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(54) **DRAIN REMEDIATION**

ABFLUSSSANIERUNG

BIORESTAURATION DE DRAIN

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Description

[0001] The invention relates to an apparatus and method for remediation of drains by agitation of drain material, such as disclosed in US 5,203,099.

[0002] A common method of draining water, such as rainwater, away from a surface or structure is the use of French drains, which comprise a trench, filled with material such as gravel and stones. Surface water runs into the drain and seeps down through the drain material. The water is therefore directed away from the area surrounding the drain.

[0003] Such drains are commonly used for the drainage of carriageways, where a drain trench is provided along an edge of the carriageway. Surface water from the carriageway is guided into the drain and seeps down through the drain material. The water is therefore directed away from carriageway, thus reducing the risk of flooding of the carriageway.

[0004] Drains installed along carriageways are typically replaced every 10 years. However, in between replacements, the performance of the drains can be compromised. This is mainly due to clogging of the material used to fill the drain. If this is not corrected, surface water can collect on the carriageway, which has the potential for causing accidents.

[0005] US 5,199,195 discloses an excavating device for scraping away high shoulder material on road sides. This material is usually formed on the roadside by rainwater, wind and vegetation erosion. The material is on the roadside and may constitute an obstruction and therefore requires removal. The excavating device comprises cutting means to cut the roadside material and material directing means to direct the cut material away from the roadside. The cutting means is provided by blades and teeth for cutting the roadside material and the material directing means is provided by conveyor blades for conveying the material after it is cut. The roadside material may be directed away from the roadside, e.g. towards a drainage ditch or windrowed to be picked up by a loader. The excavating device is not used in a drain and does not remediate a drain.

[0006] According to a first aspect of the invention there is provided a drain remediation tool comprising a housing providing an aperture, a rotatable drum at least partially disposed within the housing, a drive shaft attached to the drum and adapted to be attached to drive apparatus for rotation of the drum and a plurality of teeth attached to the drum and protruding therefrom through the aperture of the housing, which, on rotation of the drum, sequentially penetrate material in a drain causing agitation of the material to at least partially release clogging of the material and remediation of the drain, wherein the plurality of teeth comprise a first single tooth provided on a first strip along the cylindrical drum, a second single tooth provided on a second strip along the cylindrical drum and six pairs of teeth provided on third to eighth strips along the cylindrical drum and the first and second single teeth

are provided on the first and second strips at positions approximately midway along each strip, for each of the third to eighth strips the pair of teeth are spaced along the strip, for the third, fourth and fifth strips each pair of teeth are offset along the cylindrical drum to provide teeth along the length of the cylindrical drum and for the sixth, seventh and eighth strips each pair of teeth are offset along the cylindrical drum to provide teeth along the length of the cylindrical drum.

[0007] It has been found that agitation of material of a drain can significantly improve the drain's performance. The agitation has been found to at least partially release clogging of the material in the drain trench which allows the drain to work more freely and thereby remediates the drain.

[0008] The plurality of teeth may be each substantially in the shape of a triangle, particularly a right-angled triangle. The teeth may have a width of approximately 40mm. The teeth may have a length of approximately 165mm. Agitation of the material of the drain is therefore to a depth in the trench of at least approximately 165mm, which has been found to provide sufficient declogging of the drain material to remediate the drain.

[0009] The plurality of teeth may be arranged on the drum in a manner to carry some of the material of the drain over the drum.

[0010] The plurality of teeth may be arranged along and around the cylindrical drum. The plurality of teeth may comprise two or more teeth provided on each of a plurality of strips along the cylindrical drum. For each strip the two or more teeth may be spaced along the strip. For a pair of adjacent strips the two or more teeth on a first strip may be offset along the cylindrical drum from the two or more teeth on a second strip. The plurality of teeth may additionally comprise a single tooth provided on at least one strip along the cylindrical drum. The single tooth may be provided on the at least one strip at a position approximately midway along the strip. The plurality of strips along the cylindrical drum may be spaced around the cylindrical drum. The plurality of strips may be spaced at substantially equal intervals around the cylindrical drum.

[0011] The plurality of teeth comprise a first single tooth provided on a first strip along the cylindrical drum, a second single tooth provided on a second strip along the cylindrical drum and six pairs of teeth provided on third to eighth strips along the cylindrical drum. The first and second strips are spaced around the cylindrical drum at an interval of approximately 180 degrees. The third, fourth and fifth strips are spaced around a first side of the cylindrical drum at approximately equal intervals between the first and second strips. The sixth, seventh and eighth strips are spaced around a second side of the cylindrical drum at approximately equal intervals between the first and second strips. The first and second single teeth are provided on the first and second strips at positions approximately midway along each strip. For each of the third to eighth strips the pair of teeth are

spaced along the strip. For the third, fourth and fifth strips each pair of teeth are offset along the cylindrical drum to provide teeth along the length of the cylindrical drum. For the sixth, seventh and eighth strips each pair of teeth are offset along the cylindrical drum to provide teeth along the length of the cylindrical drum.

[0012] The housing may comprise an approximate partial cylinder with closed ends. The aperture may be provided in a wall of the partial cylinder. The housing may be provided with a levelling plate which acts to at least partially level the material of the drain after agitation. The housing may be provided with an attachment device adapted to attach to a machine for supporting the drain remediation tool in position over the drain in use. The drive shaft may protrude through a further aperture in the housing for attachment to the drive apparatus.

[0013] According to a second aspect of the invention there is provided a method of remediating a drain comprising causing agitation of material in the drain using a drain remediation tool of the first aspect of the invention.

[0014] An embodiment of the invention will now be described by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a perspective view of the drain remediation tool according to the first aspect of the invention; Figure 2 is a cross sectional view of the tool of Figure 1, and

Figure 3 is a schematic representation of the tool of Figures 1 and 2 attached to a machine for use.

[0015] Referring to Figures 1 and 2, the drain remediation tool 1 comprises a housing 3, a rotatable drum 5, a drive shaft 7 and a plurality of teeth 9.

[0016] The housing 3 comprises an approximate partial cylinder 11 with closed ends provided by first and second end plates 13. The partial cylinder 11 provides an aperture 15. The housing 3 further comprises a levelling plate 17 and an attachment device 19 adapted to connect to a machine in use.

[0017] The rotatable drum 5 is substantially cylindrical and is disposed within the housing 3, as shown. The drive shaft 7 is attached to the drum 5. The drive shaft 7 protrudes through a further aperture in the housing 3, as shown, and is attached to a drive apparatus (not shown) for rotation of the drum 5. The drive apparatus comprises a gearbox and a motor (not shown).

[0018] The plurality of teeth 9 are attached to the drum 5 and protrude therefrom, as shown, so that they project through the aperture 15 in the wall of the partial cylinder 11 of the housing 3. The teeth 9 are substantially in the shape of a right-angled triangle, with, in this embodiment, a width of approximately 40mm and a length of approximately 165mm.

[0019] The plurality of teeth 9 are arranged along and around the cylindrical drum 5 in a manner to carry some of the material of the drain over the drum 5. The plurality of teeth 9 comprise a first single tooth provided on a first

strip along the cylindrical drum 5, a second single tooth provided on a second strip along the cylindrical drum 5 and six pairs of teeth provided on third to eighth strips along the cylindrical drum 5. The first and second strips are spaced around the cylindrical drum 5 at an interval of approximately 180 degrees. The third, fourth and fifth strips are spaced around a first side of the cylindrical drum 5 at approximately equal intervals between the first and second strips. The sixth, seventh and eighth strips are spaced around a second side of the cylindrical drum 5 at approximately equal intervals between the first and second strips. The first and second single teeth are provided on the first and second strips at positions approximately midway along each strip, i.e. midway along the cylindrical drum 5. For each of the third to eighth strips the pair of teeth are spaced along the strip at positions approximately 300mm apart. For the third, fourth and fifth strips each pair of teeth are offset by approximately 85mm along the cylindrical drum 5 to provide teeth along the length of the cylindrical drum 5, as shown. For the sixth, seventh and eighth strips each pair of teeth is offset by approximately 85mm along the cylindrical drum 5 to provide teeth along the length of the cylindrical drum 5, as shown.

[0020] Referring to Figure 3, the drain remediation tool 1 is attached to a machine 21 for use. In this embodiment, the machine is a tracked vehicle, but other vehicles or machines could be used for operation of the tool. The attachment device 19 of the housing 3 attaches the tool 1 to an arm 23 of the tracked vehicle 21. The drive apparatus (not shown) is attached to a power supply (not shown) of the vehicle 21 for rotation of the drum 5.

[0021] In use, the drain remediation tool 1 is supported in position over a drain such that the aperture 15 of the housing 3 is placed adjacent a trench of the drain and the plurality of teeth 9 protrude through the aperture 15 into material in the drain trench. The tool 1 is moved along the drain by the vehicle 21. As the tool 1 moves along the trench of the drain, the drum 5 rotates and the plurality of teeth 9 sequentially penetrate material in the drain causing agitation of the material. As the teeth length is 165mm, agitation of the material of the drain is therefore to a depth in the trench of at least approximately 165mm. The arrangement of the plurality of teeth 9 on the drum 5 is such that some drain material is carried over the drum 5 and back into the drain trench. The result of this and the agitation is a breaking apart of particles of the drain material which have become gelled together over time by dirt and grass. As some of the drain material is carried over the drum 5, the housing 3 is provided around the drum 5 to aid in replacement of the material back into the drain trench and to protect users of the drain remediation tool 1. The levelling plate 17 of the housing 3 follows the drum 5 and at least partially levels the material back into place in the drain trench after agitation.

[0022] It has been found that agitation of the material of a drain can significantly improve the drain's performance. If remediation is carried out regularly, the working

life of the drain can be greatly extended.

Claims

1. A drain remediation tool (1) comprising a housing (3) providing an aperture (15), a rotatable drum (5) at least partially disposed within the housing, a drive shaft (7) attached to the drum and adapted to be attached to drive apparatus for rotation of the drum and a plurality of teeth (9) attached to the drum and protruding therefrom through the aperture of the housing, which, on rotation of the drum, sequentially penetrate material in a drain causing agitation of the material to at least partially release clogging of the material and remediation of the drain,
characterised in that
the plurality of teeth (9) comprise a first single tooth provided on a first strip along the cylindrical drum (5), a second single tooth provided on a second strip along the cylindrical drum (5) and six pairs of teeth provided on third to eighth strips along the cylindrical drum (5) and the first and second single teeth (9) are provided on the first and second strips at positions approximately midway along each strip, for each of the third to eighth strips the pair of teeth are spaced along the strip, for the third, fourth and fifth strips each pair of teeth are offset along the cylindrical drum (5) to provide teeth along the length of the cylindrical drum (5) and for the sixth, seventh and eighth strips each pair of teeth are offset along the cylindrical drum (5) to provide teeth along the length of the cylindrical drum (5) and the first and second strips are spaced around the cylindrical drum (5) at an interval of approximately 180 degrees, the third, fourth and fifth strips are spaced around a first side of the cylindrical drum at approximately equal intervals between the first and second strips and the sixth, seventh and eighth strips are spaced around a second side of the cylindrical drum at approximately equal intervals between the first and second strips.
2. A tool according to claim 1 in which the plurality of teeth (9) are each substantially in the shape of a triangle.
3. A tool according to claim 1 or claim 2 in which the plurality of teeth (9) are arranged on the drum (5) in a manner to carry some of the material of the drain over the drum.
4. A tool according to any preceding claim in which the drum (5) is substantially cylindrical and the teeth (9) are arranged around and along the cylindrical drum.
5. A tool according to claim 4 in which the plurality of teeth (9) comprise two or more teeth provided on each of a plurality of strips along the cylindrical drum

(5).

6. A tool according to claim 5 in which for each strip the two or more teeth (9) are spaced along the strip.
7. A tool according to claim 5 or claim 6 in which for a pair of adjacent strips the two or more teeth (9) on a first strip are offset along the cylindrical drum (5) from the two or more teeth on a second strip.
8. A tool according to any of claims 5 to 7 in which the plurality of teeth (9) additionally comprise a single tooth provided on at least one strip along the cylindrical drum (5).
9. A tool according to any of claims 5 to 8 in which the plurality of strips along the cylindrical drum (5) are spaced around the cylindrical drum.
10. A tool according to any preceding claim in which the housing (3) comprises an approximate partial cylinder (11) with closed ends.
11. A tool according to any preceding claim in which the housing (3) is provided with a levelling plate (17) which acts to at least partially level the material of the drain after agitation.
12. A method of remediating a drain comprising causing agitation of material in the drain using a drain remediation tool according to any of claims 1 to 11

Patentansprüche

1. Abflusssanierungswerkzeug (1), umfassend ein Gehäuse (3), das eine Öffnung (15) bereitstellt, eine drehbare Trommel (5), die zumindest teilweise innerhalb des Gehäuses vorgesehen ist, eine Antriebswelle (7), die an der Trommel angebracht und ausgelegt ist, um an der Antriebsvorrichtung zur Drehung der Trommel angebracht zu werden, und eine Vielzahl von Zähnen (9), die an der Trommel angebracht ist und davon durch die Öffnung des Gehäuses vorsteht, die bei Drehung der Trommel nacheinander Material in einem Abfluss durchdringt, wodurch Bewegung des Materials, um Verstopfung des Materials zumindest teilweise zu lösen, und Sanierung des Abflusses verursacht wird,
dadurch gekennzeichnet, dass
die Vielzahl von Zähnen (9) einen ersten einzelnen Zahn, der an einem ersten Streifen entlang der zylindrischen Trommel (5) bereitgestellt ist, einen zweiten einzelnen Zahn, der an einem zweiten Streifen entlang der zylindrischen Trommel (5) bereitgestellt ist, und sechs Zahnpaare umfasst, die an einem dritten bis achten Streifen entlang der zylindrischen Trommel (5) bereitgestellt sind, und der erste und

der zweite einzelne Zahn (9) an dem ersten und dem zweiten Streifen an Positionen ungefähr in der Mitte entlang jedes Streifens bereitgestellt sind, für jeden von dem dritten bis achten Streifen das Zahnpaar entlang des Streifens beabstandet ist, für den dritten, vierten und fünften Streifen jedes Zahnpaar entlang der zylindrischen Trommel (5) versetzt ist, um Zähne entlang der Länge der zylindrischen Trommel (5) bereitzustellen, und für den sechsten, siebten und achten Streifen jedes Zahnpaar entlang der zylindrischen Trommel (5) versetzt ist, um Zähne entlang der Länge der zylindrischen Trommel (5) bereitzustellen, und der erste und der zweite Streifen um die zylindrische Trommel (5) in einem Intervall von ungefähr 180 Grad beabstandet sind, der dritte, vierte und fünfte Streifen um eine erste Seite der zylindrischen Trommel in ungefähr gleichen Intervallen zwischen dem ersten und dem zweiten Streifen beabstandet sind und der sechste, siebte und achte Streifen um eine zweite Seite der zylindrischen Trommel in ungefähr gleichen Intervallen zwischen dem ersten und dem zweiten Streifen beabstandet sind.

2. Werkzeug nach Anspruch 1, wobei die Vielzahl von Zähnen (9) jeweils im Wesentlichen in der Form eines Dreiecks ist.
3. Werkzeug nach Anspruch 1 oder Anspruch 2, wobei die Vielzahl von Zähnen (9) auf der Trommel (5) auf eine Weise angeordnet ist, um einen Teil des Materials des Abflusses über die Trommel zu tragen.
4. Werkzeug nach einem vorhergehenden Anspruch, wobei die Trommel (5) im Wesentlichen zylindrisch ist und die Zähne (9) um die und entlang der zylindrischen Trommel angeordnet sind.
5. Werkzeug nach Anspruch 4, wobei die Vielzahl von Zähnen (9) zwei oder mehr Zähne umfasst, die an jedem aus einer Vielzahl von Streifen entlang der zylindrischen Trommel (5) bereitgestellt sind.
6. Werkzeug nach Anspruch 5, wobei für jeden Streifen die zwei oder mehr Zähne (9) entlang des Streifens beabstandet sind.
7. Werkzeug nach Anspruch 5 oder Anspruch 6, wobei für ein Paar von benachbarten Streifen die zwei oder mehr Zähne (9) an einem ersten Streifen entlang der zylindrischen Trommel (5) von den zwei oder mehr Zähnen an einem zweiten Streifen versetzt sind.
8. Werkzeug nach einem der Ansprüche 5 bis 7, wobei die Vielzahl von Zähnen (9) zusätzlich einen einzelnen Zahn umfasst, der an zumindest einem Streifen entlang der zylindrischen Trommel (5) bereitgestellt ist.

9. Werkzeug nach einem der Ansprüche 5 bis 8, wobei die Vielzahl von Streifen entlang der zylindrischen Trommel (5) um die zylindrische Trommel beabstandet ist.
10. Werkzeug nach einem vorhergehenden Anspruch, wobei das Gehäuse (3) einen ungefähren Teilzylinder (11) mit geschlossenen Enden umfasst.
11. Werkzeug nach einem vorhergehenden Anspruch, wobei das Gehäuse (3) mit einer Nivellierplatte (17) bereitgestellt ist, die wirkt, um das Material des Abflusses nach Bewegung zumindest teilweise zu nivellieren.
12. Verfahren zum Sanieren eines Abflusses, umfassend das Verursachen von Bewegung von Material in dem Abfluss unter Verwendung eines Abflusssanierungswerkzeugs nach einem der Ansprüche 1 bis 11.

Revendications

1. Outil d'assainissement de drain (1) comprenant un boîtier (3) qui fournit une ouverture (15), un tambour rotatif (5) au moins partiellement disposé à l'intérieur du boîtier, un arbre d'entraînement (7) fixé au tambour et conçu pour être fixé à un appareil d'entraînement pour la rotation du tambour et une pluralité de dents (9) fixées au tambour et dépassant de celui-ci à travers l'ouverture du boîtier, qui, lors de la rotation du tambour, pénètrent de manière séquentielle dans la matière dans un drain en provoquant l'agitation de la matière jusqu'à la libération au moins partielle de l'engorgement de la matière et l'assainissement du drain,
caractérisé en ce que
la pluralité de dents (9) comprend une première dent seule pourvue sur une première bande le long du tambour cylindrique (5), une deuxième dent seule pourvue sur une deuxième bande le long du tambour cylindrique (5) et six paires de dents pourvues sur la troisième à la huitième bande le long du tambour cylindrique (5) et les première et deuxième dents seules (9) sont pourvues sur les première et deuxième bandes à des positions approximativement à mi-chemin le long de chaque bande, pour chacune de la troisième à la huitième bande, la paire de dents est espacée le long de la bande, pour les troisième, quatrième et cinquième bandes, chaque paire de dents est décalée le long du tambour cylindrique (5) pour fournir des dents le long de la longueur du tambour cylindrique (5) et pour les sixième, septième et huitième bandes, chaque paire de dents est décalée le long du tambour cylindrique (5) pour fournir des dents le long de la longueur du tambour cylindrique (5) et les première et deuxième bandes sont espa-

- cées autour du tambour cylindrique (5) selon un intervalle d'environ 180 degrés, les troisième, quatrième et cinquièmes bandes sont espacées autour d'un premier côté du tambour cylindrique selon des intervalles approximativement égaux entre les première et deuxième bandes et les sixième, septième et huitième bandes sont espacées autour d'un second côté du tambour cylindrique selon des intervalles approximativement égaux entre les première et deuxième bandes.
- 5 12. Procédé d'assainissement d'un drain comprenant le fait de provoquer l'agitation de la matière dans le drain au moyen d'un outil d'assainissement de drain selon l'une quelconque des revendications 1 à 11.
- 10
2. Outil selon la revendication 1, dans lequel la pluralité de dents (9) se présente chacune sensiblement sous la forme d'un triangle.
- 15
3. Outil selon la revendication 1 ou la revendication 2, dans lequel la pluralité de dents (9) est agencée sur le tambour (5) de manière à transporter une partie de la matière du drain au-dessus du tambour.
- 20
4. Outil selon l'une quelconque des revendications précédentes, dans lequel le tambour (5) est sensiblement cylindrique et les dents (9) sont agencées autour et le long du tambour cylindrique.
- 25
5. Outil selon la revendication 4, dans lequel la pluralité de dents (9) comprend deux dents ou plus pourvues sur chacune d'une pluralité de bandes le long du tambour cylindrique (5).
- 30
6. Outil selon la revendication 5, dans lequel pour chaque bande les deux dents ou plus (9) sont espacées le long de la bande.
- 35
7. Outil selon la revendication 5 ou la revendication 6, dans lequel, pour une paire de bandes adjacentes, les deux dents ou plus (9) sur une première bande sont décalées le long du tambour cylindrique (5) par rapport aux deux dents ou plus sur une deuxième bande.
- 40
8. Outil selon l'une quelconque des revendications 5 à 7, dans lequel la pluralité de dents (9) comprend en outre une dent seule pourvue sur au moins une bande le long du tambour cylindrique (5).
- 45
9. Outil selon l'une quelconque des revendications 5 à 8, dans lequel la pluralité de bandes le long du tambour cylindrique (5) est espacée autour du tambour cylindrique.
- 50
10. Outil selon l'une quelconque des revendications précédentes, dans lequel le boîtier (3) comprend un cylindre partiel approximatif (11) doté d'extrémités fermées.
- 55
11. Outil selon l'une quelconque des revendications précédentes, dans lequel le boîtier (3) est pourvu d'une

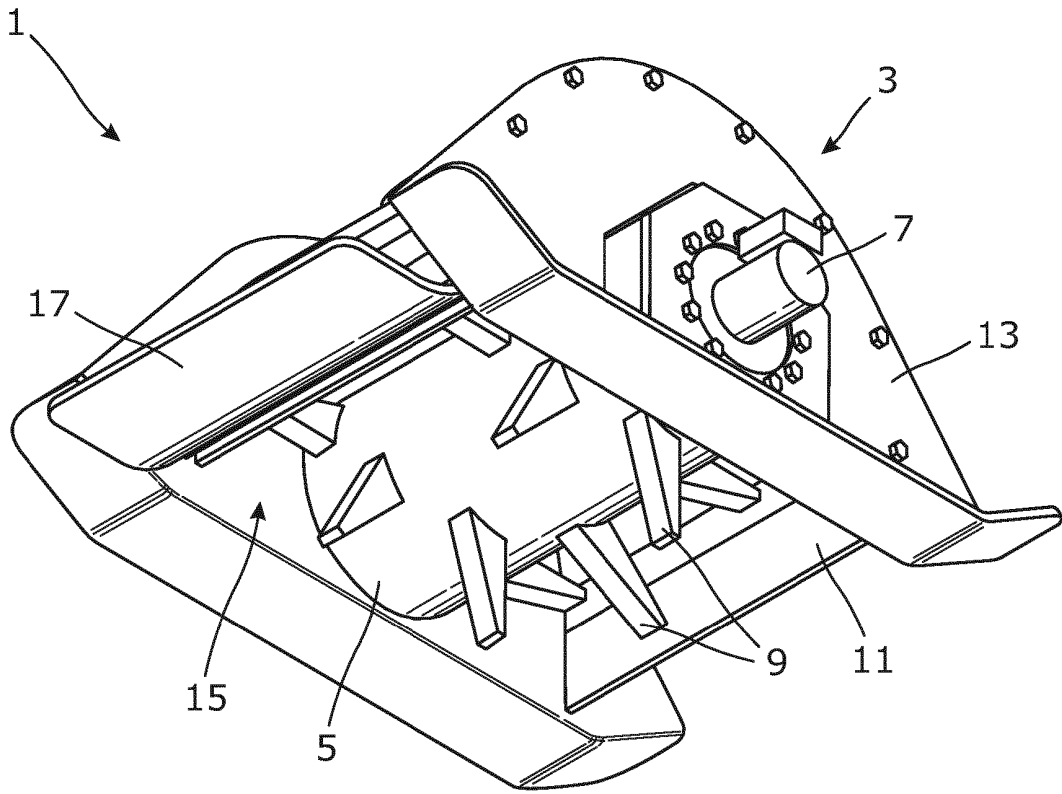


Fig. 1

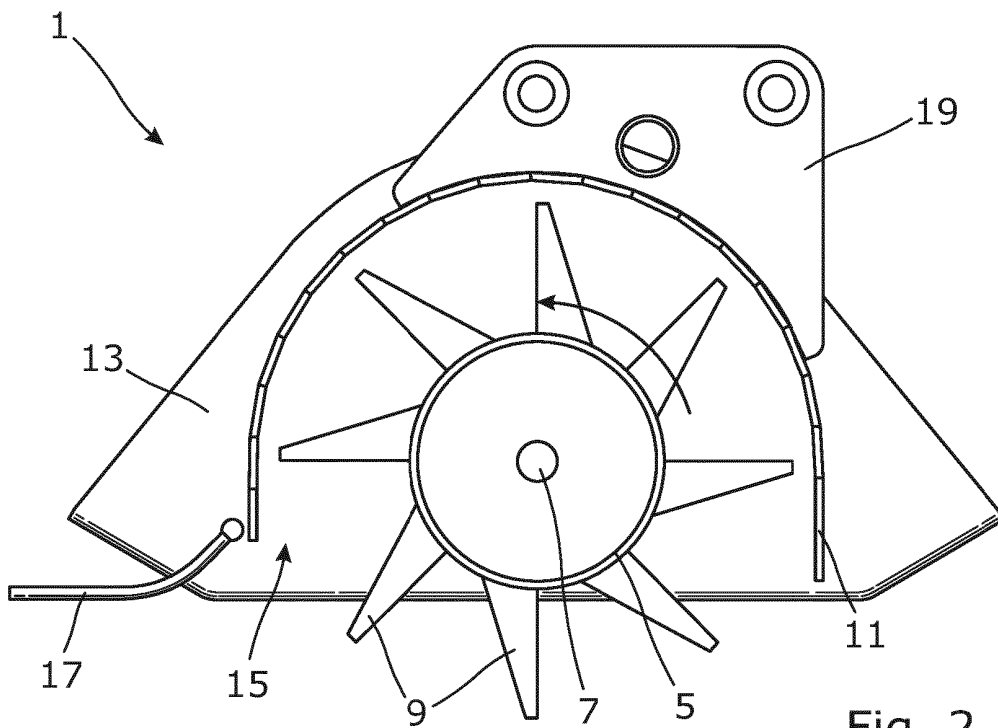


Fig. 2

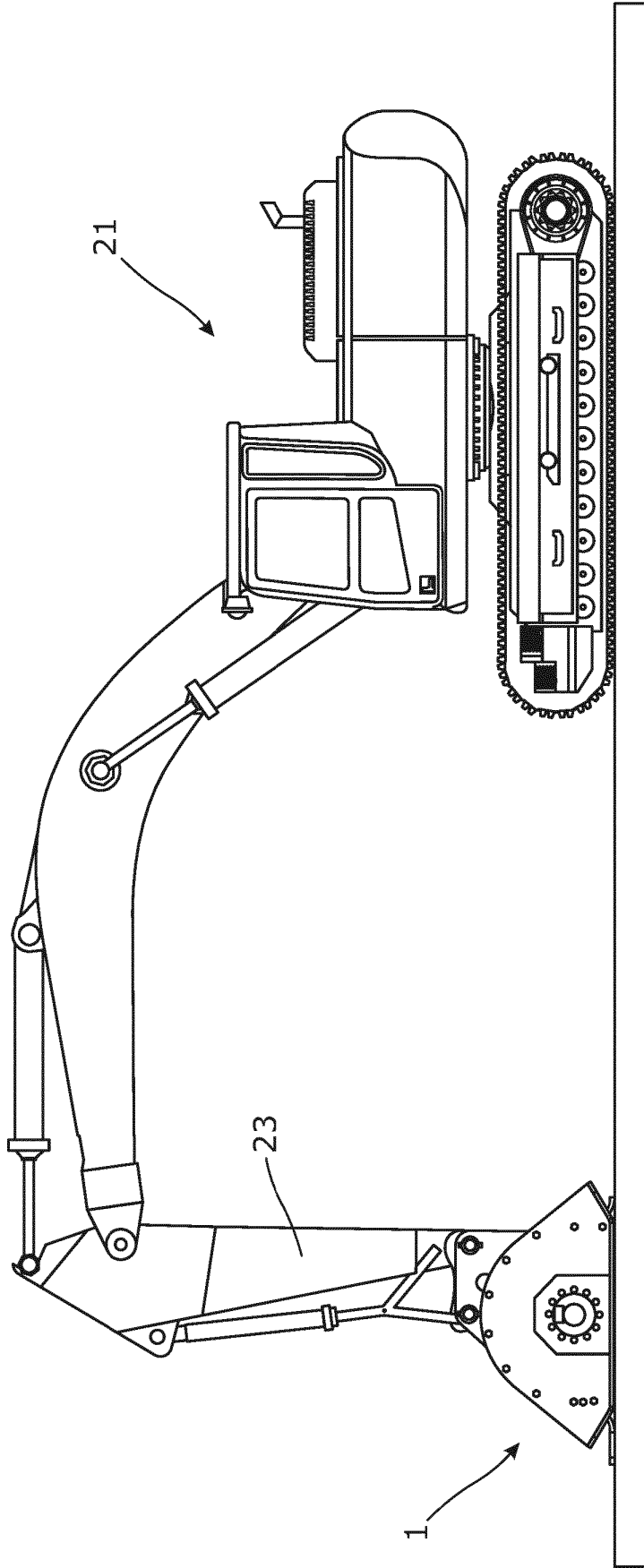


Fig. 3

REFERENCES CITED IN THE DESCRIPTION

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