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Development of the slurrybound Macadam construction technique

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PATENTS ACT, 1978

CERTIFICATE

In accordance with section 44 (1) of the Patents Act, No. 57 of 1978, it is hereby certified that

MACADAM FRANCHISE COMPANY (PTY) LIMITED

has been granted a patent in respect of an invention described and claimed in complete specification deposited at the Patent Office under the number

2005/1627

A copy of the complete specification is annexed, together with the relevant Form P2.

In testimony thereof, the seal of the Patent Office has been affixed at Pretoria with effect from the **26th** day of **October 2005**

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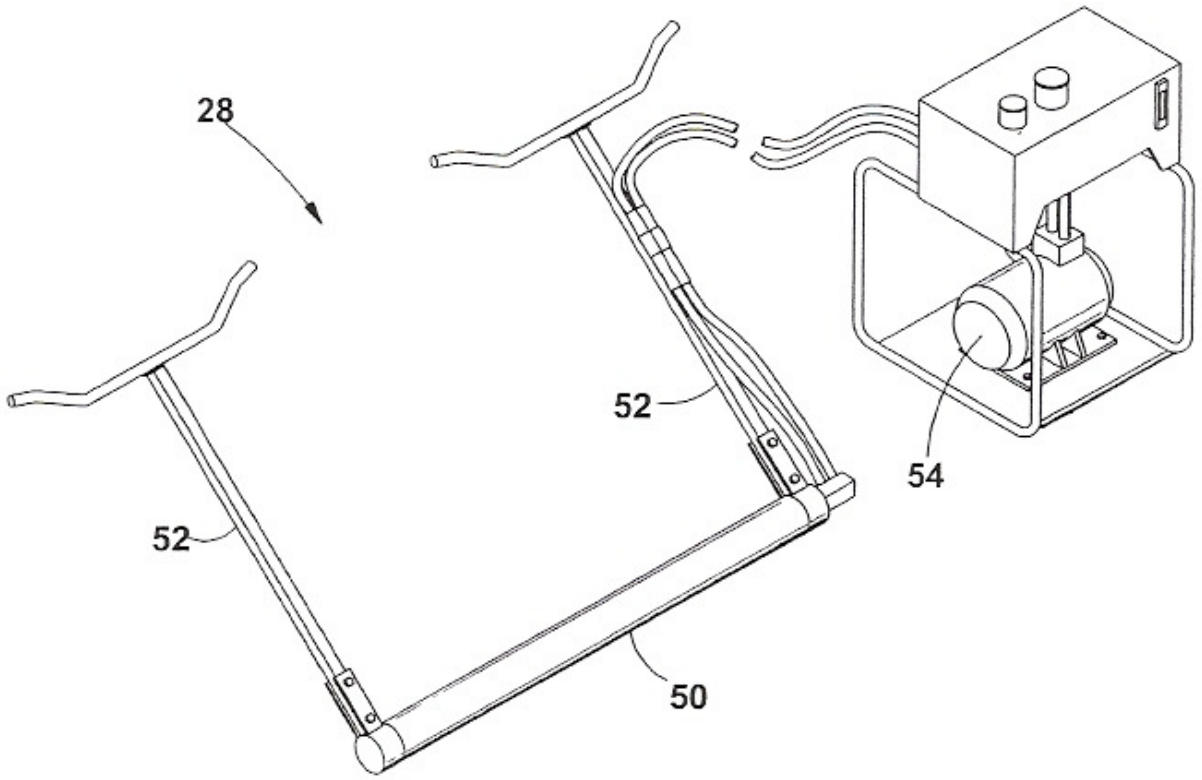


FIGURE 4

A method and use of apparatus for constructing a slurry bound or composite macadam road

Field of the Invention

This invention relates to a method of constructing a macadam road, and more specifically but not exclusively to a method of constructing a slurry bound or composite macadam road.

The invention further relates to the use of a spinning straightedge leveller in the construction of a slurry bound or composite macadam road.

Background to the Invention

For the purposes of this specification a spinning straightedge leveller comprises a cylindrical member rotatable about a central axis which is pulled along a track so as to provide dynamic compaction of a surface layer comprising a slurry spread over a base aggregate layer of uniformly graded stones. The cylindrical member is caused to rotate by means of an engine and is pulled in the opposite direction to which the cylindrical member rotates.

For the purposes of this specification, a vibratory straightedge leveller comprises a compacting member having at least one straight edge, which compacting member vibrates substantially perpendicular to the surface layer to be compacted.

During the 1990's there was a resurgence of interest in macadam pavement or roads and more particularly in the method of making such pavements or roads, in that the construction of macadam pavements or roads have a high labour component and a low equipment component.

Accordingly, from a socio economic point of view, the percentage of contract value earned by labourers is much greater than it would be if highly mechanised and non labour intensive methods were to be used and due to the high labour component inherent in the method, local job creation is spurred on as well as the creation of small, medium and micro-enterprise (SMME) development.

The construction of macadam pavements or roads is well known in the art and dates back to the 1820's and must be distinguished from the construction of paver laid hot mix asphalt roads and concrete roads, both of which are highly mechanised.

Without wishing to be bound by theory, a macadam road simply consists of an aggregate layer of uniformly sized stones having voids between the stones, which voids are filled with a suitable material. Many variations exist in respect of the method of constructing such roads, for example, traditional macadam roads were of the waterbound type where water was used to wash smaller stones and finer material into the voids.

Another variation is where a bituminous slurry is used as a filler, the resultant road thus being of a slurrybound type, wherein the bituminous slurry is vibrated into the voids by use of pedestrian rollers or vibrating plates. Rollers and/or vibrating plates are also used to orient the stones before placing the slurry over the aggregate layer so as to remove local depressions and the like. In the case of a composite bound macadam road, the voids are first filled with aggregate fines and then bituminous slurry is used to fill the remaining volume. It will be appreciated thus that the road surface finish is dependent on the slurry and its compaction.

In the construction of concrete roads, rollers or vibrating plates are used to achieve a uniform density in the concrete and thus serve a different purpose.

A disadvantage with the present methods of constructing slurry bound macadam roads is that the use of pedestrian rollers or vibrating plates result in surfaces which have good structural integrity but inferior finishing and riding quality when compared to paver laid hot mix asphalt roads. This is because the pedestrian rollers or vibrating plates run directly on the wet slurry causing surface irregularities and undulations as a result, at least partially, of their width limitations.

Object of the Invention

It is an object of the invention to provide an alternate method of constructing a slurry bound or composite macadam road which at least partially minimises the above disadvantage.

It is a further object of the invention to provide for a novel use of a spinning straightedge leveller in the manufacture of a slurry bound or composite macadam road.

Summary of the invention

According to a first aspect of the invention, there is provided a method of constructing a slurry bound or composite macadam road, comprising the steps of:

i. providing a first guide member and a second guide member on the ground so as to form a track having a channel there-between;

ii. spreading stones in the channel to form a base aggregate layer of stones having voids between the stones;

iii. pouring and spreading slurry over the base aggregate layer of stones to form a surface layer; and

iv. compacting the surface layer such that the slurry penetrates the base aggregate layer and fills the voids by means of pulling the spinning straightedge leveller along the tracks so as to strike off the surface layer thereby to form a road surface with a smooth riding quality suitable for high vehicular speeds.

The slurry is preferably bituminous slurry.

The first guide member and second guide member may comprise a longitudinal member of any suitable material such as wood or metal, preferably a metal tube having a square or rectangular cross section. The first guide member and second guide member are preferably secured to the ground and may be provided with lug members to enable the guide members to be secured to the ground by means of bolts and the like.

The stones may preferably be uniformly graded stones, that is single sized stones, and may preferably be oriented by means of a spinning straightedge leveller, preferably prior to the pouring of slurry thereon.

In an embodiment of the invention, the depth of the channel is determinative of the thickness of the base aggregate layer.

In a preferred embodiment of the invention, the base aggregate layer of uniformly graded stones is levelled off by means of a straightedge leveller comprising a beam having at least one straight edge, which beam is pulled along the track. It is

envisaged that the spinning straightedge leveller may also be used to level off the stones.

In a preferred embodiment of the invention, excess slurry is poured onto the base aggregate layer of stones and spread thereover to form a surface layer which is raised above the track so as to enable the spinning straightedge leveller to strike off the surface layer.

In an embodiment of the invention, a vibratory plate compactor may be used to compact the slurry into the base aggregate layer, prior to the use of the spinning straightedge leveller.

The slurry may be mixed in situ and may comprise sand, cement and emulsified bitumen. In an embodiment of the invention, the slurry may be spread over the base aggregate layer by squeegees and the like.

In an embodiment of the invention, bitumen pre-coated stones may be applied to the surface layer using the spinning straightedge leveller in order to achieve a coarser road surface so as to improve skid resistance and reduce mist spray under passing vehicles.

According to a second aspect of the invention, there is provided a method of constructing a slurry bound or composite macadam road, comprising the steps of:

i. securing a first guide member and a second guide member to the ground so as to form a track having a channel there-between;
ii. spreading uniformly graded stones in the channel to form a base aggregate layer of stones having voids between the stones;

iii. levelling the stones by means of a straightedge leveller or spinning straightedge leveller pulled along the track;

iv. orienting the stones by means of a spinning straightedge leveller;

v. pouring and spreading slurry over the aggregate layer to form a surface layer which is raised above the track;

vi. compacting the slurry into the aggregate layer by means of a vibratory plate compactor; and

vii. striking off the surface layer by means of pulling the spinning straightedge leveller along the track to form a road surface with a smooth riding quality suitable for high vehicular speeds.

Step vii may be repeated adding slurry to the surface layer so as to achieve specified tolerances. Again, guide members are used along which the spinning straightedge leveller may be pulled.

A further step in the method according to the second aspect of the invention, may involve the application of bitumen pre-coated stones onto the surface layer to create a coarser road surface, using the spinning straightedge leveller to apply the stones evenly on the surface layer.

The stones may preferably be single sized gritt stones passing a sieve size of from 4.00 mm to 7.00 mm, preferably from 4.7mm to 6.7mm.

According to a third aspect of the present invention, there is provided the use of a spinning straightedge leveller in the construction of a slurry bound or composite macadam road.

The spinning straightedge leveller may be used to orient stones, preferably uniformly graded stones, so as to form a base aggregate layer of stones spread out between a first guide

member and a second guide member placed on the ground which together form a track having a channel there-between.

In a preferred embodiment of the invention, the spinning straightedge leveller is pulled along the track with the base aggregate layer of stones between the first guide member and second guide member, the base aggregate layer of stones being covered in slurry to form a surface layer, so as to compact the slurry by striking off the surface layer to form a smooth road surface.

The slurry comprises a mixture of sand, cement and emulsified bitumen. In a preferred embodiment of the invention, the slurry comprises an emulsion content of between 220 to 250 litres/m^3 and a cement content of at least 1% by aggregate mass of the slurry.

Brief Description of the Drawings

Without thereby limiting the scope of the invention and by means of example only an embodiment of the invention will now be described with reference to the accompanying figures in which:

figures 1 to 3: is a diagrammatic representation of the method of constructing a slurry or composite bound macadam road according to the invention; and

figure 4: is a perspective view of a

spinning straightedge leveller used in the construction of a macadam slurry bound road.

Detailed Description of the invention

In the accompanying figures, the same reference numerals are used to denote corresponding parts.

Referring to figures 1 to 3, a slurry bound macadam road is constructed by first securing a first guide member (12) and a second guide member (14) to the ground (16) so as to form a track (18) having a channel (20) there-between.

Uniformly sized stones (22) are then poured into the channel (20) and are spread out in the channel (20) to form a base aggregate layer (24) of stones. The following aggregate gradings are recommended:

Table 1: Recommended aggregate gradings for advanced macadam materials[Ψ]

Sieve Size (mm)	Large Aggregate (WM,DM,CM,SM)					Fine Filters
	53mm	37mm	26mm	19mm	13.2mm	(WM, DM, CM)
75	100	-	-	-	-	-
53	85-100	100	-	-	-	-
37.5	35-70	85-100	100	-	-	-
26.5	0 – 15	0 – 50	85-100	100	-	-
19.0	0-5	0-25	0-50	85-100	-	-

13.2	-	0-5	0-25	0-30	85-100	-
9.5	-	-	0-5	0-5	0-30	100
4.75	-	-	-	-	-	85-100
0.075	-	-	-	-	-	10-25

Ψ University of Pretoria, Labour intensive guidelines for Macadam Pavements.

WM : waterbound macadam

DM : drybound macadam

SM : slurrybound macadam

CM : compositebound macadam

The base aggregate layer of stones (24) is then levelled off using a straightedge leveller (26) such that the thickness of the base aggregate layer is the same as the depth of the channel (20). Thereafter, a spinning straightedge leveller (28) is pulled along the track (18) so as to orient the stones relative to each other. It is envisaged that the spinning straightedge leveller may also be used to level off the stones.

Slurry (30) comprising sand, cement and emulsified bitumen is then poured onto the base aggregate layer (24) of stones and is spread our by means of squeegees (not shown). The slurry (30) is mixed in situ and requires emulsified bitumen as opposed to the asphalt used in paver laid hot mix asphalt roads, where the asphalt has to be prepared in a hot mix batch process.

It is important that the surface layer (30) is raised above the track so that the spinning straightedge leveller can strike off the surface layer. Additional slurry may be added to the surface layer in order to achieve desired tolerances.

Once the slurry (30) has been spread over the base aggregate layer (24) of stones, a vibratory plate compactor (not shown) is used to compact the slurry into the aggregate layer (24) thereby filling voids (not shown) between the stones.

Lastly the spinning straightedge leveller (28) is pulled along the track (18) so as to strike off the surface layer. It is envisaged by the inventors that the use of a straightedge leveller provides a smoother road surface with less irregularities such that high speeds can be attained on the road constructed by the above method thereby reducing the amount of vibration a vehicle is subjected to when riding on the surface. It is believed that the use of a spinning straightedge leveller in the construction of slurry bound or composite macadam roads is more advantageous than using pedestrian rollers or vibrating plates which are pulled directly on the wet slurry causing surface irregularities and undulations. Although roads constructed using pedestrian rollers or vibrating plates have good structural integrity, they are only suitable for high volume, low speed traffic.

Referring to figure 4, a straightedge leveller (28) comprises a cylinder (50) which rotates about a central axis. The straightedge leveller is also provided with handle formations (52) to enable a labourer to pull the leveller (28) along a track or rail.

In use, the straightedge leveller is caused to rotate by means of an engine (54) and is pulled in the opposite direction to which the cylinder rotates. The straightedge leveller differs from a traditional pedestrian roller in that it provides for dynamic compaction of the surface layer by striking off the surface layer. In order to achieve this dynamic compaction, the straightedge leveller must be pulled along a track or rail and the surface layer comprising slurry must be raised above the track.

It will be appreciated in the light of the above that the method of constructing a slurry bound or composite bound macadam road is labour intensive. It is envisaged by the inventors that such a method of construction will provide jobs for the historically disadvantaged and will stimulate SMMEs due to the affordability of the machinery and equipment to be used and the cost of the materials.

The above is only one embodiment of the invention and it will be appreciated that many variations are possible without departing from the scope and spirit of the invention.

For example, in the construction of a composite macadam road, the spinning straightedge leveller is still used to strike off the surface layer of slurry even though the voids between the stones are first partially filled with sand and fine materials. It is also envisaged, that in order to achieve improved skid resistance and to reduce mist spray under passing vehicles, a coarser road surface may be made by applying single sized, bitumen pre-coated stones to the surface layer, using the spinning straightedge leveller to apply the stones uniformly on the surface layer.

Claims

1. A method of constructing a slurry bound or composite macadam road, the method comprising the steps of :

   i. providing a first guide member and a second guide member on the ground so as to form a track having a channel there – between;

   ii. spreading stones in the channel to from a base aggregate layer of stones having voids between the stones;

   iii. pouring and spreading slurry over the base aggregate layer to form a surface layer; and

   iv. compacting the surface layer such that the slurry penetrates the base aggregate layer and fills the voids by means of pulling the spinning straightedge leveller along the track so as to strike off the surface layer thereby to form a road surface with a smooth riding quality suitable for high vehicular speeds.

2. The method according to claim 1, wherein the first guide member and the second guide member are secured to the ground.

3. The method according to claim 2, wherein the first guide member and second guide member are secured to the ground by means of lug members provided thereon.

4. The method according to claim 1, wherein the stones are uniformly graded stones.

5. The method according to claim 1, wherein the stones forming the base aggregate layer are oriented by means of a spinning straightedge leveller.

6. The method according to claim 1, wherein the stones forming the base aggregate layer may be levelled off by means of a straightedge leveller or a spinning straightedge leveller.

7. The method according to claim 1, wherein the base aggregate layer thickness is determined by the depth of the channel formed by the first guide member and second guide member.

8. The method according to any of the preceding claims, wherein excess slurry is poured onto the base aggregate layer of stones and spread there-over to form a surface layer which is raised above the track so as to enable the spinning straightedge leveller to strike off the surface layer.

9. The method according to claim 8, wherein a vibratory plate compactor is used to compact the slurry into the base aggregate layer, prior to the use of the spinning straightedge leveller to compact the surface layer.

10. The method according to claim 1, wherein the slurry is mixed in situ.

11. The method according to claim 10, wherein the slurry comprises a mixture of sand, cement and emulsified bitumen.

12. The method according to claim 11, wherein the slurry comprises an emulsion content of between 220 to 250 litres/m^3 and a cement content of at least 1% by aggregate mass of the slurry.

13. The method according to claim 1, wherein uniformly sized bitumen pre-coated stones are applied to the surface layer

and a spinning straightedge leveller is used to evenly apply the stones to the surface layer.

14. A method of constructing a slurry bound or composite macadam road, the method comprising the steps of :

i. securing a first guide member and a second guide member to the ground so as to form a track having a channel there-between;

ii. spreading uniformly graded stones in the channel to form a base aggregate layer of stones having voids between the stones;

iii. levelling the stones by means of a straightedge leveller or spinning straightedge leveller pulled along the track;

iv. orienting the stones by means of a spinning straightedge leveller;

v. pouring and spreading slurry over the aggregate layer to form a surface layer which is raised above the track;

vi. compacting the slurry into the aggregate layer by means of a vibratory plate compactor; and

vii. striking off the surface layer by means of pulling the spinning straightedge leveller along the tracks to form a road surface with a smooth riding quality suitable for high vehicular speeds.

15. The method according to claim 14, wherein uniformly sized bitumen pre-coated stones are applied to the surface layer and a spinning straightedge leveller is used to evenly apply the pre-coated stones to the surface layer.

16. Use of a spinning straightedge leveller in the construction of a macadam road.

17. The use according to claim 16, wherein the macadam road is a composite macadam road.

18. The use according to claim 16, wherein the macadam road is a slurry bound macadam road.

19. The use according to claim 16, wherein the construction of the macadam road includes the steps of:

    i. providing a first guide member and a second guide member on the ground so as to form a track having a channel there – between;
    ii. spreading stones in the channel to from a base aggregate layer of stones having voids between the stones;
    iii. pouring and spreading slurry over the base aggregate layer to form a surface layer.

20. The use according to claim 19, wherein the spinning straightedge leveller is used to compact the surface layer such that the slurry penetrates the base aggregate layer and fills the voids by means of pulling the spinning straightedge leveller along the tracks so as to strike off the surface layer thereby to form a road surface with a smooth riding quality suitable for high vehicular speeds.

21. The use according to claim 19, wherein the spinning straightedge leveller is used to orient the stones of the base aggregate layer.

22. A method of constructing a slurry bound or composite macadam road, substantially as herein described and exemplified and/or described with reference to the accompanying drawings.

23. Use of a spinning straightedge leveller in the construction of a slurry bound or composite macadam road, substantially as herein described and exemplified and/or described with reference to the accompanying drawings.

Dated this 24TH day of FEBRUARY 2005

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Patent Attorney / Agent for the Applicant

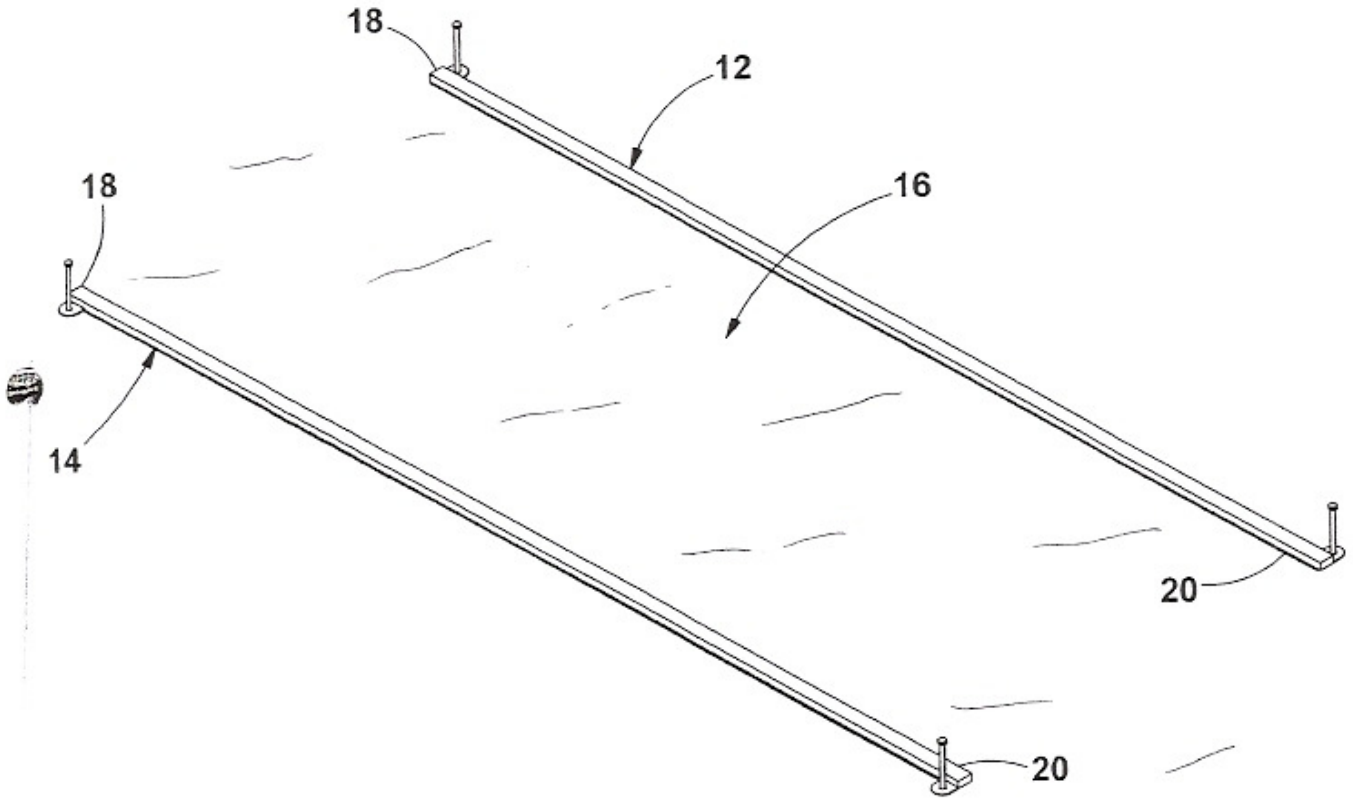


FIGURE 1

J. T. TRUTER

PATENT ATTORNEY FOR THE APPLICANT

D.M. KISCH INC.

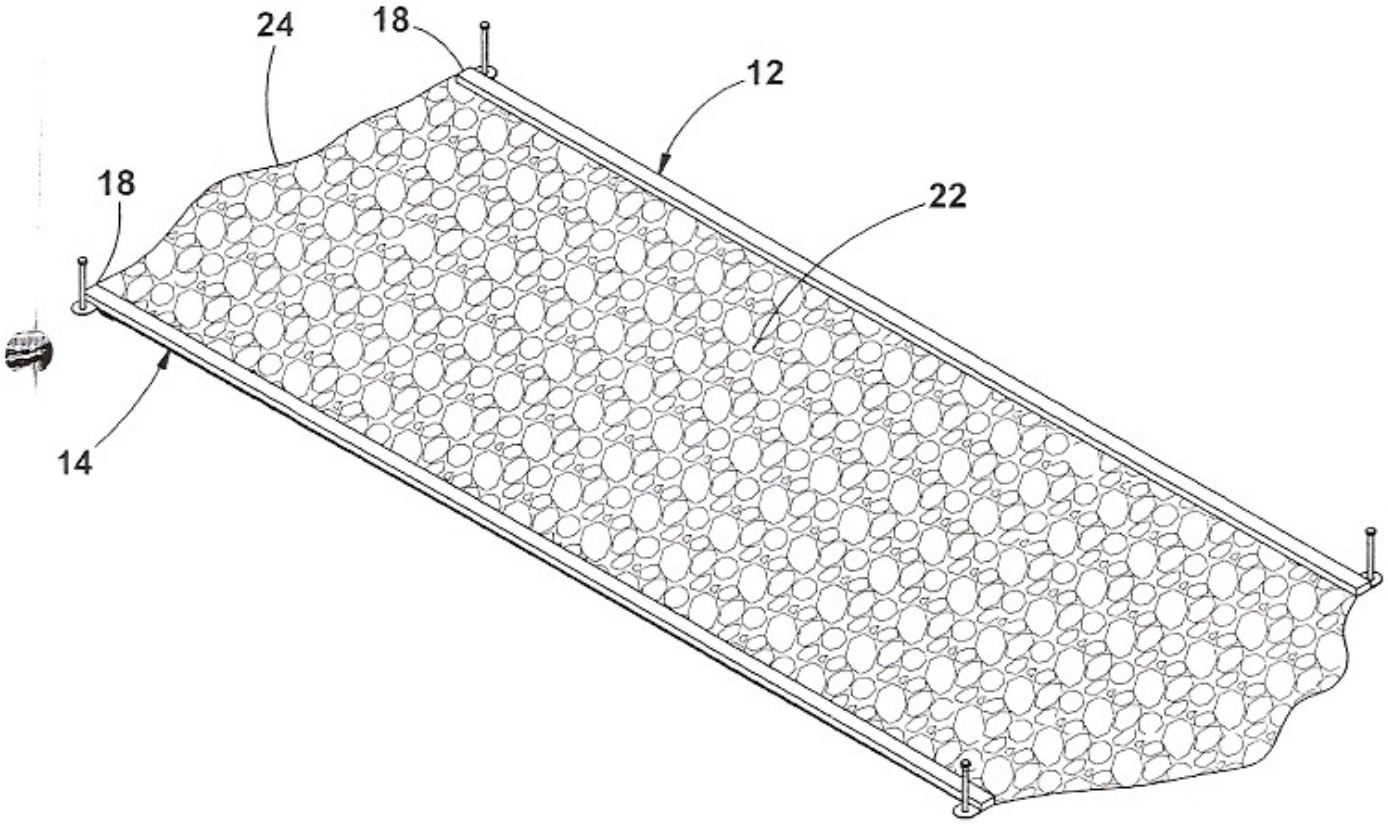


FIGURE 2

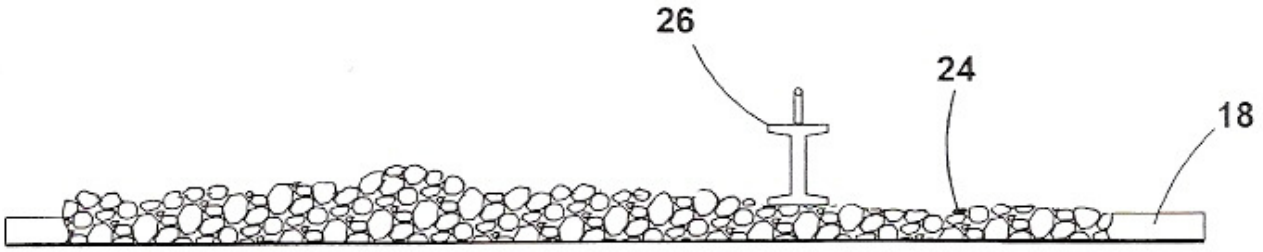


FIGURE 3a

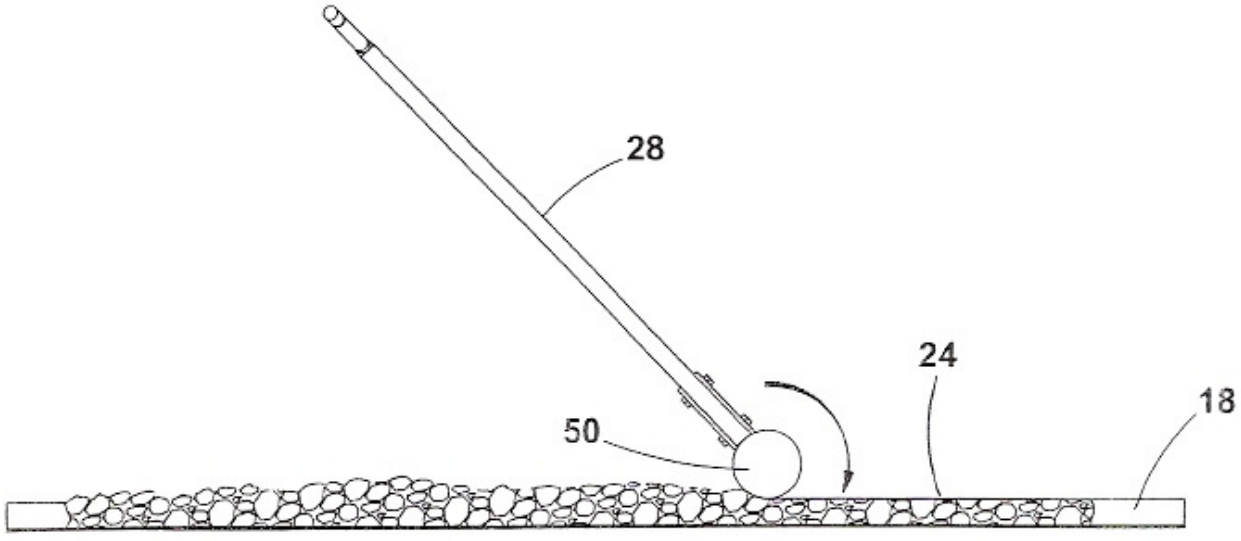


FIGURE 3b



FIGURE 3c

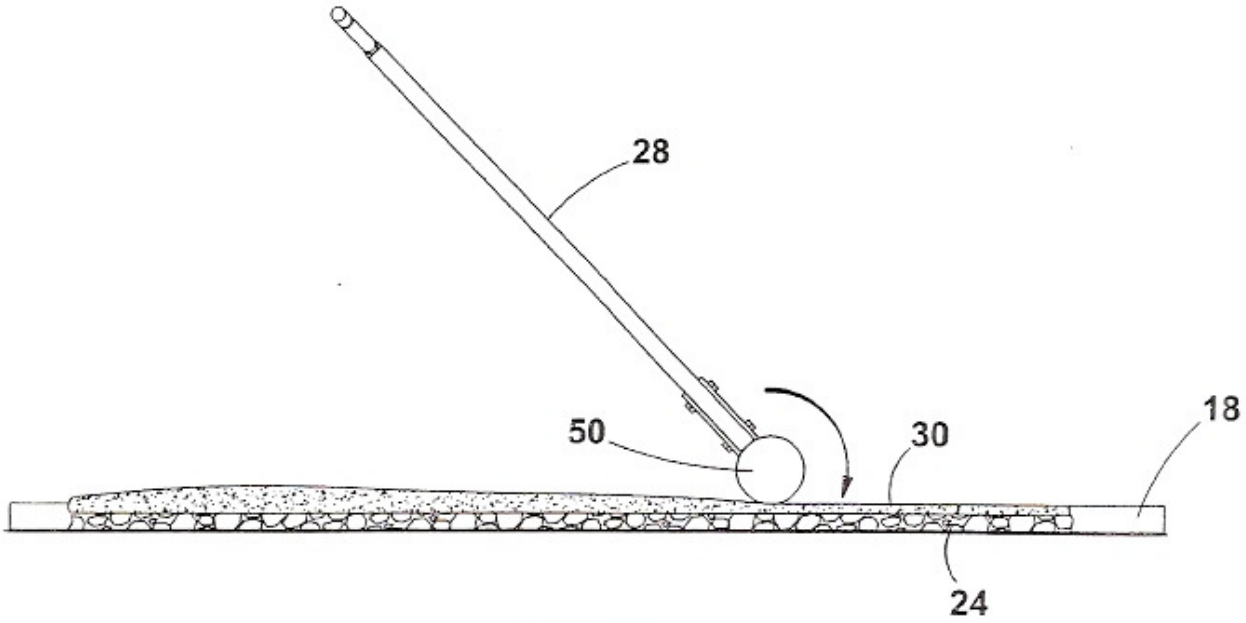


FIGURE 3d