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(54) **SOIL COMPACTOR FOR COMPACTING SOIL MATERIAL AND METHOD FOR OPERATING SUCH A SOIL COMPACTOR**

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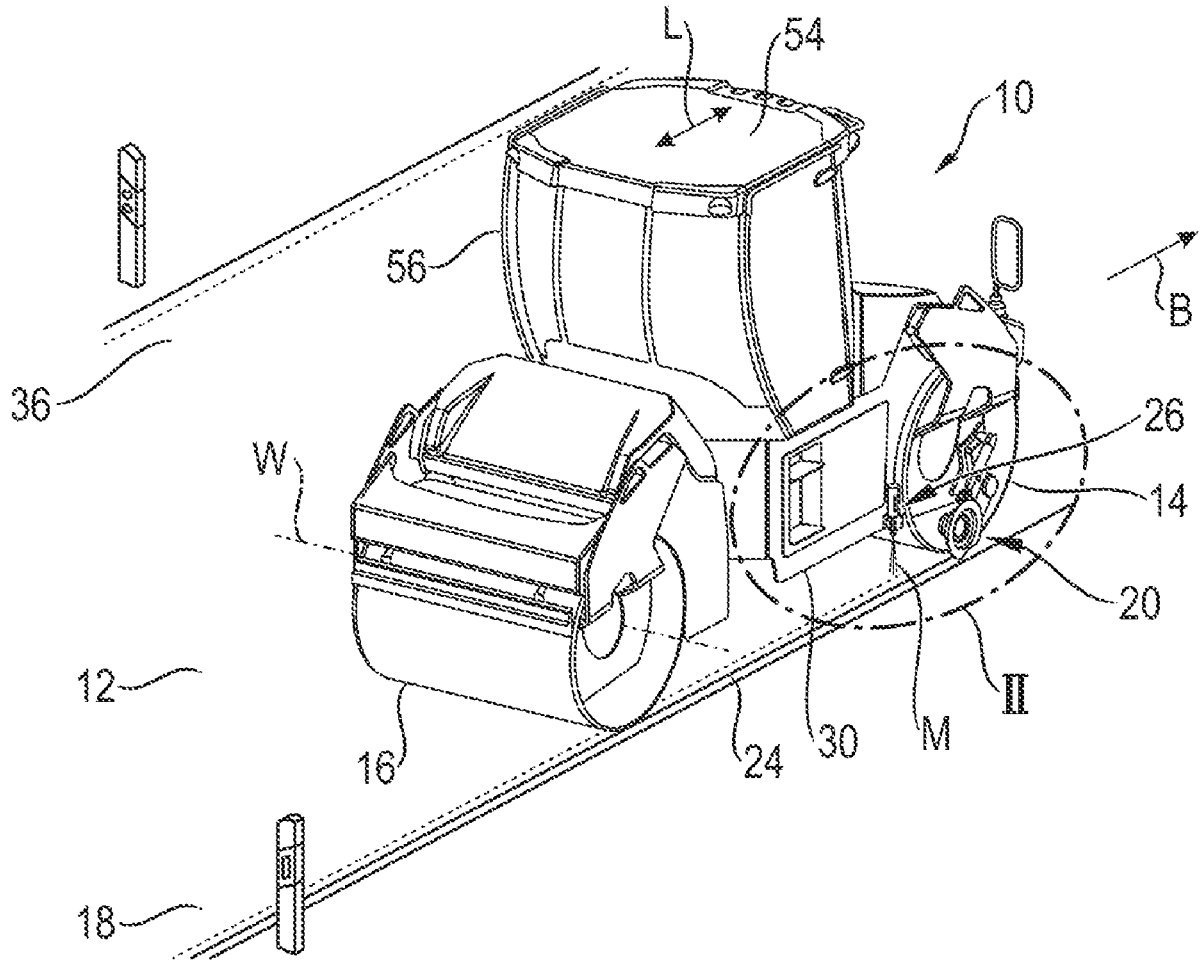
(57) **ABSTRACT**

A soil compactor for compacting soil material, in particular asphalt, comprises at least one compactor roller (**14**, **16**) which is rotatable on a compactor structure (**30**) around a roller axis of rotation (W) which is essentially orthogonal to a compactor longitudinal direction (L) and at least one marking unit (**26**, **26'**) carried on the compactor structure (**30**) for applying marking material (M) to soil material (**12**) driven over by the soil compactor (**10**).



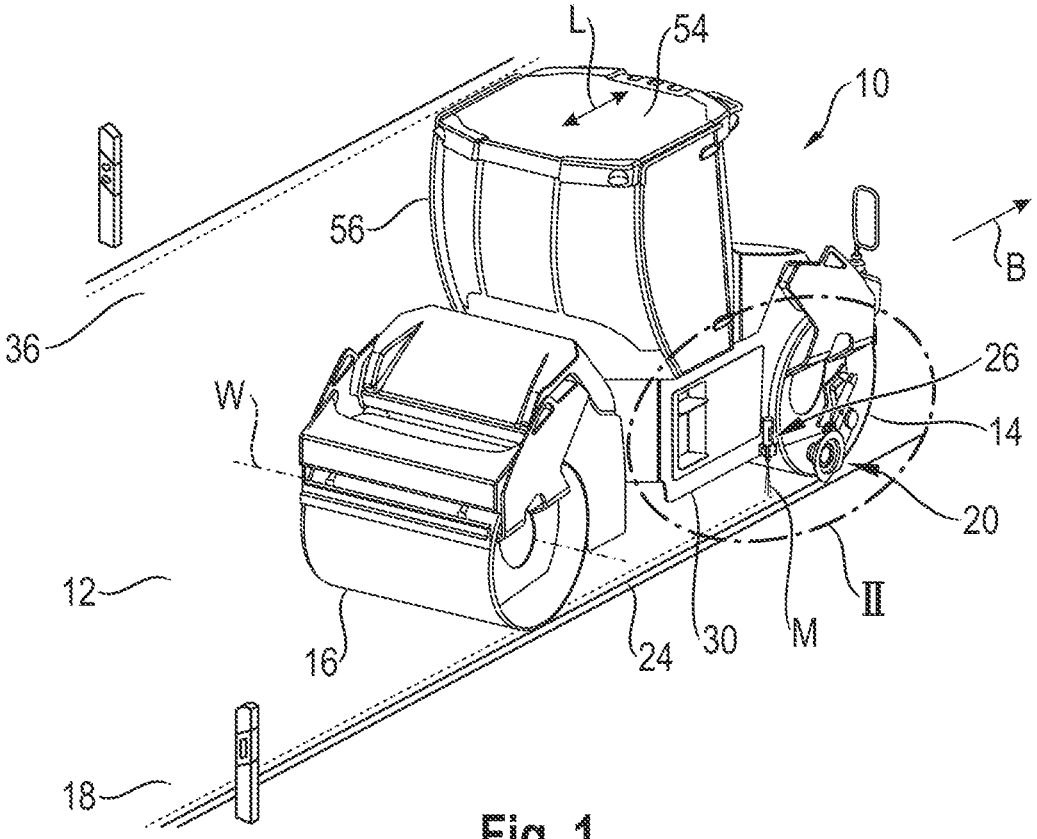

L
54
10
56
B
36
26
W
14
20
12
II
16
24
30
M
18

Fig. 1

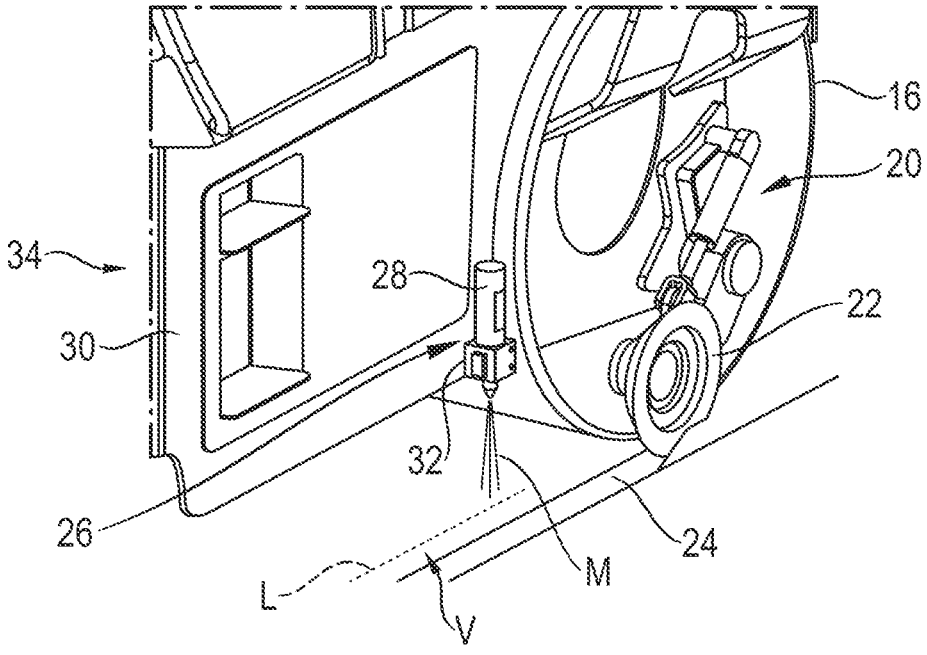

16
20
34
28
22
30
32
26
24
M
L
V

Fig. 2

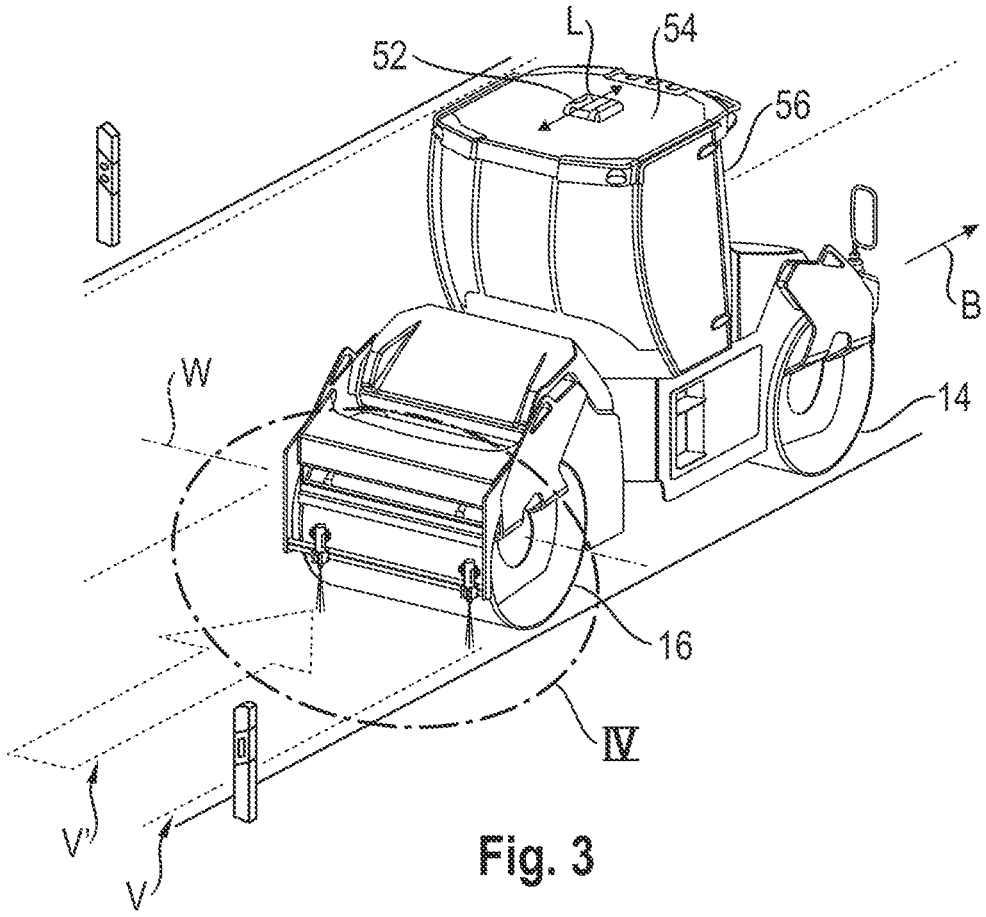


Fig. 3

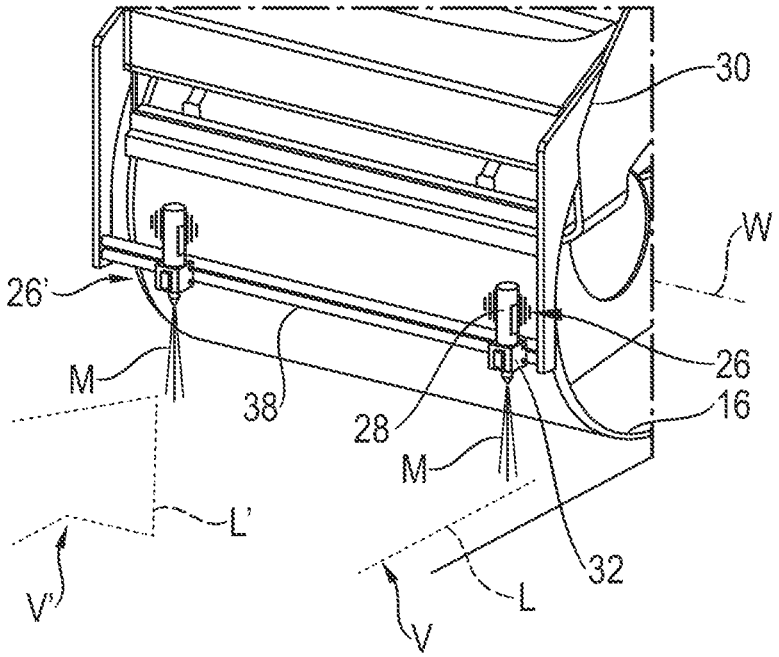


Fig. 4

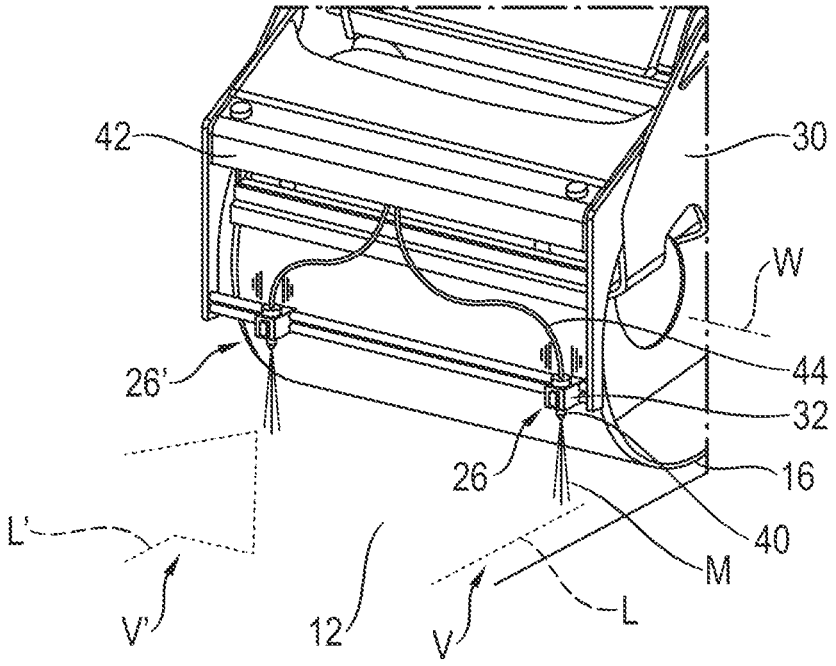

42
30
W
26'
44
32
26
16
L'
40
M
V'
12
V
L

Fig. 5

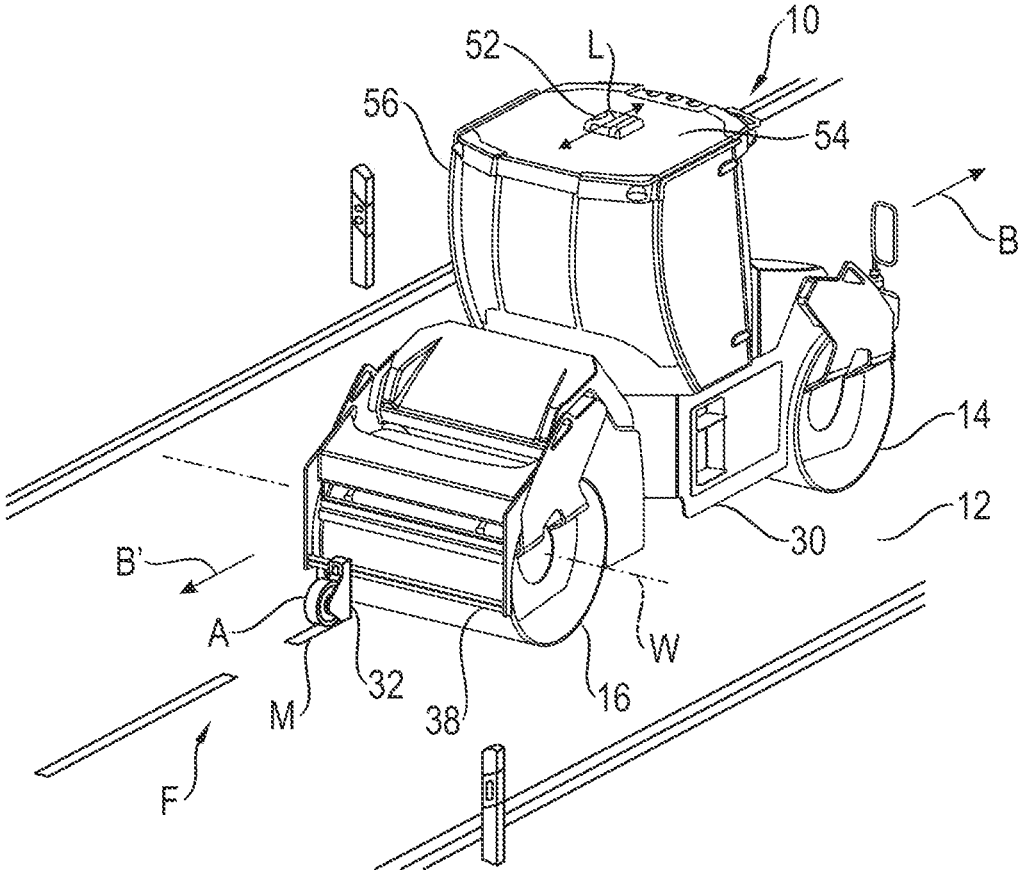

52
L
10
56
54
B
14
12
30
B'
A
W
32
M
38
16
F

Fig. 6

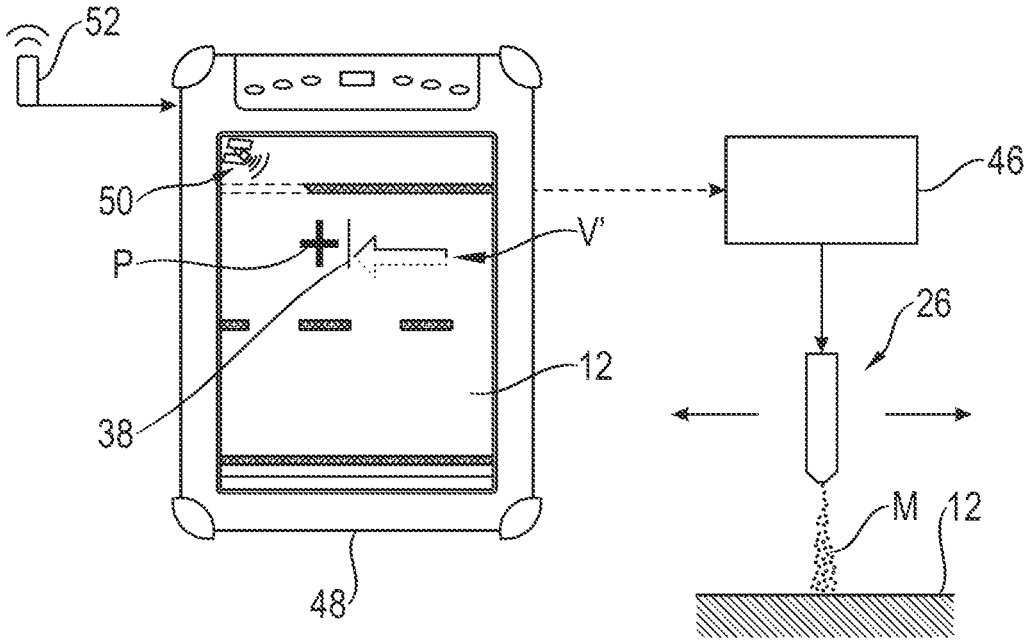


Fig. 7

SOIL COMPACTOR FOR COMPACTING SOIL MATERIAL AND METHOD FOR OPERATING SUCH A SOIL COMPACTOR

[0001] The present invention relates to a soil compactor using which soil material, in particular asphalt, can be compacted. The invention furthermore relates to a method for operating such a soil compactor.

[0002] In road construction or in the production of runways at airports or the like, applying markings, also generally referred to as road markings, after the soil, which is generally built up with asphalt material and compacted by one or more soil compactors, has been produced is known. For this purpose, for example, pre-markings are applied by means of special devices, which show the course of the road markings to be applied in a further work step using comparatively thin and, for example, only interrupted guidelines. Liquid marking material can be used to apply the pre-markings as well as the road markings, which is sprayed or applied onto the previously compacted soil material. Particularly in the area of construction sites, creating temporary road markings by applying marking material designed as roll-off strips in the manner of adhesive strips is also known.

[0003] It is the object of the present invention to provide a soil compactor and a method for operating a compactor, using which a simplified production of a soil structure is made possible.

[0004] According to a first aspect of the present invention, this object is achieved by a soil compactor for compacting soil material, in particular asphalt, comprising at least one compactor roller which is rotatable on a compactor structure around a roller axis of rotation which is essentially orthogonal to a compactor longitudinal direction, furthermore comprising at least one marking unit carried on the compactor structure for applying marking material to soil material driven over by the soil compactor.

[0005] Since in the production of a soil structure, for example in road construction, the compaction of the soil material, generally asphalt, is the last or one of the last work steps, a soil compactor designed according to the invention can also be used at the same time to apply marking material to the surface of the soil material, for example, during the last or one of the last passes for compacting the soil material. Additional work processes or additional equipment for this work step are then not required.

[0006] In a design that is easy to implement and supports defined positioning of the dispensed marking material, at least one marking unit can be carried on the compactor structure in a substantially immovable manner.

[0007] In order to achieve access in particular also to lateral edge regions of the compacted soil material, it is proposed that at least one marking unit, which is carried on the compactor structure in a substantially immovable manner, be carried on a side edge region of the compactor structure.

[0008] An edge pressing unit can be provided on the compactor structure in association with at least one side edge region. In particular in conjunction with a marking unit that is immovably carried on a side edge region of the compactor structure, it is thus ensured that a fixed predetermined distance between the edge pressing unit and this marking unit transverse to the longitudinal direction of the compactor results in a correspondingly defined predetermined distance of the applied marking material to the lateral edge of the compacted soil material.

[0009] In order to be able to create more complex forms of road markings, it is proposed that at least one marking unit be movably carried on the compactor structure.

[0010] For this purpose, for example, at least one guide rail can be provided on the compactor structure, and at least one, preferably each marking unit movably carried on the compactor structure can be movable along the at least one guide rail.

[0011] In order to be able to arrange a marking unit carried on a guide rail in different positions for dispensing marking material, a marking unit drive for moving the marking unit along the at least one guide rail can be provided in association with at least one, preferably each marking unit movable along the at least one guide rail.

[0012] Substantially the entire width of the soil material covered by a soil compactor or traversed during a pass can then be used to dispense marking material if at least one, preferably each guide rail extends essentially in the direction of the roller axis of rotation, and/or if at least one, preferably each guide rail is arranged in the compactor longitudinal direction following a compactor roller.

[0013] In particular for applications with a smaller scope or for applying guidelines for pre-markings, at least one, preferably each marking unit can comprise a spray can containing liquid marking material.

[0014] For a larger scope of work or also for applying the final road markings, it is advantageous if at least one, preferably each marking unit comprises a spray head and at least one marking material tank connected to the spray head for supplying liquid marking material is provided on the compactor structure.

[0015] At least one, preferably each, marking unit can be designed to apply a pre-marking to the soil material. Alternatively or additionally, at least one, preferably each marking unit can be designed to apply a road marking to the soil material.

[0016] In order to be able to create non-permanent road markings, for example in the area of construction sites, it is proposed that at least one, preferably each marking unit for applying marking material be designed as an unrolling tape.

[0017] For a defined operation of the at least one marking unit, it is proposed that this, preferably each marking unit, is controlled by a control unit and can be operated by outputting control commands from the control unit to dispense marking material.

[0018] According to a further aspect of the present invention, the object stated at the outset is achieved by a method for operating a soil compactor constructed according to the invention, wherein when the soil compactor is moved over the soil material, at least one marking unit is operated to apply marking material to the soil material.

[0019] For example, when creating the edge regions of a roadway constructed, for example, using asphalt, if an edge pressing unit is operated to form an edge of the soil material driven over by the soil compactor, at least one marking unit can be operated to apply marking material to the soil material as an edge marking. It can thus be ensured that marking material applied during this process has a defined distance from an edge of the soil material created by the edge pressing unit.

[0020] If a marking unit for applying marking material is operated as an unrolling tape, it is advantageous if the marking unit is arranged in front of at least one compactor roller in a direction of movement of the soil compactor.

Thus, the unrolling tape dispensed by the marking unit is rolled over by the soil compactor immediately after it is dispensed and pressed firmly against the surface of the soil material that is also compacted at the same time.

[0021] In particular for creating complexly shaped pre-markings, it is proposed that when at least one marking unit is operated for applying marking material for a pre-marking:

[0022] a part of the pre-marking is created during one marking pass and another part of the pre-marking is created during a further marking pass, and/or

[0023] a part of the pre-marking is created by one marking unit and another part of the pre-marking is created by a further marking unit.

[0024] In order to ensure that marking material is only dispensed where a road marking is supposed be present according to previous planning, it can be provided that at least one, preferably each marking unit for applying marking material to the soil material is operated based on position data representing a position of the soil compactor on the soil material, preferably GPS data, and/or based on marking model data.

[0025] The present invention is described in detail below with reference to the attached figures. In the figures:

[0026] FIG. **1** shows a soil compactor when carrying out a compaction process with simultaneous application of marking material;

[0027] FIG. **2** shows detail Il in FIG. **1** enlarged;

[0028] FIG. **3** shows an alternative embodiment of a soil compactor when carrying out a compaction process with simultaneous application of marking material;

[0029] FIG. **4** shows detail IV in FIG. **3** enlarged;

[0030] FIG. **5** shows a view corresponding to FIG. **4** of an alternative embodiment;

[0031] FIG. **6** shows an alternative embodiment of a soil compactor when carrying out a compaction process with simultaneous application of marking material;

[0032] FIG. **7** shows in principle the control of a marking unit for applying marking material to soil.

[0033] FIG. **1** shows a soil compactor **10** used in road construction in the illustrated embodiment, which drives over soil material **12** to be compacted, for example asphalt, and thereby compacts it. The soil compactor **10** is basically elongated in a compactor longitudinal direction L and, in the exemplary embodiment shown, comprises two compactor rollers **14**, **16** arranged at a distance from one another in the direction of the compactor longitudinal direction L. The soil compactor **10** shown in FIG. **1** moves in the state shown in FIG. **1** in a direction of movement B along the soil material **12**, in particular in an edge region **18** thereof.

[0034] In the work step shown in FIG. **2**, which is one of the last passes or the last pass over the soil material **12** to be compacted, the edge **24** of the soil material **12** is shaped in particular by pressing on the soil material **12** present in this area using an edge pressing unit **20** provided on the soil compactor **10** in the edge region **18** of the soil material **12** by means of a correspondingly shaped shaping tool **22**.

[0035] A marking unit generally designated by **26** is provided on the soil compactor **10**. In the illustrated exemplary embodiment, the marking unit **26** comprises a container for liquid marking material M constructed in the manner of a spray can **28**. The spray can **28** is carried interchangeably on a carrier **32** fixed on a compactor structure **30** of the soil compactor **10**, so that when the marking material M contained in the spray can **28** is completely dispensed, the spray can **28** can be replaced by a new spray can.

[0036] As shown in FIGS. **1** and **2**, by dispensing marking material M onto the surface of the soil material **12** compacted by the soil compactor **10** and processed in the edge region **18** to form the edge **24**, a guideline L of a pre-marking V, which is interrupted, for example, in the direction of movement B, is created. Since the marking unit **26** is fixedly carried on the compactor structure **30** in a side edge region **34** of the soil compactor **10** and thus has a defined, unchangeable distance from the edge pressing unit **20** transversely to the compactor longitudinal direction L and essentially in the direction of a roller axis of rotation W of the two compactor rollers **14**, **16**, the pre-marking V generated by the marking unit **26** also has a defined and constant distance from the edge **24** of the compacted soil material **12** shaped in the edge region **18**.

[0037] The marking unit **26** can be activated by an operator controlling the soil compactor **10** to create the pre-marking V, along which the actual road marking is then created, for example by a separate device. Alternatively or additionally, it is possible for the marking unit **26** to be activated automatically. For this purpose, position data, for example GPS data, which reflects the position of the soil compactor on the soil material **12** to be compacted, can be used, for example by means of a satellite-based positioning system. Furthermore, model data for the course of the soil material **12** or the roads to be produced can already be generated in the planning phase of the soil to be produced, i.e., a road in the example shown, which can also contain information about the course, for example, of the pre-marking V to be created along the edge **24** of the compacted soil material **12**. Based on the position data and the marking model data, the marking unit **26** can then be activated to dispense marking material M by a control unit provided on the soil compactor **10**.

[0038] It is to be noted that a marking unit and, if necessary, an edge pressing unit can also be arranged on the other side edge region of the soil compactor **10**, which cannot be seen in FIG. **1**, so that also during movement in a movement direction opposite to the movement direction B which can be seen in FIG. **1**, the soil compactor **10** can process the wheel region **36** shown at the rear in FIG. **1**, in particular can apply marking material M.

[0039] An alternative embodiment of a soil compactor **10** is shown in FIGS. **3** and **4**. In this soil compactor **10**, two marking units **26**, **26'** are provided following the compactor roller **16** in the compactor longitudinal direction L. The two marking units **26**, **26'** each comprise a carrier **32** which is carried on a guide rail **38** so that it is movable substantially in the direction of the roller axis of rotation W and a container in the form of a spray can **28** which contains the liquid marking material M. To move the marking units **26**, **26'** or the carrier **32** along the guide rail **38**, in association with each marking unit **26**, **26'**, a marking unit drive moving it independently from the respective other marking unit in the longitudinal direction with the guide rail **38**, thus essentially also in the direction of the roller axis of rotation W, can be provided. Such a marking unit drive can comprise a drive motor, for example an electric motor, which drives an endless belt running in the direction of the guide rail **38** to move via respective deflection rollers. A respective carrier **32** can be fixed on this endless belt.

[0040] The movability of the marking units **26**, **26'** along the guide rail **38** makes it possible to create guidelines L and L' for pre-markings V and V' with almost any shape or course. As can be seen in FIG. **4**, in particular a guideline L in an edge region **18** and a guideline L' distant from the edge region **18** can also be created. As FIGS. **3** and **4** illustrate this, in particular the guide line L' can form part of a pre-marking V', which is intended to be used to produce an arrow on the soil material **12**. When the soil compactor **10** moves in the direction of movement B, only half of this pre-marking V can be created by the marking unit **26'**. The other half can be created during another pass, for example. Alternatively, both marking units **26**, **26'** could be used to generate the entire pre-marking V' together, i.e., the outline contour of an arrow, in a single pass.

[0041] The two marking units **26**, **26'** can also be activated, for example, by an operator to apply marking material M. Alternatively or additionally, it is also possible in this embodiment to activate the two marking units **26**, **26'** to dispense marking material M, taking into consideration position data of the soil compactor **10** and a marking plan, which reflects marking model data for the application of pre-markings to the soil material **12**.

[0042] It is to be noted that, of course, a fixed marking unit that can be seen in FIG. **1** could also be provided on the soil compactor **10** of FIG. **3**, so that, for example, by means of the fixed marking unit, a pre-marking can be applied in an edge region and pre-markings having greater distance to the edge **24** of the soil material and having more complex shaping can be created by the two marking units, which are movable essentially in the direction of the roller axis of rotation W or transversely to the compactor longitudinal direction L over the entire width of the soil compactor **10**.

[0043] A modification of the exemplary embodiment shown in FIGS. **3** and **4** can be seen in FIG. **5**. In this embodiment, each of the marking units **26**, **26'** comprises a spray head **40** carried on the respective carrier **32**, via which the marking material M can be dispensed. A marking material tank **42** is also provided on the soil compactor **10**, which is connected via lines **44** to the spray heads **40** of the two marking units **26**, **26'** in order to conduct liquid marking material contained therein to the spray heads **40** of the two marking units **26**, **26'** and dispense it via them onto the soil material **12**.

[0044] The embodiment shown in FIG. **5** is particularly suitable for larger construction projects in which comparatively large quantities of marking material M are to be dispensed. In particular, the embodiment shown in FIG. **5** is also suitable for create the actual road markings themselves, without the need to previously generate pre-markings.

[0045] FIG. **6** shows an embodiment of a soil compactor, in which the marking material M is not applied to the soil material **12** in liquid form, but in the form of an unrolling tape A. The unrolling tape A is carried in an unrollable manner on a carrier **32**, which in turn is carried on the guide rail **38** following the compactor roller **16** in the compactor longitudinal direction L so that it is movable substantially in the direction of the roller axis of rotation W. When moving the soil compactor **10** in the direction of movement B, where, for example, a road marking F is to be created according to marking model data, the marking material provided to produce the road marking F in the form of the unrolling tape A can be pressed against the surface of the soil material **12**. The unrolling tape A has an adhesive characteristic, similar to an adhesive tape, so that it is unrolled in the direction of movement B when the soil compactor **10** moves and adheres to the soil material **12**. In order, for example, to create road markings F that are interrupted in the direction of movement B, a cutting tool can be provided on the carrier **32**, which cuts off the marking material M at a suitable point. In order to avoid interaction of the marking material M with the soil material **12** where the road marking F is intended to have an interruption, the carrier **32** can also be movable in a height direction.

[0046] In order to improve the adhesive effect of the marking material M in the embodiment shown in FIG. **6**, it can be provided that when such marking material M is applied to the soil material **12**, the soil compactor **10** moves in such a way that the marking unit **26** is positioned in front of at least one of the compactor rollers **14**, **16** in the direction of movement. In the example of FIG. **6**, the soil compactor **10** would be moved in a movement direction B' opposite to the direction of movement B for this purpose. The marking material M dispensed by the marking unit **26** is rolled over by the soil processing roller **16** then following in the longitudinal direction L of the compactor, in the example shown also the soil cultivation roller **14**, and is thus pressed more strongly against the surface of the soil material **12**.

[0047] The application of marking material M in the form of an unrolling tape A is particularly suitable in construction site areas where such marking material M is only to be applied temporarily and no road marking is to be created that is provided by color material that strongly adheres to the soil material **12**.

[0048] FIG. **7** illustrates the operation of such a soil compactor **10** when applying marking material M, for example liquid marking material. The marking unit **26** is controlled by a control unit **46**, which controls the marking unit **26** on the one hand to move along the guide rail **38** and on the other hand to dispense marking material M at positions provided for this purpose. The position P of the soil compactor **10** and the pre-marking V to be created in this case can be displayed on a display unit **48** designed, for example, as a tablet or the like. Via corresponding input elements, an operator can send corresponding control commands to the control unit **46** when the soil compactor **10** is at a position provided for this purpose and a pre-marking V is to be created, which control unit then positions the marking unit **26** in a corresponding manner by moving along the guide rail **38** and controls it to dispense marking material M. As already explained above, this control can also take place on the basis of position data and marking model data, so that an interaction of an operator is not required and the operator is simply shown on the display unit **48** in which position the soil compactor **10** is located and that or where a pre-marking V or, if necessary, a road marking F is to be created.

[0049] The position data, which in principle also exactly indicate the position of the soil compactor **10** in space and thus on the soil material **12** to be compacted, can be provided, for example, by the display unit **48** shown in FIG. **7**, as illustrated by a symbol **50** shown thereon, communicating directly, for example, with the GPS satellite system and having a corresponding receiving unit for this purpose and being designed to evaluate the received data to determine the position. Alternatively or additionally, such a receiving unit **52**, which is also designed to evaluate the received data and thus to determine the position, can also be

provided separately from the display unit **48** and connected to it for data exchange. For example, this receiving unit **52** can be arranged on the soil compactor **10** itself, for example on a roof **54** of an operating station **56** provided on the soil compactor **10**.

1. A soil compactor for compacting soil material, comprising at least one compactor roller which is rotatable on a compactor structure around a roller axis of rotation which is essentially orthogonal to a compactor longitudinal direction, furthermore comprising at least one marking unit carried on the compactor structure for applying marking material to soil material driven over by the soil compactor.

2. The soil compactor according to claim **1**,

wherein at least one marking unit is carried on the compactor structure in a substantially immovable manner.

3. The soil compactor according to claim **1**,

wherein at least one marking unit, which is carried on the compactor structure in a substantially immovable manner, is carried on a side edge region of the compactor structure.

4. The soil compactor according to claim **1**,

wherein an edge pressing unit is provided on the compactor structure in association with at least one side edge region.

5. The soil compactor according to claim **1**,

wherein at least one marking unit is carried on the compactor structure in a movable manner.

6. The soil compactor according to claim **5**,

wherein at least one guide rail is provided on the compactor structure, and in that at least one marking unit movably carried on the compactor structure is movable along the at least one guide rail.

7. The soil compactor according to claim **6**,

wherein, in association with at least one marking unit movable along the at least one guide rail, a marking unit drive for moving the marking unit along the at least one guide rail is provided.

8. The soil compactor according to claim **6**,

wherein at least one guide rail extends substantially in the direction of the roller axis of rotation, and/or in that at least one guide rail is arranged following a compactor roller in the compactor longitudinal direction.

9. The soil compactor according to claim **1**,

wherein at least one marking unit comprises a spray can containing liquid marking material.

10. The soil compactor according to claim **1**,

wherein at least one marking unit comprises a spray head, and in that at least one marking material tank connected to the spray head for supplying liquid marking material is provided on the compactor structure.

11. The soil compactor according to claim **1**,

at least one marking unit is designed to apply a pre-marking to the soil material, and/or in that at least one marking unit is designed to apply a road marking to the soil material.

12. The soil compactor according to claim **1**,

wherein at least one marking unit is designed to apply marking material as an unrolling tape.

13. The soil compactor according to wherein,

wherein at least one marking unit is controlled by a control unit and is operable by outputting control commands from the control unit to dispense marking material.

14. A method for operating a soil compactor according to claim **1**, wherein when the soil compactor is moved over the soil material, at least one marking unit for applying marking material to the soil material is operated.

15. The method according to claim **14**,

wherein an edge pressing unit is provided on the compactor structure in association with at least one side edge region, and

wherein, when the edge pressing unit is operated to form an edge of the soil material driven over by the soil compactor, at least one marking unit is operated to apply marking material to the soil material as an edge marking.

16. The method according to claim **14**,

wherein at least one marking unit is designed to apply marking material as an unrolling tape, and

wherein when a marking unit is operated for applying marking material as an unrolling tape, the marking unit is arranged in front of at least one compactor roller in a direction of movement of the soil compactor.

17. The method according to claim **14**,

wherein, when at least one marking unit is operated for applying marking material for a pre-marking:

a part of the pre-marking is created during one marking pass and another part of the pre-marking is created during a further marking pass,

and/or

a part of the pre-marking is created by one marking unit and another part of the pre-marking is created by a further marking unit.

18. The method according to claim **14**,

wherein at least one marking unit for applying marking material to the soil material is operated based on position data representing a position of the soil compactor on the soil material and/or based on marking model data.

* * * * *