(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 449 964 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
25.08.2004 Bulletin 2004/35

(51) Int Cl.[7]: **E01F 9/08**

(21) Application number: **03075511.0**

(22) Date of filing: **21.02.2003**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IT LI LU MC NL PT SE SI SK TR
Designated Extension States:
AL LT LV MK RO

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(54) Re-establishing of the reflectiveness of a surface marking material with reflective beads

(57) A method and a device is disclosed for re-establishing the reflectiveness of a surface marking material with reflective beads therein, such as a road surface marking material, as well as the use of compositions to perform the re-establishment.

The preferred embodiment disclosed comprises the steps to dissolve the top layer of the matrix material in which the beads are contained by means of a liquid and mechanical affecting of the material, followed by a water flushing to remove the remains of said first liquid material and the resolved matrix material. The uncovered beads are then polished by applying a second liquid to emulsify the remaining matrix material left on the beads and polish by means of rotation brushes, where after the emulsion is removed by suction.

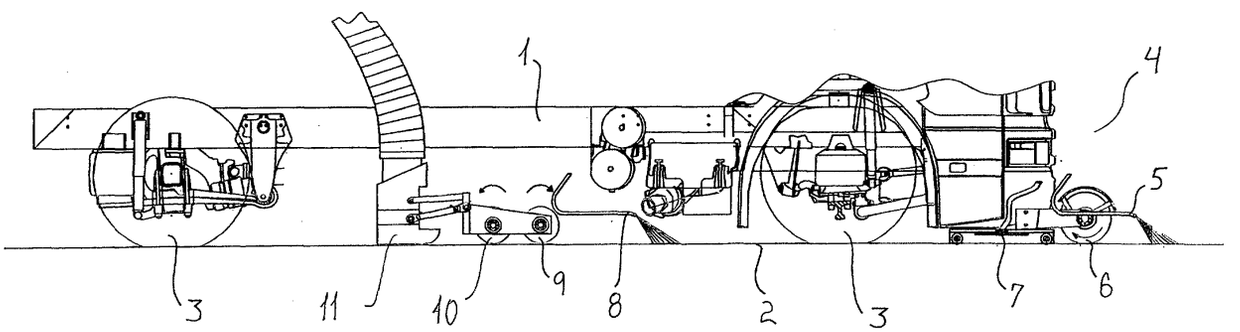

Fig. 1

EP 1 449 964 A1

Description

[0001] A method and a device is disclosed for re-establishing the reflectiveness of a surface marking material with reflective beads therein, such as a road surface marking material, as well as the use of compositions to perform the re-establishment.

[0002] The preferred embodiment disclosed comprises the steps to dissolve the top layer of the matrix material in which the beads are contained by means of a liquid and mechanical affecting of the material, followed by a water flushing to remove the remains of said first liquid material and the resolved matrix material. The uncovered beads are then polished by applying a second liquid to emulsify the remaining matrix material left on the beads and polish by means of rotation brushes, where after the emulsion is removed by suction.

BACKGROUND

[0003] Reflective surface marking materials are used to for surface markings on e.g. roads and runways. A very popular type of material comprises reflective beads, such as glass beads, contained in a solidifying matrix material, typically containing a binder of one or more types of resin, so that the markings may be laid in a liquid form that solidifies to a solid marking that is reflective. The reflectiveness of the beads in the surface deteriorates over time due to wear on the markings, and the beads become dirty and scratched or are crushed. Ordinary wash of the road markings improves the reflectiveness some, but today the markings are replaced when the reflectiveness is below an acceptable level. The old markings are peeled off the road surface, optionally after a heating to soften the marking material, and new markings are laid instead.

[0004] The replacement operation is costly to perform and constitutes a significant part of the maintenance costs of roads, as the marking material is worn down relatively fast.

[0005] Thus, it is an object of the present invention to extend the time between replacement operations, i.e. to prolong the lifetime of the surface marking material.

[0006] This object is achieved by the method according to the present invention, in which the reflectiveness of a surface material comprising reflective beads contained in a solidified matrix material is re-established by dissolving a top layer of the matrix material by applying a first liquid material to the surface material, uncovering the reflective beads of the surface material by applying a first mechanically affect to the surface material, and by polishing the uncovered reflective beads. Thereby, new reflective beads are present and polished in the top surface of the surface marking material. The polishing of the uncovered surface of the surface marking material so as to polish the uncovered reflective beads has proven to be essential to obtain the desired reflectiveness. By this method, the reflectiveness of the surface marking material may be re-established 2-4 times before it is necessary to replace the material, and the lifetime of the marking is thus prolonged to 3-5 times the original one. Preferred embodiments of the invention and various improvements of the basic invention are disclosed and discussed below.

DESCRIPTION OF THE INVENTION

[0007] The present invention relates in a first aspect to a method of re-establishing the reflectiveness of a surface marking material comprising reflective beads contained in a solidified matrix material. The reflective beads are typically glass beads with a diameter of about 0.5 mm, and the matrix material typically comprises solidifying resin or a similar material. The method comprises the steps of

dissolving a top layer of the matrix material by applying a first liquid material to the surface material,

uncovering reflective beads of the surface material by applying a first mechanically affect to the surface of the material, and

polishing the uncovered reflective beads.

[0008] The first liquid material has properties that together with the mechanical affect of the surface of the material cause the effect that the top layer of the material is dissolved.

[0009] It is advantageous to include the step of flushing the surface material after the reflective beads are uncovered and prior to the polishing by applying water, e.g. by means of rotating high-pressure nozzles, so as to at least partly remove the remains of said first liquid material and the resolved matrix material prior to the polishing of the uncovered reflective beads and to stop the dissolving of the matrix material. Thereby, the result of the polishing is improved and the use of an optional second liquid material to facilitate the polishing of the reflective beads, which is another advantageous step that may be included, is reduced. The desired feature of the optional second liquid is that it acts as soap or a degreasing agent that emulsifies the remains of the matrix material left on the reflective beads so that they may be removed to leave the beads with a clean and reflective surface.

[0010] The first mechanically affect may by provided by means of cylindrical brushing means rotated about its longitudinal axis being substantially parallel to the plane of the surface material.

[0011] The remain of said second liquid material with the material removed by the polishing contained therein should be substantially removed from the marking after the polishing. This is preferably performed by means of applying suction subsequent to said polishing so that the environment is not subjected to the liquid with its contain of environmentally hostile substances.

[0012] The polishing may advantageously be provided by means of two cylindrical brushes counter-rotating towards each other, i.e. the bristles are moving towards

each other at the surface of the marking material, about their longitudinal and substantially parallel axes, which are substantially parallel to the plane of the surface material. The axis should be substantially perpendicular to the direction in which the device performing the present method is moved, so that dirt from the surface next to the marking material is not dragged onto the marking material by the brushes. By letting the brushes counter-rotate as described, the second liquid is to a certain degree held in the area between the brushes, whereby its full polishing effect is made use of and the consumption of the second liquid in the operation is minimized.

[0013] The matrix material to which the present method is applied comprises preferably at least 10% by weight of resin, more preferred up to 20% by weight of resin and most preferred up to 30% by weight of resin. The resin is preferably a mixture of resins in which one or more artificial resins are used, in particular aliphatic hydrocarbon resin, but also e.g. natural resins and polyamide resin may be employed.

[0014] Also, the matrix material to which the present method is applied comprises preferably at least 20% by weight of reflective beads.

[0015] A preferred composition of the first liquid material comprises at least 20% by weight of 2-Methoxy-methylethoxy-propanol, from 10 to 40% by weight of 1-Methoxy-2-propanol and up to 20% by weight of n-Methyl-2-pyrrolidon. More preferred, the first liquid material is a composition comprising at least 30% by weight of 2-Methoxy-methylethoxy-propanol. Alternatively or additionally, the first liquid material is a composition comprising from 20 to 30% by weight of 1-Methoxy-2-propanol.

[0016] In particular, the first liquid material may comprise up to 10% by weight of n-Methyl-2-pyrrolidon, and in a further preferred embodiment, the first liquid material comprises at least 4% by weight and preferably at least 7% by weight of n-Methyl-2-pyrrolidon.

[0017] A preferred composition of the second liquid material comprises up to 25% by weight of non-ionic surfactants and up to 10% by weight of aliphatic hydrocarbons. The remaining part of the composition is typically water.

[0018] In a preferred embodiment of the method, the composition comprises up to 15% by weight of non-ionic surfactants and in a further preferred embodiment, it comprises at least 7% by weight, preferably at least 10% by weight, of non-ionic surfactants.

[0019] According to a yet further preferred embodiment, the composition of the second liquid material comprises up to 5% by weight of aliphatic hydrocarbons, and in another yet further embodiment, the composition comprises at least 2% by weight, preferably at least 3.5% by weight, of aliphatic hydrocarbons.

[0020] The present invention relates in a second aspect to the use of a composition comprising at least 20% by weight of 2-Methoxy-methylethoxy-propanol, from 10 to 40% by weight of 1-Methoxy-2-propanol and up to 20% by weight of n-Methyl-2-pyrrolidon for dissolving a top layer of a solidified matrix material comprising reflective beads, e.g. the types disclosed previously, so as to enable uncovering of reflective beads.

[0021] The composition according to the second aspect comprises in a preferred embodiment at least 30% by weight of 2-Methoxy-methylethoxy-propanol, and in a further preferred embodiment from 20 to 30% by weight of 1-Methoxy-2-propanol.

[0022] In a yet further embodiment the composition comprises up to 10% by weight of n-Methyl-2-pyrrolidon, and in another preferred embodiment, the composition comprises at least 4% by weight and preferably at least 7% by weight of n-Methyl-2-pyrrolidon.

[0023] In a third aspect, the present invention relates to the use of a composition comprising up to 25% by weight of non-ionic surfactants and up to 10% by weight of aliphatic hydrocarbons for facilitating polishing of reflective beads uncovered from a solidified matrix material, e.g. of the type disclosed previously and comprising said reflective beads.

[0024] The composition according to said third aspect of the invention may comprise up to 15% by weight of non-ionic surfactants, and in a preferred embodiment at least 7% by weight, preferably at least 10% by weight, of non-ionic surfactants. In a yet further embodiment, the composition comprises up to 5% by weight of aliphatic hydrocarbons, and in another preferred embodiment, the composition comprises at least 2% by weight, preferably at least 3.5% by weight, of aliphatic hydrocarbons.

[0025] The present invention relates in a fourth aspect to a device for re-establishing the reflectiveness of a road surface marking material and designed for being mounting on a vehicle having a main direction of movement, the device comprising, arranged in a row starting from the front end of the vehicle,

an applicator for applying a first liquid to a line of the surface material,

brush means to uncover reflective beads of the surface material by applying a first mechanically affect to the surface material,

a second applicator for applying a second liquid to the line of the surface material, and

polishing means to polish the uncovered reflective beads.

[0026] It is preferred that the device comprises a water applicator arranged between the brush means and the second applicator, the water applicator being adapted for flushing the road marking with water, so as to at least partly remove the remains of said first liquid material and the dissolved matrix material prior to the polishing of the uncovered reflective beads. A particularly suitable water applicator comprises a number of rotating high-pressure nozzles to eject water at a speed that effects a thorough flushing of the surface of the marking material.

[0027] The brush means may comprise cylindrical

brushing means and means for rotating the brushing means about its longitudinal axis being substantially parallel to the plane of the surface material.

[0028] The polishing means may preferably comprise two cylindrical brushes counter-rotating towards each other about their longitudinal and substantially parallel axes, which are substantially parallel to the plane of the surface material.

[0029] It is furthermore preferred that the device comprises suction means arranged after the polishing means to remove remains of said second liquid material subsequent to said polishing.

DESCRIPTION OF AN EMBODIMENT OF THE PRESENT INVENTION

[0030] A device being a specific embodiment of the present invention is for illustrative purposes described below with reference to the enclosed drawing of which Fig. 1 is a side view of the device mounted to the side of a vehicle. The vehicle will move from left to right during operation of the device.

[0031] The side of a vehicle 1 is partly shown with its wheels 3 supported on the road 2. On the side of the vehicle 1 is at the front end 4 mounted a first nozzle 5 for applying a first liquid composition to a marking on the road 2. A cylindrical brush 6 with steel fibre bristles follows the nozzle 5. The brush 6 is depicted from the end and is rotated in the counter-clockwise direction as indicated by the arrow by means of drive means. The axis of rotation of the brush 6 is parallel to the road 2 and substantially perpendicular to the direction of movement of the vehicle 1. Thereby, it is prevented that dirt from the road surface 2 next to the marking will be transferred to the marking by the brush and contaminate the marking and the first liquid. The dissolved marking material and the first liquid is substantially flushed from the marking by means of water from the rotating high-pressure water nozzles 7 arranged after the brush 6.

[0032] A second nozzle 8 is arranged for applying a second liquid to the marking material and a set of counter-rotating brushes 9, 10 are arranged to polish the reflective beads that have been uncovered. The first brush 9 has steel fibre bristles and the second brush 10 has Tampico fibre bristles, and they rotate towards each other, i.e. the bristles move towards each other at the surface of the marking material. The axes of rotation are perpendicular to the direction in which the vehicle 1 moves, so that dirt from the road surface 2 next to the marking material is not dragged onto the marking material by the brushes 9, 10. By letting the brushes 9, 10 counter-rotate as described, the second liquid is to a certain degree held in the area between the brushes, whereby its full polishing effect is made use of and the consumption of the second liquid in the operation is minimized.

[0033] A suction head 11 is arranged after the brushes 9, 10 to remove the second liquid with the remainder of the matrix material emulsified in it.

[0034] A typical road surface marking material is a composition of 1-10% by weight of mineral oil, 10-30% by weight of binder material, 20-70% by weight of reflective glass beads, 0.5-15% by weight of titanium dioxide and 30-60% by weight of mineral filler. The ratio of the different compounds is adjusted to obtain the required features for a specific use of the surface marking material. The binder material is a mixture of artificial resins or a mixture of artificial and natural resins, of which an aliphatic hydrocarbon resin constitutes the major part. The reflective glass beads are made from a soda lime glass, of which the main components are 70-73 % by weight of silicon dioxide, 13-15% by weight of sodium oxide and 7-11% by weight of calcium oxide. The diameter of the beads is mainly in the range of 0.425 to 0.85 mm. Further pigment may be added besides titanium dioxide to obtain a desired colour different from white of the marking material.

[0035] The operation of the device is as follows: The vehicle 1 moves along the road surface marking with a velocity of about 5 km/h, and the first nozzle 5 applies a layer of a first liquid to the surface marking. The first liquid is a composition of at least 30% by weight of 2-Methoxy-methylethoxy-propanol, from 20 to 30% by weight of 1-Methoxy-2-propanol, up to 10% by weight of n-Methyl-2-pyrrolidon and less than 2.5% by weight of D-Limonen, the last ingredients is mainly added for providing a pleasant odour of the composition.

[0036] The first liquid dissolves the binder component of the marking material and makes it possible for the brush 6 to loosen a top layer thereof. The main part of the mixture of the first liquid and the dissolved and loosened marking material is removed from the road marking by the rotating high-pressure water nozzles 7, and the water neutralises the active components of the first liquid so that the impact on the environment is substantially eliminated.

[0037] A thin layer of more or less dissolved matrix material on the reflective beads that was uncovered when the top layer of the marking material was removed reduces now the reflectiveness of the beads. In order to remove this layer, a second liquid is sprayed onto the road marking by means of the second nozzle 8. The second liquid has emulsifying properties such as soap or a degreasing agent that emulsifies the remains of the matrix material left on the reflective beads so that they may be removed to leave the beads with a clean and reflective surface. The second liquid used in the present embodiment is a composition comprising up to 15% by weight of non-ionic surfactants, up to 5% by weight of aliphatic hydrocarbons and water.

[0038] The newly uncovered surface of the marking material is polished by the two rotating brushes 9, 10 whereby the thin layer of material on the beads is loosened and emulsified by the second liquid. This emulsion is finally removed from the road marking by the suction head 11, leaving the surface of the reflective beads

clean. The suction head 11 removes in the same operation, due to the wideness of the head, most of the dissolved surface marking material that was flushed from the road marking by the rotating high-pressure water nozzles 7. Further suction heads may be arranged along the sides of or after the water nozzles 7 to remove the dissolved surface marking material more efficiently. Thus, the described operation restores or re-establishes the reflectiveness of the surface marking material with reflective beads.

Claims

1. A method of re-establishing the reflectiveness of a surface marking material comprising reflective beads contained in a solidified matrix material, the method comprising the steps of

   dissolving a top layer of the matrix material by applying a first liquid material to the surface material,

   uncovering reflective beads of the surface material by applying a first mechanically affect to the surface of the material, and

   polishing the uncovered reflective beads.

2. A method according to claim 1, wherein water is applied to flush the surface material after the reflective beads are uncovered and prior to the polishing, so as to at least partly remove the remains of said first liquid material and the resolved matrix material prior to the polishing of the uncovered reflective beads.

3. A method according to claim 1 or 2, wherein said first mechanically affect is provided by means of cylindrical brushing means rotated about its longitudinal axis being substantially parallel to the plane of the surface material.

4. A method according to any of the preceding claims, wherein a second liquid material is applied to the surface material, so as to facilitate the polishing of the reflective beads.

5. A method according to claim 4, wherein the remain of said second liquid material is substantially removed by means of suction subsequent to said polishing.

6. A method according to claim 4 or 5, wherein the polishing is provided by means of two cylindrical brushes counter rotating towards each other about their longitudinal and substantially parallel axes, which are substantially parallel to the plane of the surface material.

7. A method according to any of the preceding claims, wherein said matrix material comprises at least 10% by weight of resin, preferably up to 20% by weight of resin.

8. A method according to any of the preceding claims, wherein the matrix material comprises at least 20% by weight of reflective beads.

9. A method according to any of the preceding claims, wherein said first liquid material is a composition comprising at least 20% by weight of 2-Methoxy-methylethoxy-propanol, from 10 to 40% by weight of 1-Methoxy-2-propanol and up to 20% by weight of n-Methyl-2-pyrrolidon.

10. A method according to claim 9, wherein said first liquid material is a composition comprising at least 30% by weight of 2-Methoxy-methylethoxy-propanol.

11. A method according to claim 9 or 10, wherein said first liquid material is a composition comprising from 20 to 30% by weight of 1-Methoxy-2-propanol.

12. A method according to any of claims 9-11, wherein said first liquid material is a composition comprising up to 10% by weight of n-Methyl-2-pyrrolidon.

13. A method according to any of claims 9-12, wherein said first liquid material is a composition comprising at least 4% by weight and preferably at least 7% by weight of n-Methyl-2-pyrrolidon.

14. A method according to any of claims 4-13, wherein said second liquid material is a composition comprising up to 25% by weight of non-ionic surfactants and up to 10% by weight of aliphatic hydrocarbons.

15. A method according to claim 14, wherein the second liquid material is a composition comprising up to 15% by weight of non-ionic surfactants.

16. A method according to claim 14 or 15, wherein the second liquid material is a composition comprising at least 7% by weight, preferably at least 10% by weight, of non-ionic surfactants.

17. A method according to any of claims 14-16, wherein the second liquid material is a composition comprising up to 5% by weight of aliphatic hydrocarbons.

18. A method according to any of claims 14-17, wherein the second liquid material is a composition comprising at least 2% by weight, preferably at least 3.5% by weight, of aliphatic hydrocarbons.

19. Use of a composition comprising at least 20% by weight of 2-Methoxy-methylethoxy-propanol, from 10 to 40% by weight of 1-Methoxy-2-propanol and

up to 20% by weight of n-Methyl-2-pyrrolidon for dissolving a top layer of a solidified matrix material comprising reflective beads, so as to enable uncovering of reflective beads.

20. Use according to claim 19, wherein the composition comprises at least 30% by weight of 2-Methoxy-methylethoxy-propanol.

21. Use according to claim 19 or 20, wherein the composition comprises from 20 to 30% by weight of 1-Methoxy-2-propanol.

22. Use according to any of claims 19-21, wherein the composition comprises up to 10% by weight of n-Methyl-2-pyrrolidon.

23. Use according to any of claims 19-22, wherein the composition comprises at least 4% by weight and preferably at least 7% by weight of n-Methyl-2-pyrrolidon.

24. Use according to any of claims 19-23, wherein said matrix material comprises at least 10% by weight of resin, preferably at least 20% by weight of resin.

25. Use according to any of claims 19-24, wherein the matrix material comprises at least 20% by weight of reflective beads.

26. Use of a composition comprising up to 25% by weight of non-ionic surfactants and up to 10% by weight of aliphatic hydrocarbons for facilitating polishing of reflective beads uncovered from a solidified matrix material comprising said reflective beads.

27. Use according to claim 26, wherein the composition comprises up to 15% by weight of non-ionic surfactants.

28. Use according to claim 26 or 27, wherein the composition comprises at least 7% by weight, preferably at least 10% by weight, of non-ionic surfactants.

29. Use according to any of claims 26-28, wherein the composition comprises up to 5% by weight of aliphatic hydrocarbons.

30. Use according to any of claims 26-29, wherein the composition comprises at least 2% by weight, preferably at least 3.5% by weight, of aliphatic hydrocarbons.

31. Device for re-establishing the reflectiveness of a road surface marking material and designed for being mounting on a vehicle having a main direction of movement, the device comprising, arranged in a row starting from the front end of the vehicle,

an applicator for applying a first liquid to a line of the surface material,

brush means to uncover reflective beads of the surface material by applying a first mechanically affect to the surface material,

a second applicator for applying a second liquid to the line of the surface material, and

polishing means to polish the uncovered reflective beads.

32. Device according to claim 31, comprising a water applicator arranged between the brush means and the second applicator, the water applicator being adapted for flushing the surface material water, so as to at least partly remove the remains of said first liquid material and the resolved matrix material prior to the polishing of the uncovered reflective beads.

33. Device according to claim 31 or 32, wherein said brush means comprises cylindrical brushing means and means for rotating the brushing means about its longitudinal axis being substantially parallel to the plane of the surface material.

34. Device according to any of claims 31-33, wherein the polishing means comprises two cylindrical brushes counter rotating towards each other about their longitudinal and substantially parallel axes, which are substantially parallel to the plane of the surface material.

35. Device according to any of claims 31-34 comprising suction means arranged after the polishing means to remove remains of said second liquid material subsequent to said polishing.

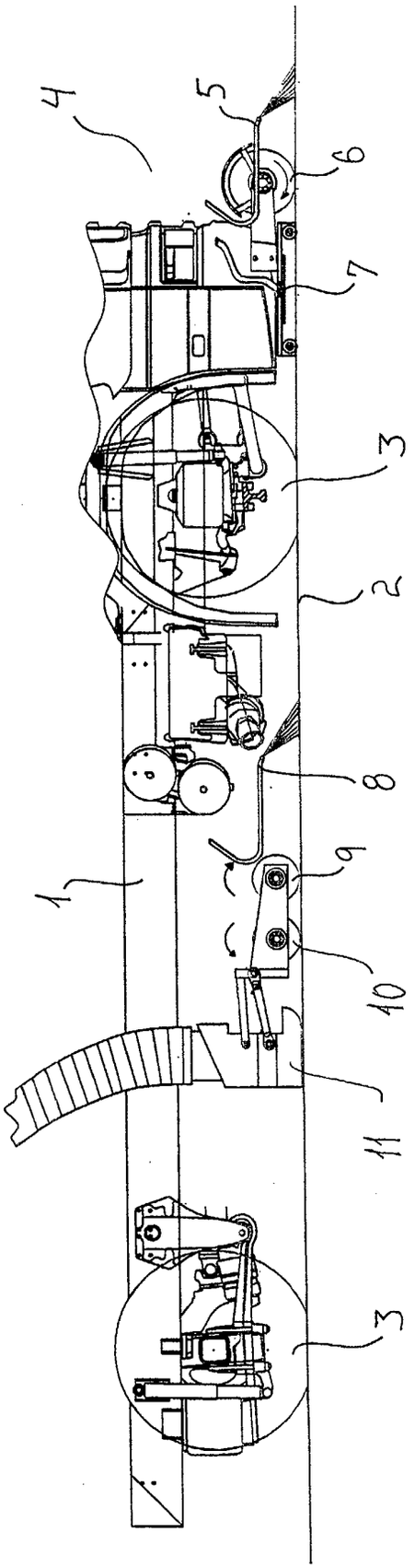

Fig. 1

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EUROPEAN SEARCH REPORT

Application Number
EP 03 07 5511

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TECHNICAL FIELDS SEARCHED (Int.Cl.7)

E01F
G02B
C11D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	25 July 2003	Grittern, A

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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