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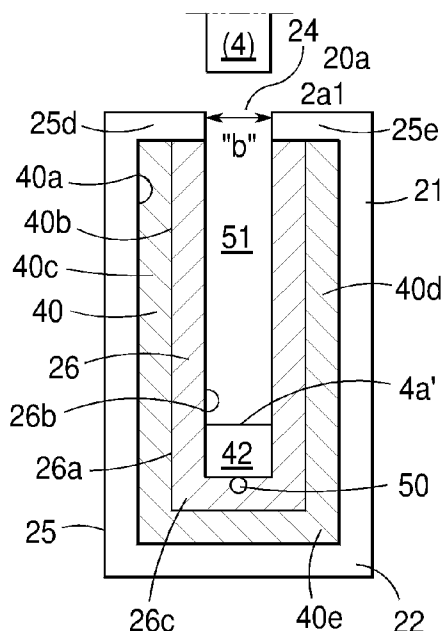
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[Continued on next page]

(54) Title: TRACK-SHAPED ARRANGEMENT



**Fig. 3**

(57) Abstract: The present invention embraces a track-shaped arrangement (20a), related to a system having electrically propellable, such as battery-propellable, vehicles, wherein each vehicle (1) has a vertically adjustable as well as laterally displaceably arranged contact means (collector shoe) ((4)), wherein this contact means is adapted for a co-operation with at least one track (51), and wherein said track is arranged to extend along a stretch of road and its assigned road sections (2a1) and has a first, an upwardly open, area (21), adapted to connect to a roadway (2') formed at the road section (2a1), and having a second, a lower area (22) adapted to support at least one energisable contact surface (4a'), and wherein said track (51) is adapted to connect to an upper opening (24) of an encapsulation (25) of the track (51) and the contact surface (4a') assigned to the track. A thermal insulation (40) is formed and introduced in order to face and connect to said encapsulation (25) and furthermore dimensioned with a selected thickness to be extendable in a horizontal direction toward a rail (26) forming the track (51).

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## 5 TRACK-SHAPED ARRANGEMENT

### ***TECHNICAL FIELD OF THE INVENTION***

The present invention generally relates to a track-shaped arrangement, which  
10 arrangement is specially designed to, by means of a heat-emitting means, be  
able to melt snow, ice and the like accumulated in the track into water, which dur-  
ing cold seasons has a tendency to accumulate in the parallel wall segments of  
the track.

15 The track-shaped arrangement, according to the present invention, should then  
be specially adapted and related to a system, having electrically propellable, such  
as battery-propellable, vehicles.

In such a system, each vehicle should have a vertically adjustable as well as lat-  
20 erally displaceably arranged contact means, and wherein this contact means, by  
its displacement motion described above, is adapted for a co-operation with at  
least one track-shaped arrangement oriented under the vehicle, and wherein said  
track should be arranged to extend along a stretch of road and its assigned indi-  
vidual road sections.

25 The track-shaped arrangement should then, as for the track itself, have a first, an  
upwardly open, area, and wherein the track in other respects is adapted to be-  
come situated under the roadway of the road section, connecting to an upper sur-  
face of the roadway formed for the road section, and having a second, a down-  
30 wardly faceable, area, adapted to support at least one energisable contact sur-  
face, such as a surface formed at, and longitudinally oriented to, an elongate con-  
tact rail.

The present invention is further based on allowing the first, upper open, area of said track to be adapted to directly connect to a formed upper opening of an encapsulation, which in other respects is formed from a thermally well conducting and/or electrically conducting material, wherein said track and encapsulation are  
5 specially adapted to protect a contact surface, assigned to the second, a downwardly faceable, area of the track, and its contact rail.

In the description below, the following expressions will be used:

10 **"Thermally conducting material"**, by which expression is meant a material having distinctly good heat-conducting properties, such as metal.

**"Thermally insulating material"**, by which expression is meant a material having distinctly good heat-insulating properties, such as foam plastic and air.

15

**"Electrically conducting material"**, by which expression is meant a material having distinctly good current- and voltage-conducting properties, such as metal.

20 **"Electrically insulating material"**, by which expression is meant a material having distinctly poor current- and voltage-conducting properties, such as plastic.

### ***BACKGROUND OF THE INVENTION***

Methods, arrangements and designs, related to the above-mentioned technical field and having a function and a nature that meet requirements made, are previously known in several different embodiments.  
25

As an example of prior art and the technical field to which the invention relates, a track-shaped arrangement, related to a system having electrically propellable, such as battery-propellable, vehicles, may be mentioned, wherein each vehicle  
30 has a vertically adjustable as well as laterally displaceably arranged contact means (collector shoe), wherein this contact means should be adapted for a co-operation with at least one track-shaped arrangement, with its associated contact surface formed along a contact rail, and wherein said track should be arranged to extend along a stretch of road and its assigned road sections and have a first, an

upper upwardly open, area, adapted to directly connect to a roadway formed at the upper surface of the road section and having a second, a downwardly faceable, area, adapted to support at least one energisable contact surface, such as formed at and oriented along a contact rail, and wherein said track further should  
5 be adapted to connect to and allowed to be formed of an upper opening of an encapsulation, dimensioned to not only be able to surround the track but also be able to surround the contact surface assigned to the track including the associated contact rail.

10 As an example of this technique, reference is made to the contents in the publications **WO 2010/140 964 A1** and **WO 2007/056 804 A1**.

**WO 2010/140 964 A1** discloses and describes a number of different track-shaped arrangements, wherein different cross-sectional shapes of tracks embedded in  
15 road sections are disclosed and described, and in Figure 5 different embodiments designated "A" to "H" illustrated.

In the embodiment "C", the presence of a heat source arranged in the inner cavity of the track is provided, here in the form of a heat-emitting cable (57a), for a direct-acting heating of the lower parts of the track and connection, and wherein a  
20 generated heat energy, primarily via convection, is allowed to spread upward in the cavity forming the track, and wherein the heat source is shown oriented at a distance from contained contact surfaces, in the form of elongate contact rails.

25 **WO 2007/056 804 A1** discloses and describes the presence of an electrical tape, placed and oriented next to an electrical contact rail with its contact surface, in order to then, via a direct-acting heat generation, provide for a melting of snow and ice into water during cold seasons (winter).

30 Here, it is taught that a special care should be applied to prevent road salt from splashing up against and being brought to cover two contact surfaces attached to the roadway and their two contact rails mounted outside on the roadway.

This publication teaches that the contact surfaces, located along thin contact rails, should be formed along and attached to the roadway of the road sections and gives accordingly no indication of allowing forming tracks in the roadway of the road section, in accordance with the fundamental conditions applying to the present invention.

## ***SUMMARY OF THE PRESENT INVENTION***

### ***TECHNICAL PROBLEM***

If attention is paid to the circumstance that the technical considerations that a person skilled in the relevant technical field has to make to be able to present a solution to one or more technical problems raised, are, on one hand, initially a necessary understanding of the measures and/or the sequence of measures that have to be taken, and on the other hand a necessary selection of the means that is/are required, then the subsequent technical problems would, in view of this, be relevant in the creation of the present subject matter of invention.

Considering prior art, such as it has been described above, it should, therefore, be seen as a technical problem to be capable of realising the significance of, the advantages associated with, and/or the technical measures and considerations that will be required to, in a track-shaped arrangement formed according to the provisions of the invention and related to a system having electrically propellable, such as battery-propellable, vehicles, wherein each vehicle has a vertically adjustable as well as laterally displaceably arranged contact means (collector shoe), and wherein this contact means should be adapted for a co-operation with at least one track-shaped arrangement, and wherein said track is arranged to extend along a stretch of road and its assigned road sections and have a first, an upwardly open upper, area, adapted to connect to a roadway formed at the road section, and having a second, a downwardly faceable area sealable by a bottom portion and adapted to support at least one energisable contact surface, such as formed along a contact rail, and wherein the area of said track first should be adapted to connect to an upper opening of an encapsulation, wherein this encapsulation should surround and partly form an upper opening of the track itself and the contact surface assigned to the track, with its contact rail, allow creating such conditions that a heat-emitting means related to and along the track should be

able to emit its heat energy, suitably via a direct transmission, at a greater efficiency and at lower energy losses than what previously proposed track-shaped arrangements within the technical field mentioned here can offer.

- 5 There is a technical problem to be capable of realising the significance of, the advantages associated with, and/or the technical measures and considerations that will be required to allow providing the presence of and the orientation of an adapted thermally insulating material and allow structuring a thermal insulation so that it, as far as possible, traps the generated heat energy within and/or near the
- 10 contact rail and under the contact surface, alternatively beside the contact surface and the contact rail, and thereby allow decreasing the heat losses, such as in an energy supply acting directly toward and within the contact rail.

- There is a technical problem to be capable of realising the significance of, the
- 15 advantages associated with, and/or the technical measures and considerations that will be required to realise that it, in a track-shaped arrangement according to the present invention, will be possible to allow decreasing the otherwise occurring energy losses, which normally and in the known technique essentially are rising, from passing through a narrow track and the upper open area of the track, since it
- 20 practically seen can be considered to be "lee" to each air flow formed by convection within the bottom portion of the arrangement and in that connection allow utilising a stationary small air volume within the track that has been accumulated, which thereby will be able to contribute to create a good thermal insulation.

- 25 There is a technical problem to be capable of realising the significance of, the advantages associated with, and/or the technical measures and considerations that are required to allow creating a track-shaped arrangement and that will be able to reduce an otherwise expected energy loss that can be considered to be present between the outer vertical, metallic wall portions of the encapsulation and
- 30 further upward, via the wall portions and outside the wall portions, in a direction toward the roadway, since such a metal encapsulation will, via a heat conduction, be able to move and conduct heat energy very good.

There is a technical problem to be capable of realising the significance of, the advantages associated with, and/or the technical measures and considerations that will be required to allow creating an efficient thermal insulation that not only can become placeable between the inner surfaces of the metal encapsulation,  
5 the live outer surfaces of the contact rail, and the opposed surfaces of the track, but likewise can surround the track, in addition to its upper opening.

There is a technical problem to be capable of realising the significance of, the advantages associated with, and/or the technical measures and considerations  
10 that will be required to allow providing a track-shaped arrangement that at a low supplied power per metre, also in a severe winter climate, can, via a thermal insulation, keep a sufficiently high temperature of the contact rail in order to melt snow and ice therefrom into water and collect this melt water within the track, and this at a power requirement that approximately by half will be able to correspond  
15 to the power requirement that otherwise would be required, without such a thermal insulation.

There is a technical problem to be capable of realising the significance of, the advantages associated with, and/or the technical measures and considerations  
20 that will be required to allow the thermal insulation to be formed and introduced as a track-forming and elongate rail in the form of a lining in such a way that this lining can face and connect to the inner surfaces of the encapsulation and dimensioned with a thickness to be extendable an adapted and sufficient distance in a direction inward toward the track to allow the track and a track-forming rail, in a  
25 cross-section, to obtain a rectangular cross-section and with a width corresponding to and only somewhat exceeding the width of the contact means.

There is a technical problem to be capable of realising the significance of, the advantages associated with, and/or the technical measures and considerations  
30 that will be required to allow such a thermal insulation in the form of a lining, in a cross-section, to be shaped into a "U" in order to partly and within its second, downwardly faceable, area allow to partly (on three of the sides of the contact rail) encompass the contact rail.

There is a technical problem to be capable of realising the significance of, the advantages associated with, and/or the technical measures and considerations that will be required to allow a second, lower area, assigned to the thermal insulation and in the form of a bottom portion, and at least one of its vertical wall portions to be assigned the same, or at least essentially the same, thickness.

There is a technical problem to be capable of realising the significance of, the advantages associated with, and/or the technical measures and considerations that will be required to allow the bottom portion of the thermal insulation, alternatively the bottom portion of the track-forming rail or rail, to be selected with a horizontal extension transverse to the track that can connect to the vertical height of a wall portion by a factor of between 2.0 and 3.0.

There is a technical problem to be capable of realising the significance of, the advantages associated with, and/or the technical measures and considerations that will be required in order to be able to allow the thermal insulation or the lining to predominantly be thin and be encompassed by said encapsulation (in addition to the upper open and track-assigned part of the encapsulation) and a rail adjacent to the track and shaped into a "U".

There is a technical problem to be capable of realising the significance of, the advantages associated with, and/or the technical measures and considerations that will be required to allow providing a positioning of an electrically insulated conductor adapted for a heating quite close to the contact rail or introduced in a lower longitudinally oriented track, formed along the contact rail.

There is a technical problem to be capable of realising the significance of, the advantages associated with, and/or the technical measures and considerations that will be required to allow an open-ended, or in another way open, channel to be arranged to extend along the road section and preferably be placeable entirely or partly within the thermally and/or electrically insulating material and in close connection to and/or placed within the contact rail, and wherein said channel very well should be connectable to a heat pump unit, such as an air/air-heat pump unit or an air/water- (air/liquid)-heat pump unit, alternatively be allowed to form an

outer protection and a casing for the electrically insulated conductor, such as for a heat generation via an electrical resistivity conductor.

5 There is a technical problem to be capable of realising the significance of, the advantages associated with, and/or the technical measures and considerations that will be required to allow said encapsulation to be formed from a metal material and an electrically conducting material, and related to 0 level or earth potential.

10 There is a technical problem to be capable of realising the significance of, the advantages associated with, and/or the technical measures and considerations that will be required to allow an electrically insulating rail shaped into a "U" and forming the track to be formed from such an electrically insulating material that can have a material structure adapted to a high resistance against wear.

15 There is a technical problem to be capable of realising the significance of, the advantages associated with, and/or the technical measures and considerations that will be required to allow a part serving as a lining and formed of a thermally insulating material to be assigned a "U"-shape.

20 There is a technical problem to be capable of realising the significance of, the advantages associated with, and/or the technical measures and considerations that will be required to allow the "U"-shape of the lining to be adapted to, within its bottom area, support, via the track-forming rail, a single contact surface, exposed  
25 to an electrical contact, and its only contact rail.

There is a technical problem to be capable of realising the significance of, the advantages associated with, and/or the technical measures and considerations that will be required to allow an outer surface of the electrically insulating rail to  
30 be assigned a "U"-shape complementary to the U-shape of the lining, which, within its bottom area, tightly should support the contact rail.

There is a technical problem to be capable of realising the significance of, the advantages associated with, and/or the technical measures and considerations

that will be required to allow a thickness of the encapsulation, a thickness of the thermal insulation in the form of a lining, and/or a thickness of the track-forming rail to be selected to be equal, or at least essentially equal.

- 5 There is a technical problem to be capable of realising the significance of, the advantages associated with, and/or the technical measures and considerations that will be required to allow the thickness of the rail and the thickness of the thermal insulation or the lining to be selected to connect to, or at least essentially connect to, a selected thickness of the contact means and/or the contact rail.

10

There is a technical problem to be capable of realising the significance of, the advantages associated with, and/or the technical measures and considerations that will be required to allow a channel and/or a plurality of channels to be entirely or partly related to the rail and/or to the lining.

15

### **THE SOLUTION**

- In that connection, the present invention starts out from the known technique provided by way of introduction and concerns a track-shaped arrangement, related to a system having electrically propellable, such as battery-propellable, vehicles,
- 20 wherein each vehicle has a vertically adjustable as well as laterally displaceably arranged contact means (collector shoe), wherein this contact means is adapted for a co-operation with at least one track-shaped arrangement, and wherein said track is arranged to extend along a stretch of road and its assigned road sections and have a first, an upper upwardly open and longitudinally oriented, area,
- 25 adapted to connect to a roadway formed at the road section, and having a second, a downwardly faceable and closed, area, situated under said roadway, adapted to support at least one energisable contact surface, such as formed along a contact rail, and wherein said track is, with its first area, adapted to connect to an upper longitudinally oriented and narrow opening of an encapsulation
- 30 of the track and the contact surface assigned to the lower area of the track, but wherein said upper opening is assigned a width that somewhat exceeds the width of the contact means.

In order to be able to solve one or more of the above-mentioned technical problems, the present invention particularly teaches that the known technique shall be supplemented by allowing a thermal insulation, in the form of a lining, to be formed and introduced in order to face and suitably connecting to the internal surface structure of said encapsulation and dimensioned to be extendable in a direction toward and suitably allow forming the track, via a rail forming the wall portions of the track.

As proposed embodiments, falling within the scope of the fundamental idea of the present invention, moreover it is taught that the thermal insulation in the form of a lining should, in a cross-section, be shaped into a "U".

A bottom portion assigned to the thermal insulation and the lining and at least one of its two wall portions should be able to be assigned the same, or at least essentially the same, thickness.

The bottom portion of the thermal insulation and lining may then be selected with a horizontal extension that connects to the vertical extension or height of a wall portion by a factor of between 2.0 and 3.0.

The thermal insulation and the lining should then be encompassed by said encapsulation, and a rail adjacent to the track and/or forming the side surfaces of the track should, in cross-section, be formed as a part shaped into a "U".

A channel may be arranged to extend along and parallel to the contact rail and suitably through the track-forming rail and/or through the thermally insulating lining and/or the adjacent areas of the contact rail, and wherein said channel may be connectable to a heat pump unit, such as an air/air-heat pump unit and/or an air/water- (air/liquid)-heat pump unit.

Furthermore, it is taught that said encapsulation should be formed thin and from an electrically conducting material, such as a metal material.

The rail shaped into a "U" and serving as a unit and forming the wall portions of the track may then be formed from an electrically insulating material and extending in parallel along the opposed inner wall portions of the track and supporting the contact rail.

5

The assigned "U"-shape may exclusively be formed from an electrically insulating material.

10 The "U"-shape of the rail should be adapted to, within its bottom area, be able to tightly connect to and support the contact rail with its contact surface.

The thermal insulation in the form of a lining should be assigned a "U"-shape, which, within its bottom area, connects to and supports the rail.

15 Furthermore, it is taught that a selected thickness of the encapsulation, a selected thickness of the thermal insulation or the lining, and/or a selected thickness of the track-forming rail should mutually be selected to be equal, or at least essentially equal.

20 Particularly, it is taught that the thickness of the rail and the thickness of the thermal insulation or the lining should be selected to connect to, or at least essentially connect to, a selected thickness or width of the contact means or the track.

25 Said channel and/or channels should entirely or partly be related to the rail and/or to the thermal insulation in the form of the lining.

### **ADVANTAGES**

The advantages that foremost may be regarded as characteristic of the present invention and the special significative features provided thereby are that, in this way, conditions have been created in order to, in a track-shaped arrangement, related to a system having electrically propellable, such as battery-propellable, vehicles, wherein each vehicle has a vertically adjustable as well as laterally displaceably arranged contact means (collector shoe), wherein this contact means is adapted for a co-operation with at least one track-shaped arrangement, wherein

said track is arranged to extend along a stretch of road and its assigned road sections and have a first, upper upwardly open, area, adapted to connect to a roadway formed at the road section, and having a second, a downwardly faceable and closed, area, adapted to support at least one energisable contact surface, such as formed into a longitudinally oriented contact rail, and wherein said track is adapted to connect to an upper opening of an encapsulation of the track and the contact surface assigned to the track, allow providing the presence of a thermal insulation, formed and introduced to face outward to the inner limiting surface of said encapsulation and dimensioned to be extendable in a direction toward a narrow track, in order to thereby be able to reduce a power requirement upon a melting of snow and ice into water, which may be accumulated in the track and then foremost within the lower part of the track as well as be removed upon the displacement of a contact means along the track and along its lower contact rail.

What foremost can be regarded as characteristic of the present invention is defined in the characterising clause of the subsequent claim 1.

#### **BRIEF DESCRIPTION OF THE DRAWINGS**

Prior art and some preferred embodiments, having the significative features associated with the invention, will now, for the purpose of exemplifying, be described in more detail with reference to the appended drawing, wherein:

**Figure 1** shows as prior art, according to the patent publication **WO 2010/140 964 A1**, in a perspective view, a vehicle, in the form of a FORD, model "A", converted for a battery operation by an electrically driven motor, a control circuit controlling the power, for a speed regulation corresponding to a present power output, as well as a controlling means;

**Figure 2** shows in a crosswise section a track-shaped arrangement formed as a measure reference, according to the present invention, in a first embodiment;

**Figure 3** shows in a crosswise section a track-shaped arrangement, according to the present invention, in a second most proposed or preferred embodiment;

**Figure 4** shows in a crosswise section a track-shaped arrangement, according to the present invention, in a third embodiment, and;

**Figure 5** shows three different temperature curves, under "A", "B", and "C", wherein the temperature curve "A" is measured in an electrical heating of a contact rail, however without a distinct thermal insulation, placed within an encapsulation within the track-shaped arrangement, according to Figure 2, while the temperature curves "B" and "C" relate to temperature curves with thermal insulation introduced, placed outside a track-forming rail but inside an encapsulation, according to Figure 3, and with two different power additions per metre (10 W/m; 5 W/m).

#### 10 ***DESCRIPTION OF A PREFERRED EMBODIMENT***

Then, by way of introduction, it should be emphasised that in the subsequent description of a preferred embodiment, exhibiting the significant features associated with the invention and being elucidated by the figures illustrated in the subsequent drawings, we have selected terms and a particular terminology with the purpose of, in that connection, first of all allowing to make evident the inventive idea.

However, it should in this connection be taken into consideration that expressions selected here should not be seen as limiting solely to the terms utilised and selected here, but it should be understood that each term accordingly selected should be interpreted so that it, in addition, embraces all technical equivalents that work in the same or essentially the same way, in order to, in this way, be able to achieve the same or essentially the same intention and/or technical effect.

25 With a reference foremost to the attached Figures 1 to 4, there is thus shown schematically and in detail not only the present invention but also the significative peculiarities associated with the invention have been made concrete, by the now proposed embodiments described in more detail in the following, one as a reference and two having a thermally insulating material introduced, wherein the insulating material is adapted to tightly encompass a rail that forms the track itself, is of electrically insulating material and is shaped to form a narrow rectangular track.

Accordingly, Figure 1 shows the principles that apply to a system "S" associated with the invention, comprising an electrically conducting arrangement (4) that serves as a vehicle-associated collector shoe and is extendably adapted between the vehicle 1 and an energisable first rail 42 or rail section 4a, in a first channel or a track 51, and an energisable second rail or rail section 4b, in a second channel or a track 52, with a separating insulation in the longitudinal extension of the rails, such as an electrically insulating canalisation 30 having an E-shaped cross-section so as to form said channels or tracks 51, 52 on each side of an electrically insulating partition wall 53.

10 The electrically conducting arrangement (4) serving as a collector shoe is thus adapted to be vertically adjustable between an electrically propellable vehicle 1 and an energisable "first contact surface" related to a stretch of road 2 and its individual road section 2a1, 2a, 2a1' 4a' and assigned to a first road section 2a1, 15 such as in the form of a first, first rail 42, and an energisable "second contact surface" 4b' assigned to a second stretch of road, such as in the form of a second, first rail 43, as viewed in the normal direction of travel "P" of a vehicle, wherein these are coupled after each other with a "first contact surface" 4a' assigned to the first stretch of road or the road section 2a1 and "second contact surface" 4b' 20 assigned to the second stretch of road or the road section 2a, as well as a separating electrical insulation, such as an electrically insulating "first insulating part", designated 44, and thereby, in such a system "S", create conditions to be able to afford an energy-economic heating of the inner and lower areas of the track 20, 21 in order to there allow melting snow and ice into water.

25 Here, the first rail 42 is illustrated as assigned to the first channel or the track 51, within the first road section 2a1, and the second rail 43 is here illustrated as assigned to the same channel or track 51, within a second road section 2a.

30 The first track 51 and the second track 52 may advantageously be adapted to be co-ordinatable parallel to each other via a canalisation 30.

The first track 51 and the second track 52 are formed within an "E"-shaped cross-section here electrically separated or insulated from each other via a vertical electrically insulating intermediate part 53, to be able to allow said collector shoe (4) 35

to pass along the first rail section 4a, its first contact surface 4a' and its first road section 2a1, the electrically insulating and separating part 44 and its second road section 2ab as well as the second rail 4b, its second contact surface 4b' and its third road section 2a, in order to divert electric power and energy to one or more electrically propellable vehicles 1 passing said first 2a and third 2a1 road sections via a road section 2ab parting these road sections electrically.

Accordingly, Figure 1 shows a system "S" adapted for the driving along a stretch of road 2 and its road section 2a1, 2ab and 2a of an electric vehicle 1 propellable by one or more batteries.

Here, the vehicle 1 is exteriorly an "A-Ford", but here, the same is converted to a battery-operated vehicle.

The vehicle 1 shown here should then comprise control equipment or a control unit 3, so that a driver "F" (not shown) can drive and steer his/her vehicle along said stretch of road 2 having assigned road sections 2a1 and 2a.

Then, the proposed system "S" according to the invention should primarily comprise: "a", one or more vehicles 1 propellable via each an electric motor or motors 5, and wherein the respective vehicle has a power-control loop "R2", for a provision of a requisite power and/or a speed regulation in the direction of the arrow "P", and wherein the requisite power is provided primarily by vehicle-associated rechargeable batteries "II", "B", and "b", a plurality of road sections 2a1, 2ab, 2a, 2a1' that can divide the stretch of road 2 and each of which (not the road section 2ab) assigned one or more electrical stations "s1", "III", in order to, thereby, i.a. allow supplementary charging the batteries "II", "B" of the vehicle.

Now, the present invention is based on a track-shaped arrangement, which, according to Figure 2, has been designated 20, alternatively, according to Figure 3, has been designated 20a and, according to Figure 4, has been designated 20b, wherein each one of these arrangements should be related to a system "S" having electrically propellable, such as battery-propellable, vehicles 1, wherein each vehicle has a vertically adjustable as well as laterally displaceably arranged con-

tact means (4) (only illustrated in Figure 3), wherein this contact means is adapted for a co-operation with at least one track 51, and wherein said track is arranged to extend along a stretch of road 2 and its assigned road sections 2a1, 2ab, 2a and 2a1'.

5

The present invention, according to Figures 2, 3, and 4, is based on a unit forming the track 51 or an elongate track-forming rail 26, which consists of an electrically insulating material usually having good thermally insulating properties.

- 10 Furthermore, the presence of a lining 40 is suggested, consisting of a thermally insulating material and an encapsulation 25, consisting of an electrically conducting material having good thermally conducting properties.

- 15 The arrangement according to the invention has a first, an upper upwardly open, area 21, adapted to connect to a roadway 2' formed at the road section 2a, and having a second, a downwardly faceable, area 22, adapted to support at least one energisable contact surface 4a', such as formed into a contact rail 4a, 42, and wherein said track 51 is adapted to directly connect to an upper narrow opening 24 of the encapsulation 25 of the track 51 formed of metal, such as aluminium, and the contact surface 4a', assigned to the track 51, with its contact rail 4a.
- 20

The encapsulation 25 has an outer surface 25a and an inner surface 25b as well as a bottom portion 25c.

- 25 Figure 2 then shows a cross-section of a track-shaped elongate arrangement 20, having a track-forming rail 26 that is composed of electrically insulating material and has an assigned thickness that provides properties corresponding to a somewhat thermally insulating material.

- 30 Figure 3 shows a cross-section of a track-shaped arrangement 20a having a track-forming rail 26 formed of electrically insulating material, for the formation of a centrally placed track 51, and a thin lining 40 that is formed of a thermally insulating material and supported by the inner surfaces 25b, 25b' of the encapsulation 25 and its bottom portion 25c.

Figure 4 illustrates an arrangement having a thin electrically insulating track-forming rail 26 and a thick thermally insulating material, in the form of a lining 40.

- 5 The rail 26 has inner wall portions 26b, 26b' facing each other and forming the track 51, while the lining 40 has inner wall portions 40b and outer wall portions 40a.

More particularly, the invention teaches that the thermal insulation 40 should be  
10 formed and introduced in order to face the inner surfaces 25b, 25b' or surface segments of said encapsulation 25 and its bottom portion 25c, in Figure 3, and dimensioned to be extendable in a vertical direction, via the track-forming rail 26 toward the track 51 and the contact rail 4a, 42.

- 15 More particularly, it is taught that the thermal insulation 40 as a lining should, in a cross-section, be shaped into a "U", with the branches 40c, 40d oriented vertically and facing upward so as to form upper horizontal surface areas covered by the upper surface portions 25d, 25e of the encapsulation 25 and a bottom area 25c oriented horizontally.

20

- A bottom portion 40e, assigned to the thermal insulation 40, and at least one 40d of its parallel wall portions 40c, 40d is assigned the same, or at least essentially the same, thickness "t", which thickness, however, should be selected depending on a selected supplied power and depending on the current temperature zone  
25 and structure of the road surface 2' and its stretch of road 2.

The bottom portion 40e of the thermal insulation is selected to, with a horizontal extension between the inner opposed wall portions 25b, 25b' of the encapsulation 25 that should connect to the height of the wall portion 40d of the thermal insula-  
30 tion by a factor of between 2.0 and 3.0.

The thermal insulation 40, according to the embodiment shown in Figure 3, is thus largely encompassed by said encapsulation 25, with its upper horizontal sur-

face areas 25d and 25e forming a narrow delimitation of the open area 24 of the track 51.

Here, the track 51 is formed of an elongate rail 26 that is composed of an electrically insulating material and assigned a "U"-shape and having an inner width  
5 connecting to, however somewhat less than, the outer width of the contact means (4), in order to form a rectangular, or at least essentially rectangular, track 51 having an inserted contact rail 4a and having a contact surface 4a'.

10 The present invention teaches furthermore that the lower part and/or bottom portion 26c of the rail 26 should be able to be formed with one or more elongate channels, wherein only one 50 is shown in Figure 3 for the purpose of simplification, arranged to extend along the contact rail 4a, 42 and may be oriented within the thermally insulating lining 40, and wherein said channel 50, in a known way,  
15 should be connectable via openings to a separate heat pump unit (not shown), such as an air/air-heat pump unit or an air/water- (air/liquid)-heat pump unit.

One or more electrical conductors 45 may be integrated with the contact rail 4a, 42 and/or the rail 26 alternatively may be oriented within the thermal insulation  
20 40, however, preferably close to the contact rail 42, alternatively, the support conductors 45 may be entirely oriented within the rail 26, somewhat above the contact rail 42.

Said encapsulation 25 may then be formed from an electrically conducting material, such as from a metal material or from an electrically and thermally insulating  
25 material, the thermally insulating lining 40 should be formed from a suitable plastic material, and said rail 26 should be formed from an electrically insulating material, which not only has good and high thermally and/or electrically insulating properties but also has good and high wear-resistant properties.

30

The requirement of high thermally insulating capacity does not need to be made too high for the rail 26 in Figure 2.

The part or the lining 40 shaped into a "U" may thus be formed from an electrical-ly insulating material, in the form of a wear-resistant plastic.

5 The encapsulation 25 has an upper opening 24, the width "b" of which connects to and is somewhat less than the width of the collector shoe (4). (Illustrated in Figure 3).

Figure 5 then illustrates in three different temperature graphs the temperature change per unit of length between the points A and B in Figure 2.

10

Figure 5A then shows a temperature distribution in °C in relation to a longitudinal axis "L"(m) ( $10^{-2}$  m), and between the points "A" and "B" in Figure 2, when no thermal insulation (26) is present or being unambiguous to the measurement re-  
sult. Here, a temperature rise from  $-0,8$  °C (atmospheric temperature) to  $4,9$  °C is  
15 observed, approx.  $5$  °C, of the contact rail 4a, 42, via an energy supply of  $10$  W/m. Admittedly, the thermal insulation (26) is selected to be thick but has small thermally insulating properties.

Figure 5B then shows a temperature distribution in °C between the corresponding  
20 points as in Figure 2 (however not shown) in relation to a longitudinal axis "L"(m) ( $10^{-2}$  m), when a thermal insulation 40, according to Figure 3, is present and is encompassed by the rail 26 and the encapsulation 25. The thickness of the rail 26 and the insulation or the lining 40 is selected to be equal. At this power  $10$  W/m, a temperature rise from  $-0.8$  °C atmospheric temperature to  $13-14$  °C,  
25 approx.  $15$  °C, of the contact rail 4a, 42 is obtained.

Figure 5C then shows a corresponding temperature distribution in °C in relation to a longitudinal axis "L"(m) ( $10^{-2}$  m), when a thermal insulation or lining 40, accord-  
ing to Figure 3 is present and at a supplied power of only  $5$  W/m. At this power, a  
30 temperature rise from an atmospheric temperature of  $-3$  °C to  $4$  to  $5$  °C, approx.  $7$  °C, of a contact rail 4a, 42 is obtained.

Figure 4 then shows an embodiment example wherein the thermal lining 40 has a thickness that exceeds the thickness of the rail 26 by a factor of "3".

It is evident that a "thermally conducting material" very well can have electrically insulating properties or electrically conducting properties.

- 5 It is evident that a "thermally insulating material" very well can have electrically insulating properties or electrically conducting properties.

It is evident that an "electrically conducting material" very well can have thermally conducting properties or thermally insulating properties.

10

It is evident that an "electrically insulating material" very well can have thermally conducting properties or thermally insulating properties.

- 15 As an electrically insulating material, according to the present invention, primarily a plastic material, such as polyethylene, polytetrafluoroethylene (Teflon), or the like, is suggested, and as thermally insulating material, primarily air, cellular plastic, foam plastic, glass wool, mineral wool, and the like are suggested.

- 20 The invention is of course not limited to the embodiment given above as example, but may be subjected to modifications within the scope of the general idea according to the invention, illustrated in the subsequent claims.

- 25 Particularly, it should be taken into consideration that each unit and/or category shown can be combined with any other unit and/or category shown within the scope in order to be able to attain the desired technical function.
-

**CLAIMS**

1. Track-shaped arrangement, related to a system having electrically propellable vehicles, for instance propellable via vehicle-internal batteries, wherein each vehicle (1) has a vertically adjustable as well as a laterally displaceably arranged contact means ((4)), wherein this contact means is adapted for a co-operation with at least one track (51), and wherein said track is arranged to extend along a stretch of road (2) and its assigned road sections (2a1, 2a) and have a first, an upper upwardly open, area (21), adapted to connect to a roadway (2') formed into the road section and a second, a downwardly faceable, area (22), adapted to support at least one energisable contact surface (4a'), such as formed into and along a contact rail (42), and wherein said track (51) is adapted to connect to an upper opening (24) of an encapsulation (25) of the track (51) and the contact surface (4a') assigned to the track, **characterised in that** a thermal insulation in the form of a lining (26, 40) is formed and introduced in order to face the inner surface (25b, 25b') of said encapsulation (25), as well as its bottom portion (25c), and dimensioned to be extendable in a direction toward an intermediately orientated track (51) and adapted to form the track (51) itself.
2. Track-shaped arrangement according to claim 1, **characterised in that** the thermal insulation, in the form of a lining (40), is, within an assigned cross-section, shaped into a "U".
3. Track-shaped arrangement according to claim 2, **characterised in that** a bottom portion (40e), assigned to the thermal insulation (40), and at least one of its wall portions (40c, 40d) is assigned the same, or at least essentially the same, thickness ("t").
4. Track-shaped arrangement according to claim 3, **characterised in that** the bottom portion (40e) of the thermal insulation is selected with a horizontal extension that connects to the height of a wall portion (40d) by a factor of between 2.0 and 3.0.

5. Track-shaped arrangement according to claim 1, **characterised in that** the thermal insulation (40) is encompassed by said encapsulation (25) and a track-forming rail (26) adjacent to the track (51) and shaped into a "U".
6. Track-shaped arrangement according to any one of the preceding claims, **characterised in that** a channel (50) is arranged to extend along the contact rail (4a, 42), and wherein said channel supports an electrical cable (45) dimensioned for a heat emission and/or is connected to a heat pump unit, such as an air/air heat pump unit or an air/water (air/liquid) heat pump unit.
7. Track-shaped arrangement according to any one of the preceding claims, **characterised in that** said encapsulation (25) is formed from an electrically conducting and/or insulating material, such as a metal material and/or a plastic material.
8. Track-shaped arrangement according to claim 5, **characterised in that** the lining (40) shaped into a "U" is formed from an electrically insulating material.
9. Track-shaped arrangement according to claim 2 or 8, **characterised in that** the "U"-shape assigned to the lining (40) is formed from one and the same electrically and/or thermally insulating material.
10. Track-shaped arrangement according to claim 2 or 9, **characterised in that** the "U"-shape of the lining (40) is adapted to, within its bottom portion (40e), support the contact surface and its contact rail (40, 42).
11. Track-shaped arrangement according to claim 1, **characterised in that** the thermal insulation (40), with an assigned "U"-shape, is adapted to, within its bottom portion (40e), to directly support a track-forming rail (26).
12. Track-shaped arrangement according to claim 1, **characterised in that** a thickness of the track-forming rail (26), a thickness ("t") of the thermal insulation or the lining (40), and/or a thickness of the encapsulation (25) is selected to be equal, or at least substantially equal.

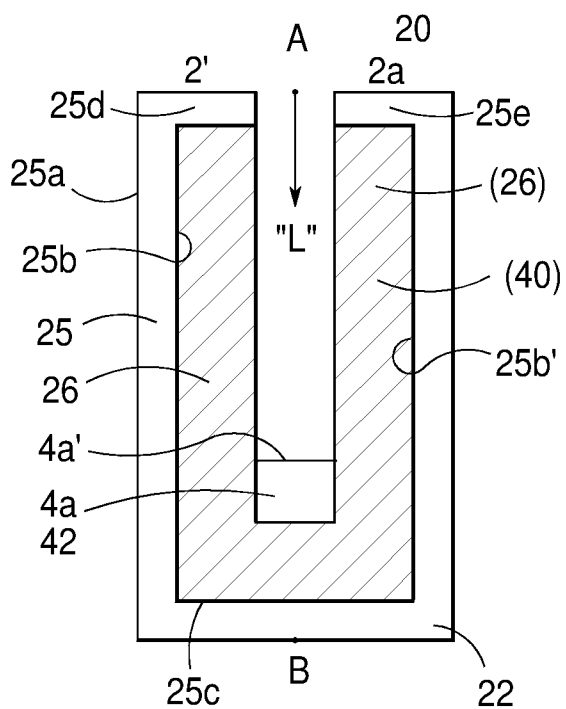
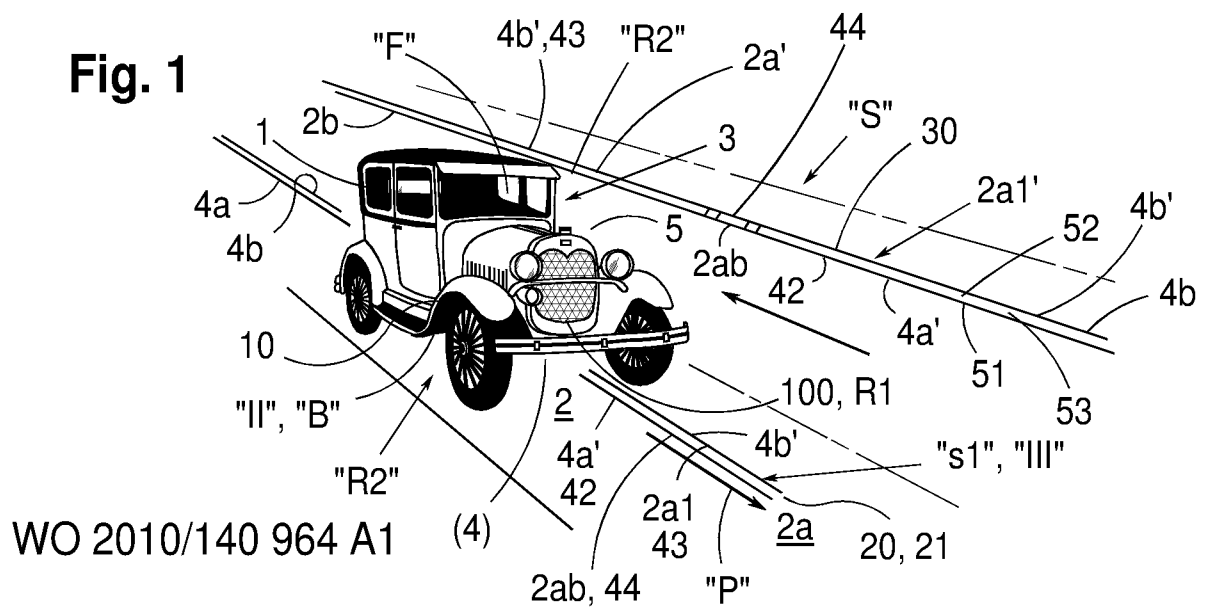
13. Track-shaped arrangement according to claim 1 or 12, **characterised in that** the thickness of the track-forming rail and the thickness of the thermal insulation or the lining is selected to connect to, or at least substantially connect to, a selected thickness of the contact means ((4)).

14. Track-shaped arrangement according to claim 1 or 6, **characterised in that** said channel (50) and/or channels are/is entirely or partly related to the track-forming rail (26) and/or to the thermal insulation (40).

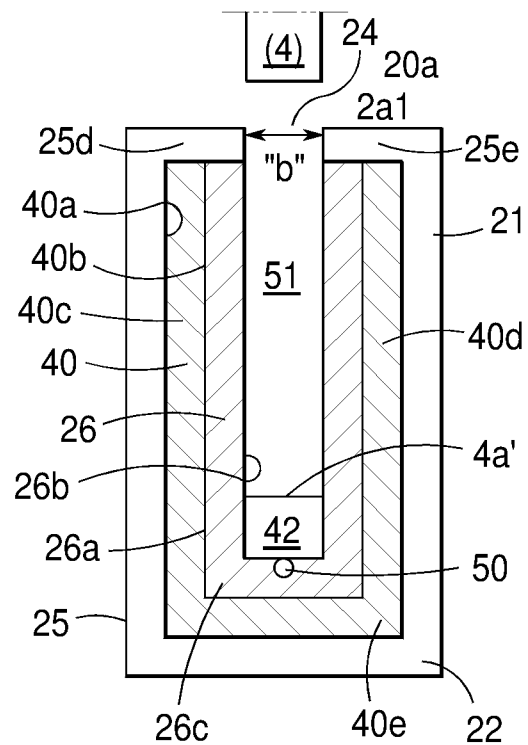
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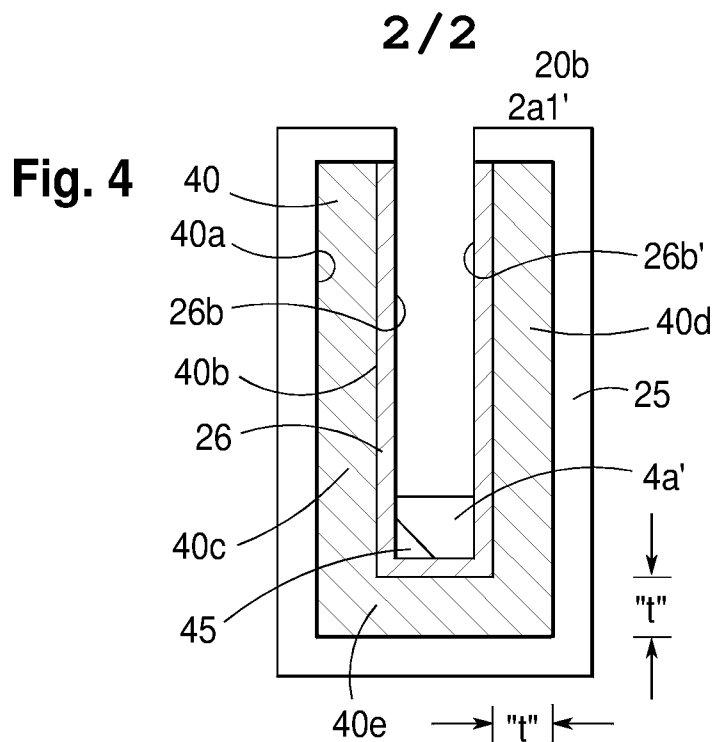
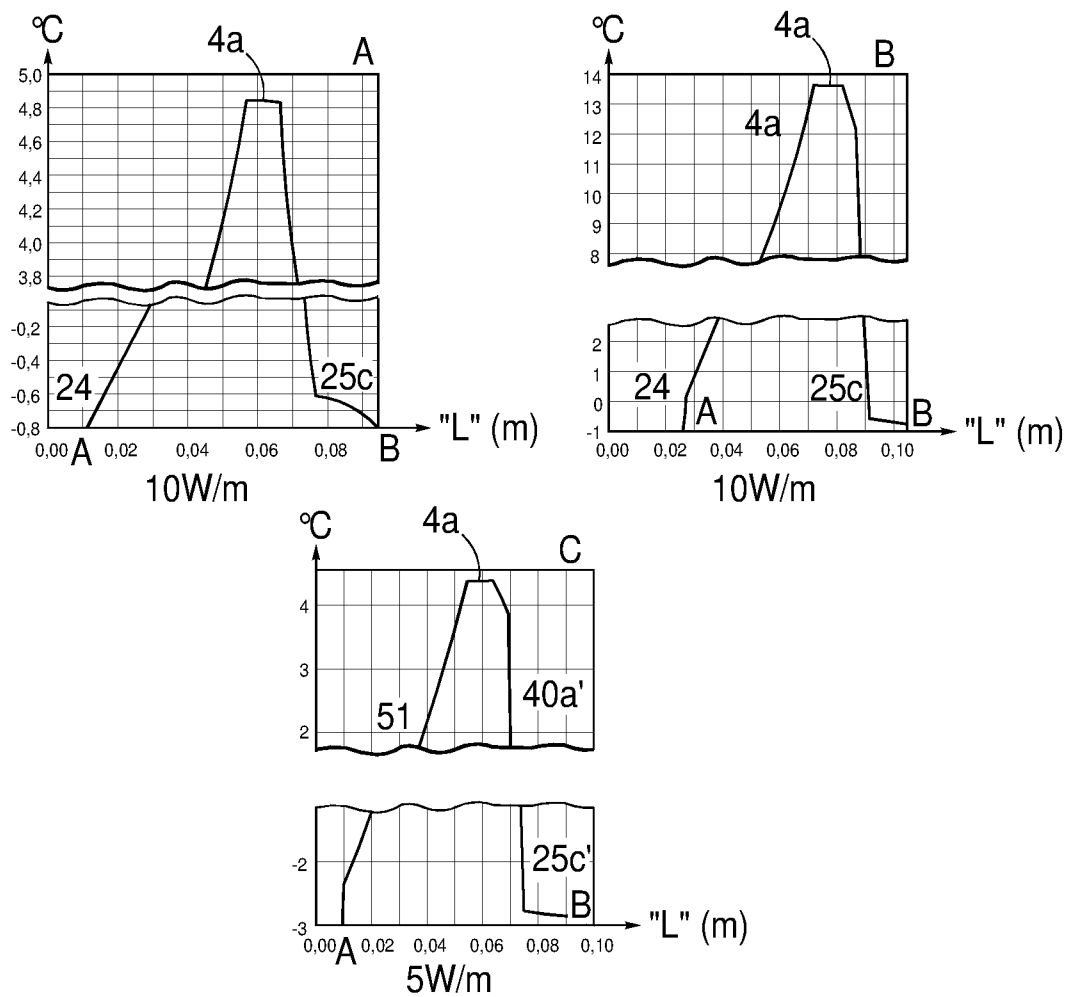
**Fig. 1**



**Fig. 2**



**Fig. 3**

**Fig. 5**

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/SE2012/050345

## A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: B60L, B60M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE, DK, FI, NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, PAJ, WPI data

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                                                | Relevant to claim No. |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| A         | US 4139071 A (TACKETT LOUIS E), 13 February 1979 (1979-02-13); abstract; column 7, line 57 - column 8, line 22; figures 2-5<br>-- | 1-14                  |
| A         | WO 03104016 A1 (MILLER BERNHARD), 18 December 2003 (2003-12-18); claim 6<br>--                                                    | 1-14                  |
| A         | US 3848712 A (FLODELL B), 19 November 1974 (1974-11-19); abstract; figure 1<br>--                                                 | 1-14                  |
| A         | WO 2007056804 A1 (ROBERTSON JOHN), 24 May 2007 (2007-05-24); abstract; cited in the application<br>--                             | 1-14                  |



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

15-06-2012

Date of mailing of the international search report

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**INTERNATIONAL SEARCH REPORT**

International application No.  
PCT/SE2012/050345

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                                                      | Relevant to claim No. |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| A         | WO 2010140964 A1 (ELWAYS AB ET AL), 9 December 2010<br>(2010-12-09); abstract; figures 5,14,15; cited in the application<br>--<br>----- | 1-14                  |

**Continuation of:** second sheet

**International Patent Classification (IPC)**

**B60L 5/02** (2006.01)

**B60L 5/40** (2006.01)

**B60M 1/34** (2006.01)

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**INTERNATIONAL SEARCH REPORT**

Information on patent family members

International application No.

PCT/SE2012/050345

|    |               |            |      |                |            |
|----|---------------|------------|------|----------------|------------|
| US | 4139071 A     | 13/02/1979 | NONE |                |            |
| WO | 03104016 A1   | 18/12/2003 | AU   | 2003237676 A1  | 22/12/2003 |
|    |               |            | DE   | 10225962 A1    | 24/12/2003 |
| US | 3848712 A     | 19/11/1974 | NONE |                |            |
| WO | 2007056804 A1 | 24/05/2007 | NONE |                |            |
| WO | 2010140964 A1 | 09/12/2010 | EP   | 2437959 A1     | 11/04/2012 |
|    |               |            | KR   | 20120027455 A  | 21/03/2012 |
|    |               |            | SE   | 535136 C2      | 24/04/2012 |
|    |               |            | SE   | 0900759 A1     | 04/12/2010 |
|    |               |            | US   | 20120067684 A1 | 22/03/2012 |