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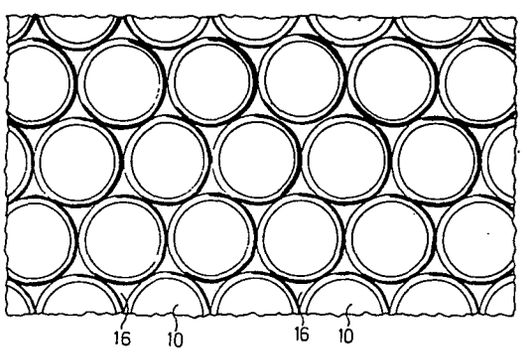
(54) Roadway paving.

(57) A roadway paving which may be formed in whole or in part, by the laying of a number of precast concrete segments (10), which have generally oblate top and bottom surfaces and cylindrical sides, in the densest possible packing upon a suitably prepared base and in association therewith a number of cast in situ star shaped, prismatic interlocking segments (16) which are formed by filling the interstices left between the precast segments with a concrete grout.



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IMPROVEMENTS IN ROADWAYS

This invention relates to a method and means for paving a roadway with paving stones.

For centuries the most common paving system has been that of cobblestones. The cobblestone was eventually superceded by the concrete road , which it was found, was cheaper and essentially much quicker to construct. The concrete road eventually was superceded by the development of macadamised surfaces which resulted in what is now commonly known as a "tarred" roadway.

Regretably, leakage of oil, fuel and in particular diesel fuel from vehicles tends to destroy the tarmacadam surface of a roadway and this is particularly noticeable at traffic lights, stop areas, intersections, turns and sharp dips or similar areas where vehicles tend to be stationary for periods of time or are subject to accelerations which enhance oil drips.

In order to minimise the destruction of the tarred surface of roadways, particularly in cities, resulting from spillage or leaking of diesel and oil, a system of concrete blocking has been introduced in a scheme of which the inventor is aware.

Of the numerous systems developed, the pre-cast concrete formations of a roughly flattened "Z" configuration have found favour.

These concrete formations are generally in the order of 100 mm thick and up to 300 mm long by about 100 mm wide.

In use, these blocks are laid on a prepared sandy base and are laid as closely together as is possible so that they tend to interlock with each other with the purpose of forming a substantially rigid surface.

However, these concrete formations which are produced in great numbers, perhaps partly because of their complex shapes, do not necessarily fit as closely together as is desired.

As a further consequence, a certain amount of joint filling with fine sand, or like material is generally used to try to compensate for imperfect fit and improve the interlocking between the formations.

It is understood that in practice, interlocking is only eventually relatively complete after a substantial amount of traffic has passed over the surface. This can take several months from the date of laying of such a block system, and in any event, this interlocking results more from

the effects of road dirt and natural accretions of fine particles which eventually lock the blocks firmly together so that they will adequately carry the usual in service loading.

However, the conditions necessary to achieve satisfactory interlocking using the above system, are seldom available, as ideally, such a roadway should initially be lightly loaded and have a slow build up of traffic carrying or there is a tendancy for the newly laid roadway to distort or the blocks to shift if subjected to heavy loads straight away, allowing any rain water or similar access through the joints to soften up the underlying base material and consequently allowing further distortion with further traffic.

In view of the above shortcomings, the invention has as its object improving upon the block roadway system by providing a method for the producing of an improved roadway surface and means in the form of precast concrete sections used in the construction of such a roadway surface.

According to one aspect of the present invention, a roadway is paved in whole or in part by superimposing upon a prepared base with the densest possible packing, a plurality of precast concrete segments having generally rounded oblate top and bottom surfaces and cylindrical sides in side by side abutment and in combination therewith, a plurality of substantially star shaped prismatic interlocking segments which are cast in situ in the

form of a grout and then compacted by mechanical vibration and allowed to set and cure.

This invention will now be more fully described by way of example of one embodiment of the invention which is

the best method known to the inventor of forming a road surface in accordance with the present invention. The road surface is formed by following the steps of :

1) Confirming that the ground which will be beneath the surface has been adequately prepared to withstand the traffic loadings that the surface is expected to withstand. Confirm that the ground beneath the surface has a smooth profile and the desired alignments.
2) Placing the pre-cast segments on the prepared surface in the densest possible packing in a single layer, flat side down.
3) Ensuring the upper surfaces of the precast segments have the correct alignment and the desired profile. If necessary, fine adjustments to the alignment can be effected by inserting any fine insert aggregate beneath the precast segments, said inserts being usually between 10 mm and 15 mm in thickness.

4) Casting concrete edge beams at all the edges of the new surface to ensure that no edge segments become dislodged.

5) Forming the star shaped cast in situ segments by pouring a concrete grout into the interstices left by the precast segments and use suitable mechanical vibration to ensure complete compaction. Repeat this process until the interstices are completely filled. It has been found that compaction is best achieved using a flat vibrating plat compactor or alternatively a light vibrating roller.

6) Cleaning off the surface by removing all the excess concrete grout from the upper surface of the precast segments, and removing approximately 6mm of the grout so as to leave the precast segments proud.

7) Allowing the in situ segments to set hard and preferably to ensure greater strength and durability of the surface as a whole, curing of the in situ segments may be effected.

During the development of the present invention, it was found by the inventor that a rounded cylindrical shaped precast segment substantially as illustrated in the accompanying drawings has several advantages over other shapes.

For instance, the laying of a surface using this shape of segment is very simple, it not being necessary to

conform to any fixed joint patterns. It is considered that this is a very important feature of the present invention, as it makes it possible to use a simple machine to lay the precast segments with the many apparent advantages attached to such a step. It is also well suited to laying by unskilled labour in, for instance, many under developed countries.

In addition, any joints which may open up during the first two weeks of use of the surface by traffic are very quickly filled by traffic debris and/or particles worn from the softer cast in situ segments and at all times the road surface will remain entirely servicable.

In the above regard, it has been found to be an advantage, that the cast in situ segments, being softer than the precast segments, tend with use, to be worn down to a level approximately 6mm to 8 mm below the general level of the surface and this small indentation seems to assist traction of rubber tyred vehicles particularly in wet weather conditions.

It has further been found that the quantity of material used with the present system to construct a roadway surface, is less than any other method using concrete products, to produce a roadway of comparable quality known to the inventor. This is attributed to the fact that, unlike some other systems, the present

invention does not rely entirely on the surface thickness to keep the precast segments in place.

Through extensive development research, it has been found that a substantially rounded cylindrical segment within the ranges 150mm to 250 mm in diameter and in varying thicknesses between 25mm and 100 mm depending on the anticipated loadings and the quality of ground preparation, is the most advantageous design.

The mixtures used in manufacturing the precast segments obtain a 28 day strength in the range 15 to 60 mPa (which is the pressure needed to crush the precast segment after a 28 day setting period) while the optimum range of 28 day strengths is between 20 and 25 mPa which substantially minimizes the chances of sub-standard precast segments.

The invention will now be further described by way of example with reference to the accompanying drawings in which:

Figure 1 is an isometric view of one precast segment in accordance with the present invention, (not drawn to scale),

Figure 2 is a plan view of a portion of a road surface showing a multiplicity of pre-cast and cast in situ segments.

Referring to figure 1, reference numeral 10 indicates one preferred embodiment of a pre-cast segment in accordance with the present invention.

The upper portion of the segment 10 is chamferred 12 at approximately 45^{o}, this chamfering which is done during manufacture has been found through extensive experimentation by the inventor, to improve the durability of the segment in use. In addition, it has also been found that chamfering lessens road noise levels when traffic moves over the road surface.

The base section 14 of the segment 10 is substantially flat with no chamfer around the periphery.

Referring now to figure 2, a number of pre-cast segments 10 of the type illustrated in figure 1 can be seen as laid together to form the basis of a road surface. Deposed between adjacent pre-cast segments are a number of cast in situ substantially star shaped segments 16 (only 2 indicated) which serve to interlock the segments 10.

CLAIMS:

1. A method of paving a roadway which comprises the steps of superimposing upon a prepared base, with the densest possible packing, a plurality of precast concrete segments having generally oblate top and bottom surfaces and rounded cylindrical sides in side by side abutment, and superimposing upon the base in combination with the rounded segments a plurality of star shaped prismatic interlocking segments which star shaped segments are cast in situ in the form of a grout after superimposing the rounded segments, and allowing the segments to set and cure.

2. A method of paving a roadway as claimed in claim 1, which is characterised by the further step carried out at a suitable stage of emplacing edge beams which are adapted to limit displacement of the segments.

3. A method of paving a roadway as claimed in either claim 1 or 2, the displacement limiting edge beams being cast in concrete and allowed to set after the precast rounded cylindrical concrete segments have been laid in side by side abutment in the densest possible packing and before the star shaped prismatic interlocking segments are cast in situ.

4. A method of paving a roadway as claimed in any one of the preceeding claims further characterised in that the star shaped prismatic interlocking cast in situ segments are compacted by vibration before setting takes place.

5. A method of making a roadway which comprises the steps of: preparing a base to adequately withstand expected traffic loadings; ensuring that the base has a smooth profile and a desired alignment; placing upon the prepared base in the densest possible packing a plurality of precast concrete segments having generally oblate top and bottom surfaces and rounded cylindrical sides in a single layer, in side by side abutment; ensuring that the upper surfaces of the generally rounded cylindrical precast concrete segments have the correct alginment and the desired profile; effecting fine adjustments to the alignment by inserting any suitable inert aggregate beneath the generally rounded cylindrical precast concrete segments; casting displacement limiting concrete edge beams along all the edges of the roadway surface and allowing said displacement limiting edge beams to set; forming star shaped prismatic interlocking cast in situ segments, by introducing a concrete grout into the interstices left between the generally rounded cylindrical precast concrete segments and subjecting said concrete grout to vibration so as to cause compaction and repeating the grouting and com-

pacting procedure until the interstices are completely filled; cleaning off any excess concrete grout from the roadway surface; removing approximately 6mm of the cast in grout so as to leave the precast segment proud, and allowing the star shaped prismatic interlocking cast in situ segments to set and cure.

6. A roadway paving comprising in whole or in part a plurality of precast concrete segments 10 having generally oblate top and bottom surfaces and rounded cylindrical sides laid in side by side abutment in the densest possible packing upon a suitably prepared base and superimposed upon the base and in combination with the generally rounded cylindrical precast concrete segments a plurality of star shaped prismatic interlocking cast in situ segments 16.

7. A roadway paving as claimed in claim 6 characterised in that the roadway paving is defined around its edges by displacement limiting concrete edge beams.

FIG 1

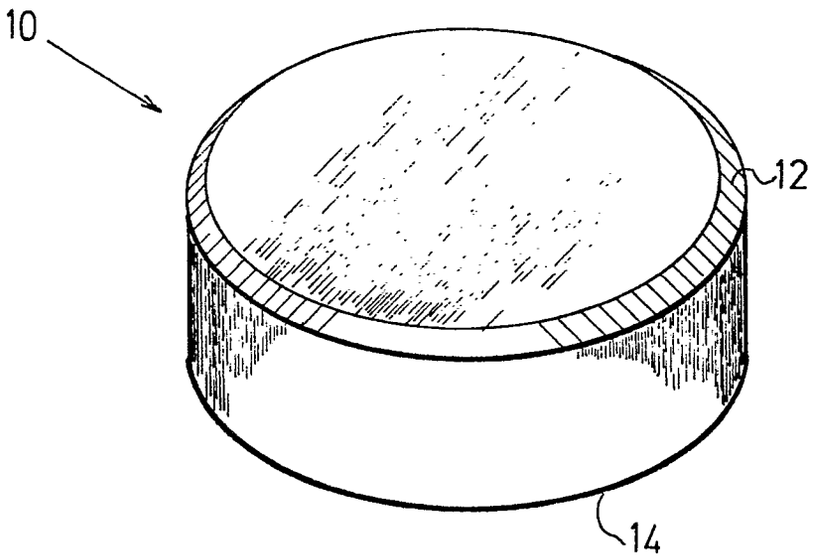
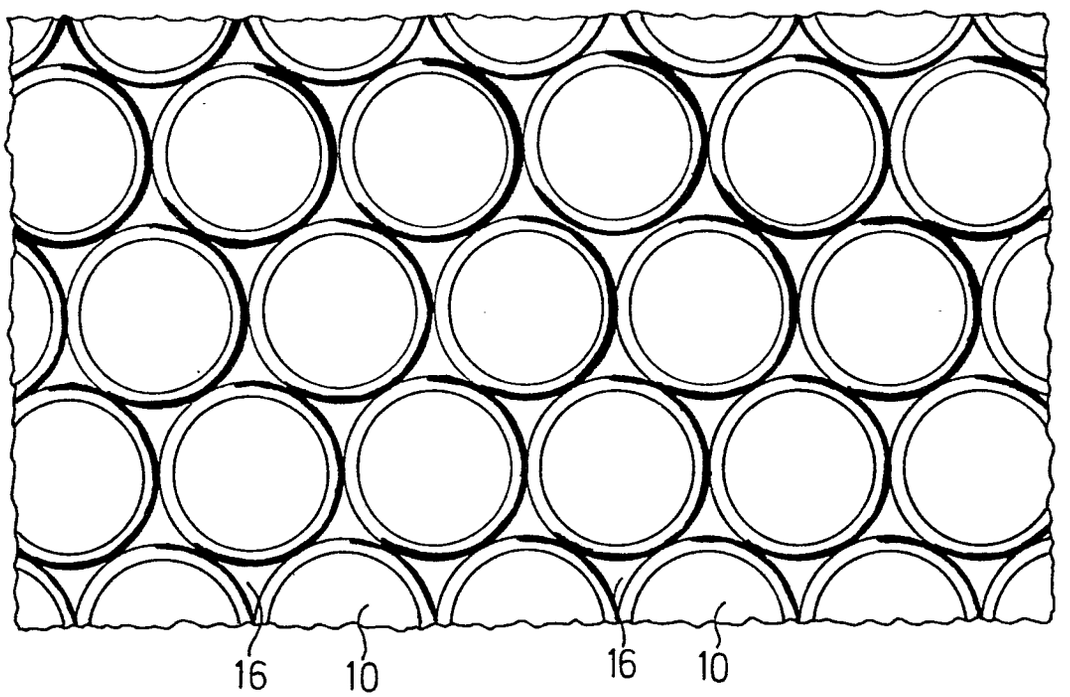


FIG 2



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EUROPEAN SEARCH REPORT

0039555
Application number

EP 81 30 1777.9

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
	FR - A - 848 141 (VON VASS) * page 1 to page 3, line 47 * --	1,5
	DE - C - 879 251 (HINCKELDEY et al.) * lines 1 to 70 * --	1,5
	DE - A1 - 2 831 751 (DYCKERHOFF & WIDMANN AG) * page 7, paragraph 2 to page 11, paragraph 4 * --	1,5
	FR - A - 623 051 (POHLIG) * page 3, lines 23 to 31; fig. 12, 13 * --	2,7
	FR - A - 568 294 (SANDBERG et al.) * fig. 1 * --	6
	DE - U - 7 707 697 (METTEN GMBH & CO.) * fig. 1 to 15 * --	6
	DE - U - 7 820 179 (WEBER) * fig. 1, 2 * --	6
	DE - U - 7 627 698 (REINSCHÜTZ) * fig. 13 to 18 * & CA - A - 1 088 792 -- ./..	6

CLASSIFICATION OF THE APPLICATION (Int. Cl.³)

E 01 C 5/06

TECHNICAL FIELDS SEARCHED (Int. Cl.³)

E 01 C 5/00
E 01 C 15/00

CATEGORY OF CITED DOCUMENTS

X: particularly relevant
A: technological background
O: non-written disclosure
P: intermediate document
T: theory or principle underlying the invention
E: conflicting application
D: document cited in the application
L: citation for other reasons

&: member of the same patent family, corresponding document

X The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Berlin	23-06-1981	PAETZEL

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DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl.³)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
	DE - U - 7 829 810 (TEEWEN) * fig. 1, 2 * --	6	
A	DE - U - 7 438 032 (FRIES & CO BETON-WERK KG et al.) --		
A	DE - C - 651 166 (NEUGEBAUER) ----		
			TECHNICAL FIELDS SEARCHED (Int. Cl.³)