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(54) **Recycling of road sand**

(57) The present invention relates to a method for recycling road sand including the steps of, collecting the road sand 1, a first mechanical sorting 2a of the road sand, for separating organic materials and stones from the road sand, washing 3 the road sand, for further separating organic materials from the road sand, and finally,

reusing 4 the remaining road sand by mixing the remaining road sand into an asphalt or a concrete mix. Further, the present invention relates to use of road sand recycled according to the method for recycling road sand in an asphalt or concrete mix, and finally an asphalt or concrete mix comprising road sand recycled according to the method for recycling road sand.

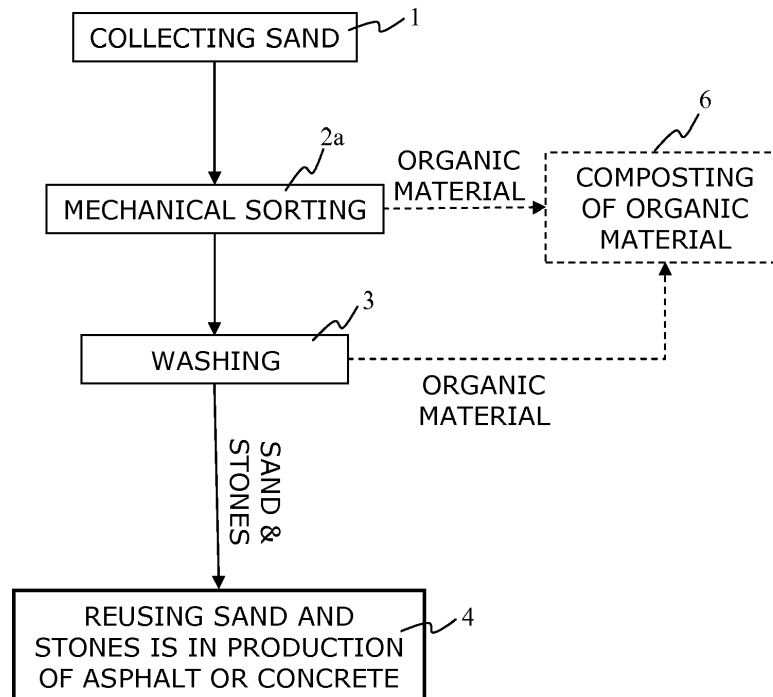


FIG.1

Description

Field of the invention

[0001] The present invention relates to a method for recycling road sand, use of road sand recycled according to the method in an asphalt or concrete mix, and an asphalt or concrete mix comprising road sand recycled according to the method, according to the preambles of the independent claims.

Background of the invention

[0002] In colder climates, sand and gravel are often-times used to increase surface friction, reduce braking distance on icy and slippery roads and to ensure non-slippery walking conditions during the winter. After the winter, the spread out sand and gravel has to be collected from the road system by means of road sweepers.

[0003] The collected sand and gravel contains a considerable amount of particles hazardous to the environment, e.g. from asphalt, tyres and exhaust gas. Such hazardous particles may be: rubber residue, PAH (Polycyclic Aromatic Hydrocarbons), oil residue, heavy metals and other organic environmental pollutions. The collected sand and gravel may therefore be regarded as hazardous waste. A problem is that disposal of hazardous waste often involves a cost, since it has to be disposed properly at appropriate recycling plants.

[0004] Today, parts of such collected material is recycled at special recycling plants, and reused in winter maintenance. However, before reusing the sand and gravel, it has to be carefully purified to prevent hazardous particles from leaking out in the surroundings. This process, as mentioned above, is performed at recycling plants specially adapted for this purpose. Accordingly, today's recycling of sand and gravel involve several disadvantages, such as long-distance transports to and from recycling plants, costly disposal of the polluted sand and gravel, and a time-consuming purification process.

[0005] An example of recycling of concrete waste is described in JP 2000 263026, which discloses a method including concrete scraps being crushed into sand, which sand subsequently is separated into sand and powder which may be used for example as an extender for cement or asphalt.

[0006] Another example of recycling is described in US 7 448 825 B2, which discloses a method for recycling in place an asphalt mixture layer of a paved road continuously, while moving a self-propelled vehicle system.

[0007] However, the methods disclosed in JP 2000 263026 and US 7 448 825 B2 relates to recycling of concrete scraps and an asphalt layer of a paved road, respectively, and these methods are not applicable for the recycling of road sand.

[0008] Thus, there is a need for an improved method for recycling of collected sand and gravel.

Summary of the invention

[0009] The above-mentioned objects are achieved by the present invention according to the independent claim.

[0010] Preferred embodiments are set forth in the dependent claims.

[0011] Thus, an object of the present invention is to recycle road sand by using it in production of asphalt or concrete. Advantageously, the hazardous particles are bound, when mixed into the asphalt or concrete. Since the asphalt or concrete acts as a binder for the hazardous particles, the road sand does not need to be completely purified, but may contain a greater amount of hazardous particles than if the road sand would have been reused as road sand.

[0012] The method for recycling road sand, in accordance with the present invention, includes the steps of:

- a) collecting the road sand;
- b) a first mechanical sorting of said road sand, for separating organic materials from said road sand;
- c) washing said road sand, for further separating organic materials from said road sand;
- d) reusing the remaining road sand by mixing said remaining road sand into an asphalt or a concrete mix.

[0013] In one embodiment of the present invention step b) further includes the sub step of:

- b1) metal screening of said road sand, for removing metal objects.

In step b1) metal objects present in the collected road sand are removed. Removing metal objects improves the quality of the road sand, particularly if the collected road sand contains a high amount of metal waste. It may also be an advantage that large fragments already have been removed when separating metal objects from the sand.

[0014] In an alternative embodiment, step a) instead includes the sub step of b1), such that the metal screening is performed before the first mechanical sorting. It is an advantage to be able to vary the disposition of the plant depending on for example the condition of the collected sand.

[0015] According to another embodiment of the present invention, step b) includes the sub step of:

- b2) a second mechanical sorting of said road sand, for separating waste materials from said road sand.

The collected road sand may contain waste materials, such as bottles, and plastics, and other similar waste materials. In this step such waste materials advantageously is removed, which further improves the quality of the road sand. Step b2) may preferably be performed after or before the metal screening depending on for ex-

ample the condition of the collected road sand and the disposition of the plant, and the type of plant being used.

[0016] In another embodiment of the present invention, step b) includes step b2) or step b1). It is an advantage to be able to separate different kinds of materials, such as organic materials, stones and waste materials in the same step. Reducing the number of steps may be time saving.

[0017] According to another embodiment of the present invention, in order to further separate the collected road sand from unwanted materials, step c) includes the sub step of:

c1) separating said road sand and a filler product from stones and yet further organic materials, preferably by means of a sand washer.

Advantageously, the sand which is separated in step c1) is reused.

[0018] According to yet another embodiment, step c1) includes the sub step of:

c2) separating said stones from said organic materials, preferably by means of a logwasher.

Step c2) employs high speed scrubbing to aid in the washing of the road sand in order to remove dry and other deleterious contaminants still remaining in the road sand. The separated stones from step c2) are advantageously reused.

[0019] As an alternative embodiment, step c1) further includes separating said stones from said organic materials, preferably by means of a logwasher. Step c1) and step c2) is then performed in the same step, which may be time saving.

[0020] In one embodiment of the present invention step c1) includes the sub step of:

c1.1) separating said road sand from said filler product and further organic materials.

Advantageously, the sand which is separated in step c1.1) is reused.

[0021] According to yet another embodiment of the present invention, step c 1.1) is followed by step:

c1.2) separating said filler product and further organic materials from water.

Advantageously, the water which is separated in step c1.2) may be reused in step c1).

[0022] Further, and in another embodiment of the invention, step c1.2) is followed by step:

c1.3) separating said filler product from organic materials.

Advantageously, the sand being separated in this step

may be reused.

[0023] Finally, according to one embodiment of the present invention, step c1.3) further includes the sub step of:

c1.3.1) further separating said filler product from water.

[0024] The water which is separated in this step may advantageously be reused in step c1).

[0025] Each step, in the method for recycling road sand according to the present invention, helps to improve the quality of the separated sand and stones, i.e. the quality of the remaining road sand. Thus, the road sand becomes stepwise cleaner. Each step also increases the amount of sand and stones obtained from the collected road sand.

[0026] The present invention further includes use of road sand recycled, according to the method for recycling road sand as described above, in an asphalt or concrete mix. The road sand is advantageously reused, and at the same time hazardous particles are prevented from leaking out and contaminating the environment.

[0027] The present invention also includes an asphalt or concrete mix comprising road sand recycled according to the method for recycling road sand, as described above. The asphalt or concrete mix safely retains the hazardous particles which are still remaining in the remaining road sand, and thus prevents the hazardous particles from leaking out in the surroundings. Thereby, the hazardous particles are prevented from contaminating the environment.

Short description of the appended drawings

[0028]

Figure 1 shows a schematic diagram of the method according to one embodiment of the present invention.

Figure 2 shows a schematic diagram of the method according to another embodiment of the present invention.

Detailed description of preferred embodiments of the invention

[0029] With reference to the Figures, and initially to Figure 1, a schematic diagram of the method for recycling road sand is shown. According to this preferred embodiment of the present invention, the method for recycling road sand includes the steps of: collecting the road sand 1, a first mechanical sorting 2a of the road sand for separating stones and organic materials from the road sand, washing 3 the road sand for further separating organic materials from the road sand, and finally reusing 4 the remaining road sand in production of asphalt or concrete

by mixing the remaining road sand into an asphalt or a concrete mix.

[0030] Asphalt and concrete normally contains a certain amount of sand and stones. For example regarding asphalt, a conventional asphalt mix often contains both fin-graded aggregates and coarse-graded aggregates. According to the present invention, sand and stones are separated from the collected road sand stepwise in a plurality of steps and finally reused in an asphalt or concrete mix. The asphalt or concrete mix safely retains the hazardous particles still present in the remaining road sand, i.e the separated sand and stones, which remaining road sand is being reused 4. Thus, the particles are prevented from leaking out in the surroundings and consequently, the road sand does not need to be completely purified before being reused 4.

[0031] The road sand is preferably collected from the roads by means of conventional road sweepers. The collected road sand contains not only sand, but also stones, branches, leaves and other things which may be in the road shoulder. Therefore, a first mechanical sorting 2a is performed wherein organic materials and stones are separated from the collected road sand. In the first mechanical sorting 2a, the organic materials and stones which are separated preferably have a size exceeding 40 mm. Thus, in this step large fragments are separated from the collected road sand.

[0032] In the next step, as also shown in Figure 1, the road sand is washed 3. This step is preferably performed by means of a sand washer and separates the road sand from organic materials still present in the road sand after the first mechanical sorting 2a. The organic materials which has been separated from the road sand in the first mechanical sorting 2a and the washing 3 are preferably brought to a facility suitable for composting organic materials 6.

[0033] The method for recycling road sand according to the present invention, may be performed at a facility for recycling road sand or in place, in the area where the sand is being collected.

[0034] Accordingly, the method for recycling road sand according to the preferred embodiment shown in Figure 1, includes the steps of:

- a) collecting 1 the road sand;
- b) a first mechanical sorting 2a of the road sand, for separating organic materials and stones;
- c) washing 3 the road sand, for further separating organic materials;
- d) reusing 4 the remaining road sand by mixing the remaining road sand into an asphalt or a concrete mix.

[0035] According to another preferred embodiment of the present invention shown in Figure 2, the first mechanical sorting 2a further includes the sub step of b1). This step comprises metal screening 5 of the road sand for removing metal objects. The metal screening 5 is pref-

erably performed by means of a magnetic separator, such as a magnetic band. The metal screening 5 of the road sand may be followed by the sub step of b2), which step comprises a second mechanical sorting 2b for separating waste materials from the road sand.

[0036] According to yet another embodiment of the present invention the metal screening 5 instead is carried out prior to the first mechanical sorting 2a. Thus, in this embodiment step a) is followed by the sub step of b1).

[0037] Furthermore, the first mechanical sorting 2a and the second mechanical sorting 2b may be performed in the same step. This means that organic materials and stones and waste materials are separated simultaneously. Naturally, this simultaneous first and second mechanical sorting 2a, 2b may be followed by a metal screening 5 of said road sand.

[0038] As an obvious variation, the second mechanical sorting 2b may be performed prior to the metal screening 5.

[0039] According to a preferred embodiment of the present invention, as illustrated in Figure 2, step c) further includes step c1). In step c1) the road sand and a filler product are separated from stones and yet further organic materials. The filler product consists of sand, which has a grain size of approximately 0 to 2 mm, and organic material. This step is preferably performed by means of a sand washer. In the sand washer up to approximately 6000 litres of water is added to the road sand. The water helps to separate the road sand and the filler product from stones and organic materials. As also shown in Figure 2, the stones may thereafter be further separated from organic materials, according to step c2). This separation is preferably carried out by means of a logwasher. The logwasher is designed to remove still remaining organic materials from stones. A conventional logwasher is provided with two inclined shafts which agitates the materials using the archimedial screw principal, and the stones are pushed forward towards a discharge chute. The stones separated in step c2) are then recycled and mixed into an asphalt or concrete mix.

[0040] In another embodiment of the present invention, the separation of the road sand and the filler product from stones and yet further organic materials, and the separation of stones and organic materials may be performed simultaneously, which means that step c1) is performed in the same step as step c2).

[0041] In the preferred embodiment of the present invention shown in Figure 2, the separation of the road sand and the filler product from stones and yet further organic materials according to step c1) includes the sub step of c1.1). In step c1.1) the road sand is separated from the filler product and further organic materials. The sand which is separated in this step has a grain size of approximately 0-4 mm. This sand is reused in production of asphalt or concrete, thus, the sand is recycled and mixed into an asphalt or concrete mix.

[0042] After the road sand has been separated from the filler product, the filler product and further organic

materials are separated from water, in step c1.2). Thereafter, the filler product is separated from remaining organic materials, in step c1.3). In this step the finest grained sand, which as mentioned above has a grain size of approximately 0 to 2 mm, is separated and recycled and mixed into an asphalt or concrete mix.

[0043] As also shown in Figure 2, step c1.3) may further include the sub step of c1.3.1). In step c1.3.1) the filler product is separated from water. After the water has been separated, a remainder containing the filler product is left.

[0044] The water being used in the sand washer, which is separated in step c1.2) and step c1.3.1) is preferably recycled and reused in the sand washer, as illustrated in Figure 2.

[0045] The present invention further relates to use of road sand recycled according to the method for recycling road sand as described above in an asphalt or concrete mix.

[0046] The present invention also relates to an asphalt or concrete mix comprising road sand recycled according to the method for recycling road sand, as described above. Thereby, the asphalt or concrete mix safely retains the hazardous particles which are still remaining in the remaining road sand, and thus prevents the hazardous particles from leaking out in the surroundings.

[0047] The present invention is not limited to the above-described preferred embodiments. Various alternatives, modifications and equivalents may be used. Therefore, the above embodiments should not be taken as limiting the scope of the invention, which is defined by the appending claims.

Claims

1. Method for recycling road sand, including the steps of:

- a) collecting the road sand;
- b) a first mechanical sorting of said road sand, for separating organic materials and stones from said road sand;
- c) washing said road sand, for further separating organic materials from said road sand;
- d) reusing the remaining road sand by mixing said remaining road sand into an asphalt or a concrete mix.

2. Method for recycling road sand according to claim 1, where step b) further includes the sub step of:

- b1) metal screening of said road sand, for removing metal objects.

3. Method for recycling road sand according to claim 1, where step a) further includes the sub step of:

- b1) metal screening of said road sand, for removing metal objects.

4. Method for recycling road sand according to claim 1, where step b) further includes the sub step of:

- b2) a second mechanical sorting of said road sand, for separating waste materials from said road sand.

5. Method for recycling road sand according to any of claims 2-3, where step b1) further includes the sub step of:

- b2) a second mechanical sorting of said road sand, for separating waste materials from said road sand.

6. Method for recycling road sand according to claim 4, where step b2) further includes the sub step of:

- b1) metal screening of said road sand, for removing metal objects.

7. Method for recycling road sand according to claim 1, where step b) further includes a second mechanical sorting of said road sand, for separating waste materials from said road sand.

8. Method for recycling road sand according to claim 7, where step b) further includes the sub step of:

- b1) metal screening of said road sand, for removing metal objects.

9. Method for recycling road sand according to any of claims 1-8, where step c) further includes the sub step of:

- c1) separating said road sand and a filler product from stones and yet further organic materials, preferably by means of a sand washer.

10. Method for recycling road sand according to any of claims 1-8, where step c) further includes the sub steps of:

- c1) separating said road sand and a filler product from stones and yet further organic materials, preferably by means of a sand washer;
- c2) separating said stones from said organic materials, preferably by means of a logwasher.

11. Method for recycling road sand according claim 9, where step c1) further includes separating said stones from said organic materials, preferably by means of a logwasher.

- 12.** Method for recycling road sand according to any of claims 9-11, where step c1) further includes the sub steps of:

c1.1) separating said road sand from said filler product and further organic materials; 5
c1.2) separating said filler product and further organic materials from water;
c1.3) separating said filler product from organic materials. 10

- 13.** Method for recycling road sand according to claim 12, where step c1.3) further includes the sub step of:

c1.3.1) further separating said filler product from water. 15

- 14.** Use of road sand recycled according to the method in any of claims 1-13 in an asphalt or concrete mix. 20

- 15.** Asphalt or concrete mix comprising road sand recycled according to the method in any of claims 1-13. 25

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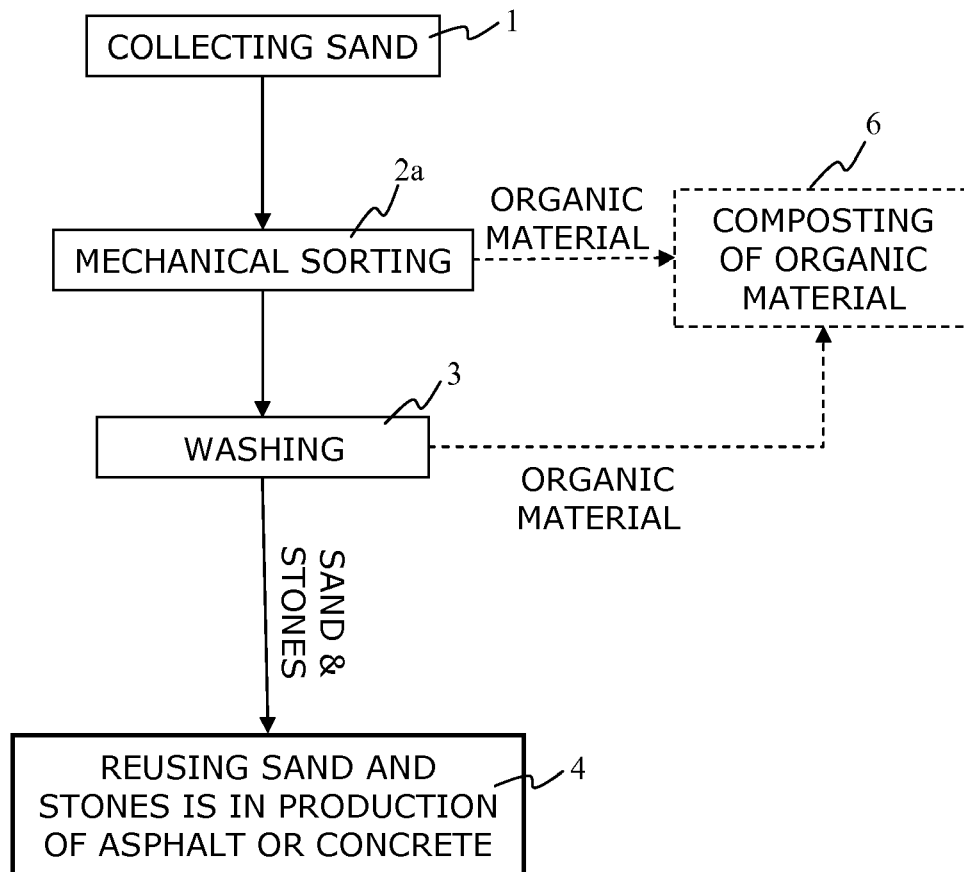


FIG.1

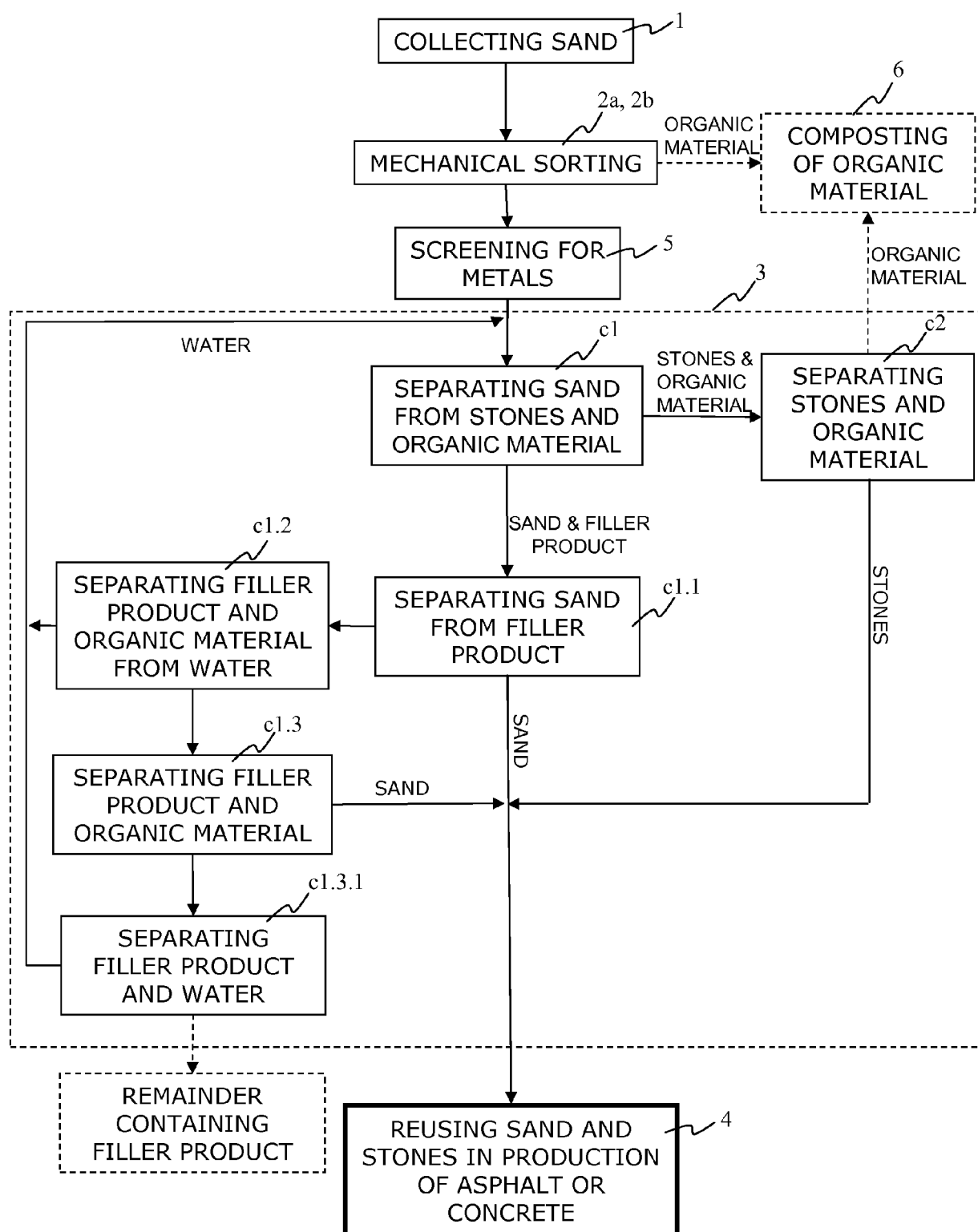


FIG.2



EUROPEAN SEARCH REPORT

Application Number
EP 10 16 7116

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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Place of search The Hague		Date of completion of the search 17 December 2010	Examiner Gallego, Adoración
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 10 16 7116

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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