blow torch to soften the bitumen for adhesion purposes. The bitumen may be modified by use of additives such as Styrene-Butadiene-Styrene rubber.

In accordance with one aspect of the present invention we provide a paving sheet comprising a sheet of non-opaque thermoplastic resin having a stone effect applied to the resin. The stone creates the appearance of cast ***in situ*** paving.

By non-opaque resin we mean a resin, which in the sheet form may be translucent or completely or mainly transparent, so as to allow the stone chippings in the sheet to be visible through the resin sheet.

In this way it is possible to achieve the appearance of a paving surface, for example a gravel surface, by applying stone, in this case in the form of stone chippings, to the surface which will be exposed when the sheet material is applied to a substrate.

The sheet may include fibre reinforcement preferably on one side of the sheet with the stone embedded mainly on the other side of the sheet. More preferably the reinforcing fibres are heat-resistant fibres, in particular glass fibres, permitting the pre-formed sheet to be rendered adhesive by the application of heat, for example with a blow torch, without destroying the integrity of the fibres.

In one preferred form of the invention, a plurality of such sheets of a suitable shape, in the manner of carpet tiles, can be pre-formed and then applied to the substrate with the application of heat, so as to lie side-by-side and to form a virtually continuous stone-effect surface. Preferably the sheets may be laid so as to interlock with one another, e.g. as in the case of a brick wall.

Advantageously the stone may be applied in various different colours so as to permit different colours of paving to be provided. It is also within the scope of the invention to provide a single sheet of the paving surface with areas of different colours.

Another aspect of the present invention provides a method of laying a stone effect surface on a substrate, comprising taking a pre-formed paving sheet of non-opaque thermoplastic resin with a stone effect, laying the sheet on the substrate to be covered, applying heat to the exposed surface of the sheet to soften the resin, and smoothing the resin sheet on to the substrate. If desired a primer may first be applied to the substrate.

This is different from the conventional process in which the substrate, for example concrete, optionally first of all primed with a suitable primer, has bitumen sprayed on to it (without the use of reinforcing fibres) and finally has the stone applied in the form of chips while the bitumen is still soft, so that rolling the stone on to the bitumen will then securely attach it to the substrate.

A further aspect of the invention provides a method of pre-forming a stone effect paving sheet comprising mixing a hot thermoplastic resin which, on cooling, will set to form a non-opaque sheet; pouring the hot resin into a mould with aggregate to be attached to the resin to define a stone effect; allowing the resin to set in the mould with the aggregate; and removing the resulting stone effect sheet from the mould.

In order that the present invention may more readily be understood the following description is given, merely by way of example, with reference to the accompanying drawing in which the sole Figure illustrates a cross-section through a paving sheet material in accordance with the present invention.

In the drawing, a substrate 1 of non-opaque thermoplastic resin is optionally reinforced by a plurality of, preferably heat-resistant, fibres, e.g. glass fibres 2, embedded therein, in this case at its undersurface. The upper surface of the resin sheet includes stone chippings 3 embedded therein so as to provide an uneven upper surface which has the appearance of a stone chipping paving surface. Preferably the resin is transparent, and more preferably the stone chippings are covered by the resin so as to be totally embedded in the sheet.

The optional reinforcing fibres 2 may be of any suitable length for example from 10 mm to 50 mm, but fibres in the range of from 20 to 30 mm in length are preferred. The fibres are formed by chopping from continuous glass fibre or polyamide fibre strand and thus the staple length is readily able to be selected. If desired, the fibres may be placed in a mould before the hot resin is poured into the mould.

The resin layer 1 is preferably of a material which enhances the adhesion of the sheet to a concrete substrate. One preferred form of the non-opaque resin constitutes a mixture of mainly a hydrocarbon resin and an ethylene vinyl acetate, with oil. As a fraction of the resin, approximately half of the mixture may be the hydrocarbon resin, approximately a third may be the ethylene vinyl acetate, and the remainder would be the oil. By weight, such a resin may be loaded with from 6 to 8 parts, preferably approximately 7 parts, aggregate to 1 part resin.

In one particular example the resin may comprise:-

45 to 55 weight %, preferably 47 to 50%, of a hydrocarbon resin in the form of flakes or prills,
30 to 40 weight %, preferably 32 to 36% of ethylene vinyl acetate in the form of pellets,
an optional additive of Styrene-Isoprene-Styrene rubber resin in pellet in proportions of from 5 to 10% of the total weight of the resin, and
the remainder composed of an oil which improves flexibility of the binder.

The components are mixed hot, at a temperature in

the range of from 100 to 200°C (preferably 180°C), and agitated to ensure thorough mixing.

Preferably the stone effect in the form of aggregate is added to the hot resin mix in a ratio of 7 parts aggregate to 1 part by weight of the resin, and the hot aggregate/resin mix poured into a mould and allowed to set upon cooling. Optionally the mould has been lined with a layer of fibres, preferably chopped glass fibres, to provide reinforcement. However, the resulting sheet has been found to have adequate strength even without reinforcing fibres.

The resin then cools to provide a transparent sheet including the aggregate, with the visible surface of the aggregate covered by the transparent resin.

Alternatively the aggregate may include wood chips which will impart additional resilience to the finished sheet.

Alternative transparent or translucent thermoplastic resins are known, and one possibility is to use a flexible Styrene-Butadiene-Styrene rubber as the basis for the resin.

Preferably the finished sheet has a thickness of from 4 to 6 mm, using stone chippings measuring from 3 to 4 mm across.

As indicated above, heat is applied to the sheet to soften the resin to allow the resin to be smoothed on to the underlying substrate. This may be effected by application of a heating flame. Alternatively and preferably the heat may be applied by conduction using a heated smoothing tool in the form of a metal plate having a handle which can be grasped by the laying operator to allow the plate, when heated, to be stroked over the resin to both heat-soften the resin and smooth it into position.

Afterwards the sheet may be smoothed on the surface, possibly by rolling it on, in order to enhance the degree of bonding to the concrete.

In order to provide a range of colours available, the stone may be of any coloured type, for example a brown or a red gravel is possible. Equally a greenish gravel, known as CRIGGEON, may be used.

If desired, different colours may be used on the same sheet so as to enable the sheets to be applied next to one another, for example in an interlocking or partially overlapping pattern, to generate a pattern over an extensive area.

When using a translucent resin the coloration of the stone is sufficient to impart the desired colour to the sheet even when the stone material is entirely covered by the resin binder.

It is envisaged that the stone paving surface in accordance with the present invention will be used for semi-domestic applications for example garden paths and driveways.

In order to lay the sheet on a concrete substrate it is preferable to apply an adhesion-promoting primer to the substrate and then to lay the sheet on the primed surface.

The flexibility inherent in the resin sheet will then allow the sheet to conform to the rough surface of the concrete and this further increases the adhesion.

As compared with the conventional system of spraying bitumen on the substrate, then scattering gravel on the still-soft sprayed bitumen, and then finally rolling the surface to finish the job, the method of laying the sheet in accordance with the present invention may require simply a first step of heat-softening the resin sheet and then a second step of smoothing, e.g. rolling, the sheet on the substrate.

The sheet of the invention may be prepared using a shallow mould of a size sufficient to mould a single sheet, and optionally a release agent may be first of all applied to the mould.

The resin, mixed as described above and already containing aggregate, is then poured hot from the mixer so that it then sets in the mould in sheet form, with the aggregate embedded in the sheet, preferably with the surface of the aggregate covered by at least a film of the transparent resin. When set, the resin sheet with its enclosed stone effect can be removed from the mould and rolled up for transport to a location of use.

If exposed aggregate on the surface of the sheet is desired, further aggregate may be applied to the surface of the above defined aggregate-embedding sheet, so that the majority of this further aggregate will adhere to the sheet.

The stone effect may also be achieved using a mixture of wood chips and stone chipping aggregate. Such a sheet may be lighter than one including only stone aggregate. The wood chips would then be better protected if totally embedded in the resin, in order to cover the wood chip surfaces totally for weatherproofing.

To achieve the desired stone effect, the above-mentioned optional further application of resin over the wood chips may be made, and then further stone aggregate may be applied, for example by scattering it on the second layer of resin.

If desired, the wood chips may be stirred into the resin before casting of the sheet, and the stone chippings may then be applied separately to the still soft cast sheet. Where wood chips are used, it is preferred that they have a size in the range of from 1 mm to 5 mm.

When it is removed from the mould the sheet can be held up and shaken in order to remove any surplus stone chippings which can then be recycled.

If desired, a layer of bitumen may be painted on the underside of the sheet (normally the side which has been in contact with the base of the mould) so that this layer of bitumen will come in contact with the substrate surface on to which the sheet is to be applied.

With this bitumen-added alternative possibility, the method of applying the sheet, for example on a concrete surface, is rather different than described above.

The sequence of steps is as follows:

(a) warm the surface to which the sheet is to be applied, raising its temperature to a value which is high

enough to soften the bitumen when applied thereto;
(b) lay the sheet, or set of sheets in a desired pattern, on to the still warm surface whereby the bitumen warms to bond to the warm surface; and
(c) optionally roll the sheets to enhance the bond.

The advantage of this alternative form is that there will be no need for a primer in order to enhance the bonding of the sheet to the substrate. The application of such a primer is normally made to the substrate surface before the sheet is applied, so the number of steps required to lay the pre-formed sheets is reduced, and it is a simple economical matter to provide for the painting of the bitumen on to the sheets during manufacture.

The bitumen-backed form of sheet is particularly useful where a deep coloration of the resin material is provided for, or where the finished surface defined by the laid sheets can have the same colour as bitumen (which will show through the translucent or transparent resin).

In order to allow the sheet of the present invention to be used for covering irregular areas of paving the sheet material will be formed as separate identical slabs, for example 1 metre long and 0.75 metres wide, with an overall thickness of from 4 to 6 mm.

Such slabs can then be laid in the manner of carpet tiles so that they are preferably applied end-to-end and laterally abutting one another. However, other shapes of sheet may be provided and they may if desired be irregular to give a desired non-grid like pattern, provided the shapes are such that the finished array of laid sheets presents a substantially continuous surface over the substrate to be covered.

An example of the application of the slab in accordance with the present invention is in the marking and construction of a walk-way for use on flat roofs or between the pitches of a roof. The surface elements can be laid on parts of the roof which are known to be structurally capable of supporting workmen walking thereon, and can be coloured so as to define quite clearly the extent of that structurally adequate part of the roof. For example a white aggregate may be incorporated in order to contrast with a darker colour for the parts of the roof which are outside the walk-way and which may not be structurally adequate to support workmen on them.

Claims

1. A paving sheet comprising a sheet of a non-opaque thermoplastic resin having a stone effect applied to the sheet.

2. A paving sheet according to claim 1 wherein the stone effect is applied in the form of stone chippings.

3. A paving sheet according to claim 2, wherein the resin sheet is transparent, and wherein optionally the stone chippings are embedded within the transparent resin.

4. A paving sheet according to any one of the preceding claims, wherein the resin comprises a mixture of a hydrocarbon resin and ethylene vinyl acetate and preferably further includes Styrene Isoprene Styrene.

5. A paving sheet according to any one of the preceding claims, further including heat-resistant reinforcing fibres, preferably chopped glass fibres which more preferably have a staple length of from 10 to 50 mm.

6. A paving sheet according to any one of claims 1 to 4, wherein the resin is based on Styrene Butadiene Styrene.

7. A paving sheet according to any one of claims 1 to 6 including bitumen applied to one face of the sheet.

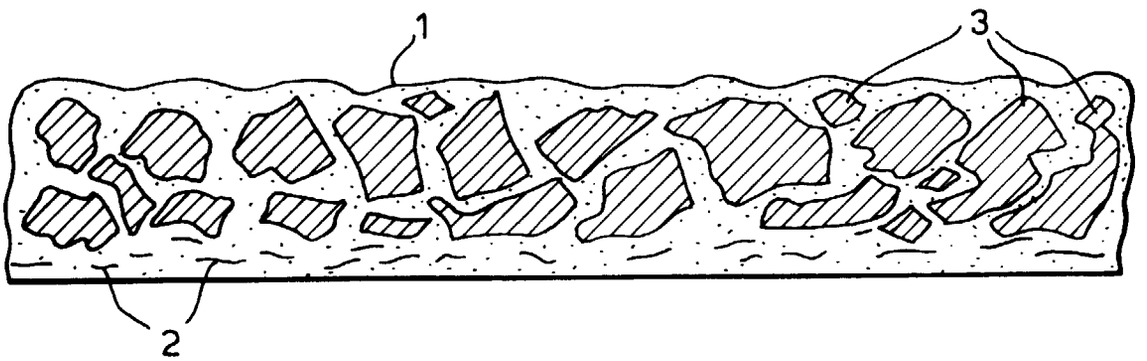
8. A method of laying a stone effect surface on a substrate, comprising taking a pre-formed paving sheet of non-opaque thermoplastic resin with a stone effect, laying the sheet on the substrate to be covered, and applying heat to soften the sheet.

9. A method according to claim 15 or 16, wherein the application of heat to the sheet comprises contacting the sheet with a heated smoothing tool, or playing a blow torch on the exposed surface of the sheet.

10. A method according to claim 8, wherein the sheet includes a layer of bitumen on one surface and the heat applying step comprises the step of applying heat to the substrate to raise its temperature to a value at which the bitumen on the sheet will soften, and wherein the bitumen surface of the sheet is immediately laid on the pre-warmed substrate.

11. A method of pre-forming a stone effect paving sheet comprising mixing a hot thermoplastic resin which, on cooling, will set to form a non-opaque sheet; pouring the hot resin into a mould with aggregate to be attached to the resin to define a stone effect; allowing the resin to set in the mould with the aggregate; and removing the resulting stone effect sheet from the mould.

12. A method according to claim 11, wherein the aggregate is added to the hot mixed resin before pouring into the mould, and wherein, when the aggregate and resin settle in the mould, the aggregate is covered by resin, and preferably further aggregate is applied over the resin and aggregate in the mould.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EUROPEAN SEARCH REPORT

Application Number
EP 98 30 0897

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)
X Y	GB 1 326 006 A (STENITE LTD) 8 August 1973 * the whole document * ---	1-3,11 4-10,12	E01C5/20 E01C5/22
Y	GB 968 463 A (MONSANTO CHEM.) * the whole document * ---	4,5	
Y	GB 2 289 681 A (NISSIN KASEI CO LIMITED) 29 November 1995 * abstract * ---	6	
Y A	GB 1 032 964 A (RUBBEROID COMP.W) * the whole document * ---	7 5	
Y	EP 0 466 249 A (STEVIN WEGENBOUW) 15 January 1992 * the whole document * ---	8,9	
Y	DE 85 23 177 U (GRÜN) 26 September 1985 * claim 1; figures * ---	10	
Y	DE 43 34 616 A (MEYER PIPES GMBH & CO KG) 6 April 1995 * the whole document * -----	12	TECHNICAL FIELDS SEARCHED (Int.Cl.6) E01C E04D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	8 May 1998	Dijkstra, G

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