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(54) **Device for excavating a channel**

Werkzeug um einen Graben zu baggern

Outil pour excaver un canal

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NL-A- 8 800 565 US-A- 3 122 398
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Description

[0001] The present invention relates to a device for excavating a channel.

[0002] Existing devices make use of rotating discs for cutting away the flanks of a channel in combination with a container in which the cut-away material is collected and out of which the cut-away material can be suctioned. Such a device is moved forward in the channel in order to excavate the channel over a determined length.

[0003] Document JP 2011 163005 discloses a construction method and equipment for excavating and removing accumulated mud. The equipment includes an agitating blade in a bucket with an open front side, and a suction port at the backside of the bucket. Excavation is performed concurrently with the rotation of the agitating blade, and the excavated sediment is sucked in via the suction port while being crushed by the agitating blade.

[0004] Document EP 1 972 724 describes a device for profiling ditches. The device comprises a profiling cutter wherein a bin is open in the front and comprises two rotating cutter elements formed of disc-shaped knives that are mounted next to one another on a frame in front of the foremost open end of the bin. The bin is formed of a bottom, a standing rear wall and two slantwise standing side walls. The front ed of the bottom is situated slantingly in relation to the riding direction and work as a knife to shovel up the ground from the bottom of a ditch.

[0005] Document NL7 714 038, describes a device which is configured to detach plants at a bottom of a ditch. The device is moved by a vehicle across the length of the ditch. The device comprises a housing wherein a rotating drum with teeth is mounted. The housing cooperates with a knife arranged at a front bottom portion of the housing such that when the housing is dragged across the bottom of the ditch, the knife cuts away the plants and removes pollutants. The plants and other debris, like clay, stones or pollutants, is thrown by the drum to a rear portion of the housing. The plants and debris fall on a transport belt, such that they may be moved up the flank of the ditch and dumped near the top of the ditch.

[0006] The present invention has for its object to provide an improved device for excavating a channel, and particularly to provide a device with which the material for removing can be dislodged and discharged in a more efficient manner.

[0007] A device according to the invention comprises for this purpose a container and a rotor arranged in this container. The container has standing side walls, a rear end and an open front end which is provided with cutting edges configured to cut away flanks of the channel. The rotor is provided with a number of knife elements and is configured to dislodge and move soil to the rear end of the container between the standing side walls of the container. The rear end of the container is provided with a discharge opening through which the dislodged soil can be discharged.

[0008] Providing the container at its open front end with

cutting edges on the one hand and providing knife elements rotating in the container on the other ensures that the flanks of the channel are cut away in neat manner, while the material which comes to lie between the standing side walls of the container is dislodged by the rotating knife elements and moved to the rear end of the container by these rotating knife elements. These features make it possible for the container to be moved forward at an acceptable speed in the channel and for a good result to be achieved.

[0009] The rotor is preferably mounted for rotation around a horizontal shaft attached against a standing side wall of the container. This allows the rotor to be positioned roughly in the centre of the container such that the knife elements can be positioned in suitable manner. It is noted that it is possible to provide in the container a hydromotor which drives the rotor.

[0010] The knife elements preferably have substantially the form of a shovel. This shovel form will allow the knife elements to carry material in efficient manner to the rear end of the container. According to an advantageous embodiment, each knife element has a first part with a cutting edge and a second part which forms an angle with the first part, this such that the dislodged soil can be carried in this angle. The cutting edge of such a knife element is preferably parallel to the rotation axis of the rotor. In addition, each knife element is preferably mounted for pivoting around an axis parallel to the rotation axis. A knife element can in this way take up an advantageous position in accordance with the type of material, and the material carried to the rear end of the container can fall off a knife element when this knife element is moved upward by the rotor.

[0011] According to an advantageous embodiment, the rotor comprises a central rotor plate and the knife elements are provided in holders mounted at regular intervals along the periphery of the central plate, preferably on either side of the central rotor plate. The knife elements are preferably arranged pivotally in the holders here, preferably around a pivot axis parallel to the rotation axis of the rotor.

[0012] The standing side walls of the container preferably run obliquely upward at an angle corresponding substantially to the desired angle of inclination of the flanks of the channel.

[0013] According to another aspect of the invention, the container is formed from a first part with a first standing side wall and a first bottom wall part, and a second part with a second standing side wall and a second bottom wall part. The container is further configured such that the first and second bottom wall parts are mountable in different positions relative to each other such that the width of the bottom wall formed by the first and second bottom wall parts is adjustable. The width of the container can in this way be adjusted to the desired width of the channel to be excavated. In such an embodiment guide means are preferably provided between the first and second parts for the purpose of guiding the first part relative

to the second part during setting of the width. This will further facilitate the setting of the width. In addition, locking means are preferably provided for locking the first part relative to the second part once the desired width has been set.

[0014] According to another aspect of the invention, the rear end of the container is provided with a guide piece with a guide wall running gradually upward for the purpose of guiding the dislodged soil upward. This guide wall preferably runs upward in arcuate manner in the direction of an upper wall of the container. According to an advantageous embodiment, the guide wall runs upward along a path roughly parallel to a part of the path followed by the knife elements. The discharge opening can be provided in the wall running gradually upward, close to an upper wall of the container. The material carried upward along the guide wall by the knife elements can in this way be properly discharged. The guide piece can further be provided with a discharge pipe which connects to the discharge opening. This discharge pipe can then for instance be connected by means of a universal coupling to a soil suction excavator, for instance a suction excavator with turbines.

[0015] According to a particularly advantageous embodiment, the guide piece comprises a first guide part with a first guide wall part and a second guide part with a second guide wall part. This first and second guide wall part are configured such that they are mountable in different positions relative to each other such that the width of the guide wall formed by the first and second guide wall parts is adjustable. A good discharge of material can in this way be realized for channels of differing widths.

[0016] According to the present invention, the front end of the container is provided with a lower cutting edge in the line of the bottom wall of the container and with two standing cutting edges in the line of the standing side walls of the container. This lower cutting edge is preferably formed by a removable elongate knife. A set of lower knives of a differing length can in this way be provided such that an appropriate lower cutting edge can be arranged in accordance with the width of the container.

[0017] The present invention will be further elucidated on the basis of a number of by no means limitative embodiments of the present invention with reference to the accompanying drawings, in which:

Figure 1A is a schematic perspective view of an embodiment of a device according to the invention as viewed from the front end of the container;

Figure 1B is a schematic perspective view of the embodiment of figure 1A as viewed from the rear end of the container;

Figures 2A and 2B are schematic perspective views of a left-hand part of the container as viewed from respectively the front end and the rear end of the container;

Figures 3A and 3B are further schematic perspective views of the embodiment of figures 1A and 1B as

viewed from respectively the upper side of the container and the inner side of the rear end of the container; and

Figures 4A and 4B are perspective views of a right-hand part of the container as viewed from respectively the upper side and the underside.

[0018] Figures 1A, 1B, 3A and 3B illustrate an embodiment of a device for excavating a channel according to the invention. The device comprises a container 1 with standing side walls 11, 12, a bottom wall 13 and a rear wall 17. The container has an open front end 14 with a lower cutting edge 23 in the line of bottom wall 13 and with second standing cutting edges 21, 22 in the line of the respective standing side walls 11, 12. Lower cutting edge 23 preferably forms part of a removable knife part which is attachable to bottom wall 13 using for instance bolts 24. The standing side walls 11, 12 run obliquely upward at an angle 16 which substantially corresponds to a desired angle of inclination of the flanks of the channel. As best shown in figure 3A, a discharge opening 41 through which dislodged soil can be discharged is provided at the rear end 14 of the container.

[0019] A rotor 3 provided with a number of knife elements 30 is arranged in container 1. Rotor 3 with knife elements 30 is configured to dislodge and move to the rear end 14 of container 1 soil cut into by cutting edges 21, 22, 23. Rotor 3 is mounted for rotation around a horizontal axis R. The rotor shaft is driven by a hydraulic motor received in a housing 37. This housing is fixed against a standing side wall 12 of container 1. Rotor 3 comprises a central plate 35 on which a number of holders 36 for knife elements 30 are mounted. These holders 36 are arranged distributed along the periphery of central plate 35 on either side thereof. A shovel-like knife element is mounted in each holder 36. The shovel-like knife element 30 comprises a first part 31 with a cutting edge 33 and a second part 32 which forms an angle 34 with first part 31. The dislodged soil can in this way be carried in angle 34. The knife elements are preferably mounted pivotally in holder 36. Breaking of knife elements is in this way avoided when they make contact with a hard object. Cutting edge 33 of each knife element is parallel to the rotation axis R of the rotor and the pivot axis S of knife element 30 is likewise parallel to the rotation axis R of the rotor.

[0020] As illustrated in figures 2A, 2B, 4A and 4B, container 1 is formed from two parts: a first part which is shown in figures 4A and 4B with a first standing side wall 11 and a first bottom wall part 13a; and a second part which is shown in figures 2A and 2B with a second standing side wall 12 and a second bottom wall part 13b. The first and second bottom wall parts 13a, 13b are mountable in different positions relative to each other such that the width of the bottom wall 13 formed by the first and second bottom wall parts is adjustable. In order to facilitate the positioning of the first part relative to the second part, guide means 51, 52 in the form of two sets of tele-

scopically co-acting pipes are provided on the upper side of the container. In the illustrated embodiment a limited number of different positions of the first part is possible relative to the second part, and the first part is lockable relative to the second part using locking means arranged here on the upper side of the container and on rear wall 17. First locking means 60 in the form of for instance a hole-pin locking are provided on the upper side of container 1. A locking mechanism 61 which is adjustable in accordance with the desired width can also be provided on the rear side, see figure 3B in particular.

[0021] The rear end 15 of container 1 is provided with a guide piece 4 with a guide wall 42 running gradually upward for guiding the dislodged soil upward. Guide piece 4 is formed here from a first guide part 4a with a first guide wall part and a second guide part 4b with a second guide wall part, see figures 2A and 4A. The second guide part 4b can slide over the first guide part 4a such that the width of guide piece 4 is also adjustable. Guide wall 42 formed by guide parts 4a, 4b runs upward along a path roughly parallel to a part of the path followed by knife elements 30 such that knife elements 30 move along the guide surface up to a certain height while they move rearward and upward. Discharge opening 41 is formed in the guide wall 42 running gradually upward. The knife elements will in this way ensure that the dislodged soil is moved upward along the guide surface and into the discharge opening. Provided between rear wall 17 and guide wall 42 is a discharge pipe 43 extending from discharge opening 41 to an opening in rear wall 17. Provided from rear wall 17 is a second pipe part 44 which can be connected by means of for instance a universal coupling to a soil suction extractor.

[0022] Rear wall 17 can be provided with a second opening 71 along which container 1 can be further cleaned. This opening 71 is also used for passage of the conduits, for instance the hoses for feed to the hydromotor, for connection to for instance a tractor or mobile crane used to move the container forward in the channel. The mechanical coupling between container 1 and the mobile crane or tractor takes place by means of the gear ring 81 provided on the upper side of the container.

[0023] Finally, container 1 can be provided with a protective cover 18 which has on the one hand a mudguard function and on the other hand functions as a safety guard partially shielding the knife elements.

[0024] The skilled person will appreciate that the invention is not limited to the above described embodiments and that many variants and modifications can be envisaged within the scope of the invention, which is defined solely by the following claims.

[0025] The skilled person will thus appreciate that container 1 can be embodied with more than one rotor instead of with one rotor, for instance two rotors, one on each side wall of the container. In this case a partition can optionally be provided in the container between the two rotors. Particularly for very wide channels, this can be a useful solution. A plurality of suction openings can

also be provided at the rear end of the container.

[0026] The skilled person will also understand that the design of the knife elements is not limited to shovel-like elements. The knife elements could for instance also be partially cup-like or rake-like, and can be optimized in accordance with the type of material to be removed.

[0027] In the embodiment shown in the figures the setting of the width takes place in wholly manual manner. It is however also possible to envisage providing a hydraulic system for the purpose of setting the width. The width can then optionally be adjusted while the container is located in the channel for excavating.

15 Claims

1. Device for excavating a channel, comprising:

- a container (1) with standing side walls (11, 12), a rear end (15) and an open front end (14), ; which container is configured to be moved forward through the channel;
- a rotor (3) arranged in the container and provided with a number of knife elements (30), which rotor with knife elements is configured to dislodge and move soil to the rear end of the container between the flanks of the channel; wherein the rear end of the container is provided with a discharge opening (41) through which the dislodged soil can be discharged **characterized in that** the open front end is provided with cutting edges (21, 22, 23) configured to cut away flanks of the channel and that the cutting edges at the front end of the container comprise a lower cutting edge (23) in the line of a bottom wall of the container and two standing cutting edges (21, 22) in the line of the standing side walls of the container.

2. Device as claimed in claim 1, **characterized in that** the lower cutting edge forms part of a removable elongate cutting piece.

3. Device as claimed in any of the foregoing claims, **characterized in that** the rotor (3) is mounted for rotation around a horizontal shaft attached against a standing side wall (12) of the container.

4. Device as claimed in any of the foregoing claims, **characterized in that** the knife elements (30) have the form of a shovel.

5. Device as claimed in any of the foregoing claims, **characterized in that** each knife element has a first part (31) with a cutting edge (33) and a second part (32) which forms an angle (34) with the first part, this such that dislodged soil can be carried in this angle.

6. Device as claimed in claim 5, **characterized in that** the rotor (3) has a rotation axis (R) and that the cutting edge (33) of each knife element is substantially parallel to the rotation axis (R). 5
7. Device as claimed in any of the foregoing claims, **characterized in that** the rotor has a rotation axis and that each knife element is mounted pivotally around an axis (S) parallel to the rotation axis (R). 10
8. Device as claimed in any of the foregoing claims, **characterized in that** the rotor (3) comprises a central rotor plate (35) and that the knife elements are provided in holders (36) distributed along the periphery of the central rotor plate, preferably on either side of the rotor plate (35). 15
9. Device as claimed in claim 8, **characterized in that** the knife elements are arranged pivotally in the holders. 20
10. Device as claimed in any of the foregoing claims, **characterized in that** the standing side walls (11, 12) run obliquely upward at an angle (16) corresponding substantially to a desired angle of inclination of the flanks of the channel. 25
11. Device as claimed in any of the foregoing claims, **characterized in that** the container is formed from a first part with the first standing side wall (11) and a first bottom wall part (13a), and a second part with the second standing side wall (12) and a second bottom wall part (13b), wherein the first and the second bottom wall part are mountable in different positions relative to each other such that the width of the bottom wall formed by the first and second bottom wall parts is adjustable. 30
12. Device as claimed in claim 11, **characterized in that** guide means (51, 52) are provided between the first part and the second part for the purpose of guiding the first part relative to the second part during setting of the width. 40
13. Device as claimed in claim 11 or 2, **characterized in that** the device comprises locking means (60, 61) for locking the first part relative to the second part. 45
14. Device as claimed in any of the foregoing claims, **characterized in that** the rear end of the container is provided with a guide piece (4) with a guide wall (42) running gradually upward for the purpose of guiding the dislodged soil upward; wherein the guide wall runs upward along a path roughly parallel to a part of the path followed by the knife elements. 50

Patentansprüche

1. Vorrichtung zum Ausheben eines Kanals, aufweisend:

- einen Behälter (1) mit stehenden Seitenwänden (11, 12), einem hinteren Ende (15) und einem offenen vorderen Ende (14), wobei der Behälter so ausgebildet ist, dass er durch den Kanal vorwärtsbewegt werden kann;
- einen Rotor (3), der in dem Behälter angeordnet und mit einer Anzahl von Messerelementen (30) versehen ist, wobei der Rotor mit den Messerelementen so ausgebildet ist, dass er Erde ablöst und zum hinteren Ende des Behälters zwischen den Flanken des Kanals bewegt; wobei das hintere Ende des Behälters mit einer Austragsöffnung (41) versehen ist, durch die die abgelöste Erde abgeführt werden kann

dadurch gekennzeichnet, dass

das offene vordere Ende mit Schneidkanten (21, 22, 23) versehen ist, die so ausgebildet sind, dass sie die Flanken des Kanals abtrennen, und dass die Schneidkanten am vorderen Ende des Behälters eine untere Schneidkante (23) auf Höhe einer Bodenwand des Behälters und zwei stehende Schneidkanten (21, 22) an den Stirnseiten der stehenden Seitenwände des Behälters aufweisen.

2. Vorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** die untere Schneidkante Teil eines abnehmbaren, länglichen Schneidstücks ist.
3. Vorrichtung nach einem der vorherigen Ansprüche, **dadurch gekennzeichnet, dass** der Rotor (3) um eine horizontale, an einer stehenden Seitenwand (12) des Behälters befestigten Welle drehbar gelagert ist.
4. Vorrichtung nach einem der vorherigen Ansprüche, **dadurch gekennzeichnet, dass** die Messerelemente (30) die Form einer Schaufel aufweisen.
5. Vorrichtung nach einem der vorherigen Ansprüche, **dadurch gekennzeichnet, dass** jedes Messerelement einen ersten Teil (31) mit einer Schneidkante (33) aufweist sowie einen zweiten Teil (32), der mit dem ersten Teil einen Winkel (34) bildet, so dass abgelöste Erde in diesem Winkel gefördert werden kann.
6. Vorrichtung nach Anspruch 5, **dadurch gekennzeichnet, dass** der Rotor (3) eine Drehachse (R) aufweist und dass die Schneidkante (33) jedes Messerelements im Wesentlichen parallel zur Drehachse (R) verläuft.

7. Vorrichtung nach einem der vorherigen Ansprüche, **dadurch gekennzeichnet, dass** der Rotor eine Drehachse aufweist und dass jedes Messerelement um eine zur Drehachse (R) parallele Achse (S) schwenkbar gelagert ist. 5
8. Vorrichtung nach einem der vorherigen Ansprüche, **dadurch gekennzeichnet, dass** der Rotor (3) eine zentrale Rotorplatte (35) aufweist und dass die Messerelemente in Haltern (36) vorgesehen sind, welche entlang des Umfangs der zentralen Rotorplatte, vorzugsweise auf beiden Seiten der Rotorplatte (35), verteilt angeordnet sind. 10
9. Vorrichtung nach Anspruch 8, **dadurch gekennzeichnet, dass** die Messerelemente in den Haltern schwenkbar angeordnet sind. 15
10. Vorrichtung nach einem der vorherigen Ansprüche, **dadurch gekennzeichnet, dass** die stehenden Seitenwände (11, 12) schräg nach oben in einem Winkel (16) verlaufen, der im Wesentlichen einem gewünschten Neigungswinkel der Flanken des Kanals entspricht. 20
11. Vorrichtung nach einem der vorherigen Ansprüche, **dadurch gekennzeichnet, dass** der Behälter aus einem ersten Teil, mit der ersten stehenden Seitenwand (11) und einem ersten Bodenwandteil (13a), sowie einem zweiten Teil, mit der zweiten stehenden Seitenwand (12) und einem zweiten Bodenwandteil (13b), gebildet ist, wobei erster und zweiter Bodenwandteil relativ zueinander in unterschiedlichen Positionen montierbar sind, so dass die Breite der durch den ersten und den zweiten Bodenwandteil gebildeten Bodenwand einstellbar ist. 25
12. Vorrichtung nach Anspruch 11, **dadurch gekennzeichnet, dass** zwischen dem ersten Teil und dem zweiten Teil Führungsmittel (51, 52) vorgesehen sind, um während der Einstellung der Breite den ersten Teil relativ zum zweiten Teil zu führen. 30
13. Vorrichtung nach Anspruch 11 oder 12, **dadurch gekennzeichnet, dass** die Vorrichtung Verriegelungsmittel (60, 61) zum Verriegeln des ersten Teils relativ zum zweiten Teil aufweist. 35
14. Vorrichtung nach einem der vorherigen Ansprüche, **dadurch gekennzeichnet, dass** das hintere Ende des Behälters mit einem Führungsteil (4) mit einer Führungswand (42) versehen ist, die allmählich nach oben verläuft, um die abgelöste Erde nach oben zu führen; wobei die Führungswand entlang eines Weges nach oben verläuft, der in etwa parallel zu einem Teil des Weges verläuft, der dem der Messerelemente entspricht. 40

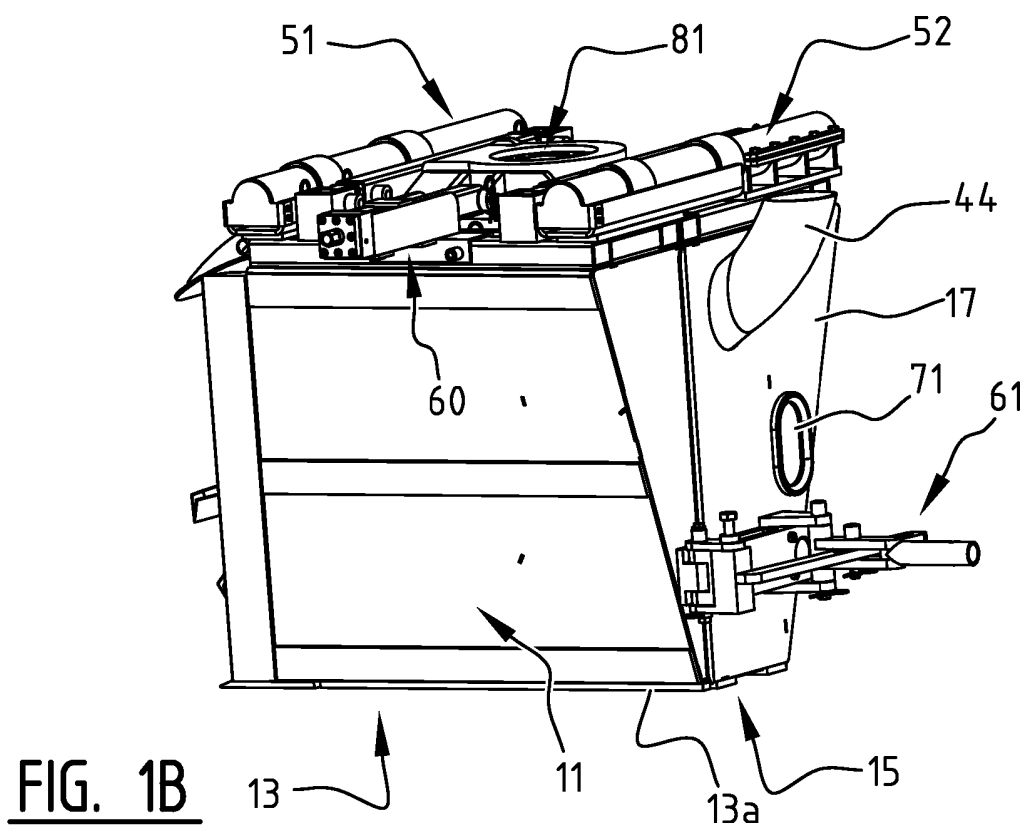
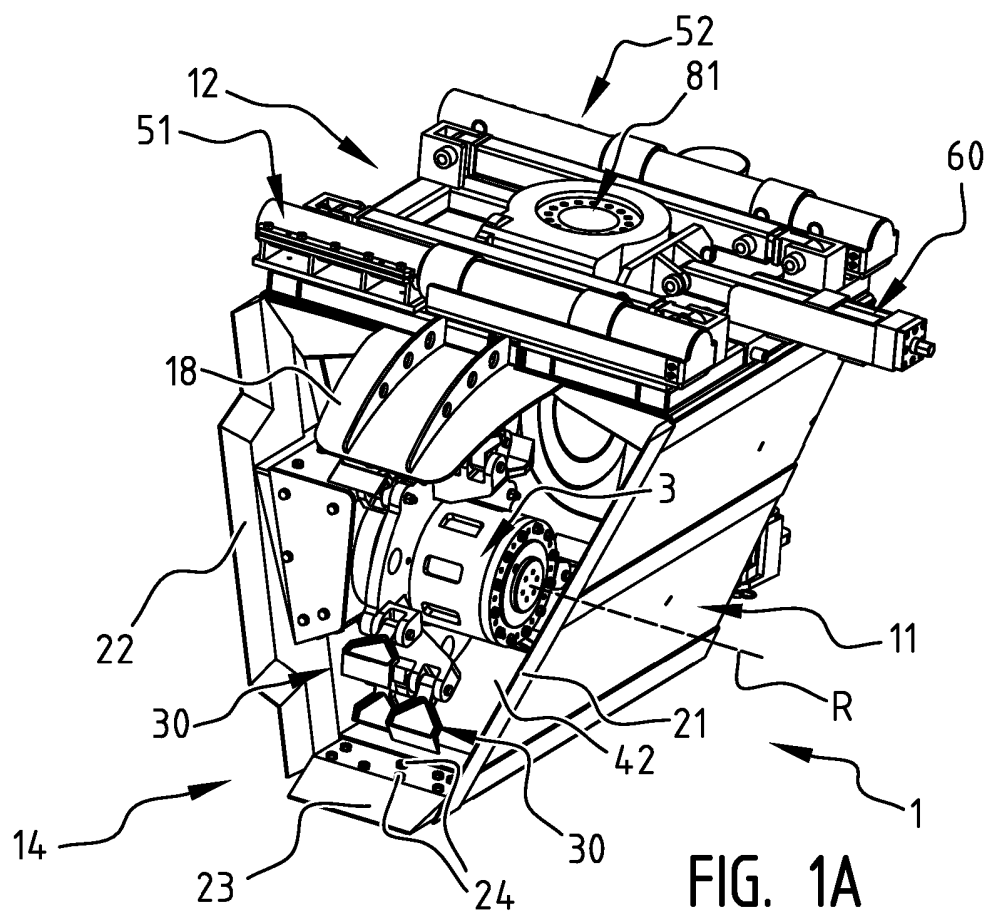
Revendications

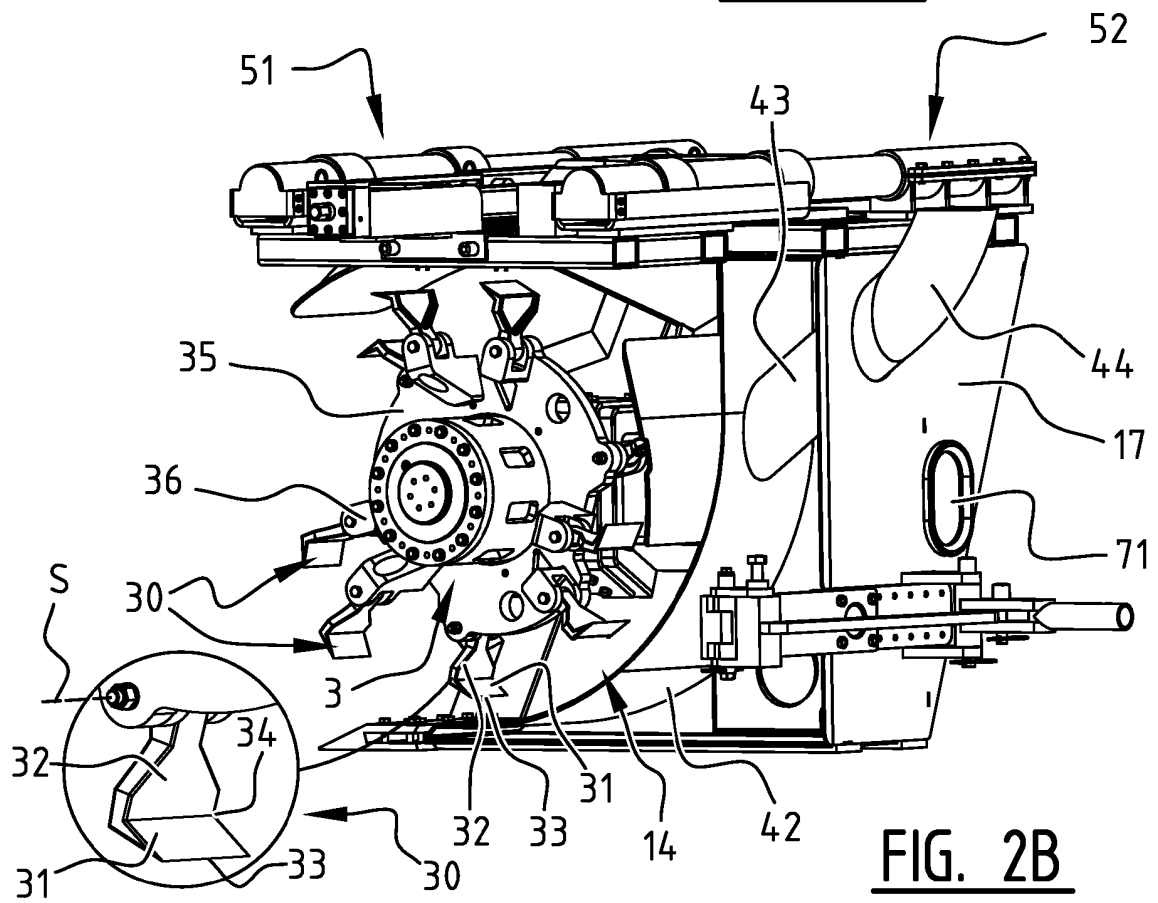
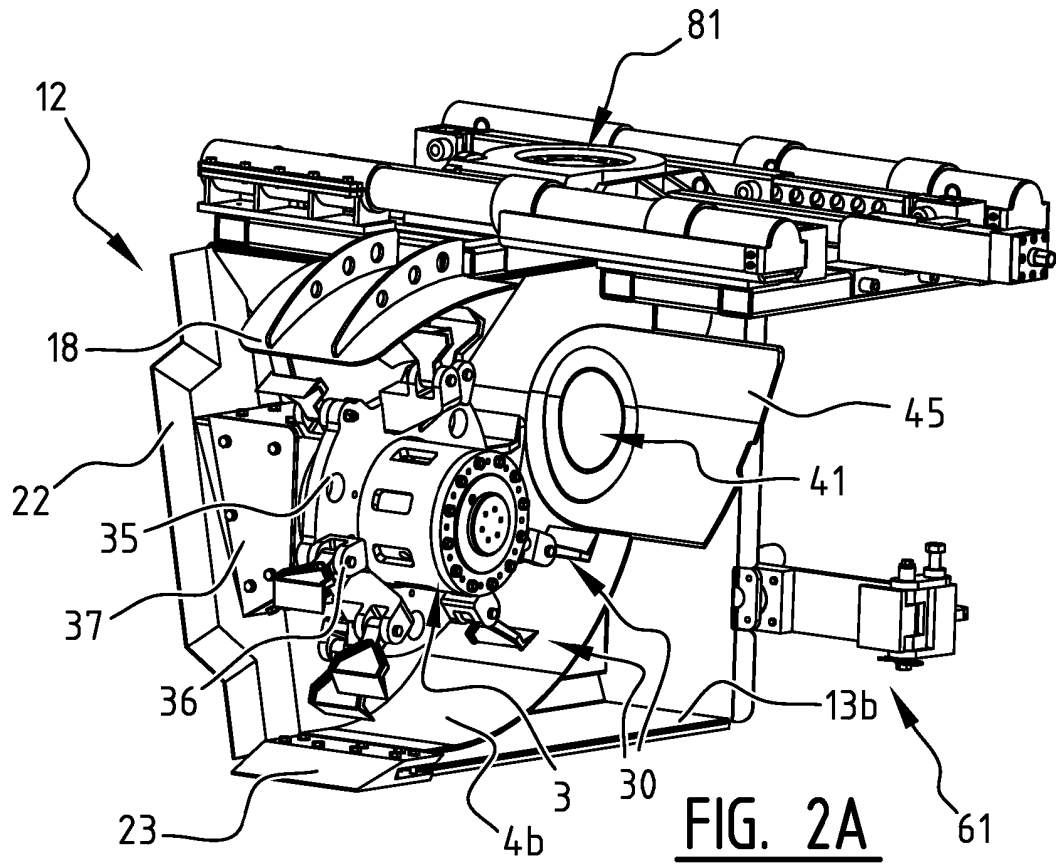
1. Dispositif d'excavation d'un canal, comprenant : 5
 - un conteneur (1) avec des parois latérales verticales (11, 12), une extrémité arrière (15) et une extrémité avant ouverte (14) ; lequel conteneur est configuré de manière à être déplacé vers l'avant à travers le canal ;
 - un rotor (3) agencé dans le conteneur et comportant un certain nombre d'éléments de coupe (30), lequel rotor avec les éléments de coupe est configuré de manière à séparer et à déplacer le matériau du sol vers l'extrémité arrière du conteneur entre les flancs du canal ; dans lequel l'extrémité arrière du conteneur comporte une ouverture de déchargement (41) à travers laquelle le sol séparé peut être déchargé **caractérisé en ce que** l'extrémité avant ouverte comporte des arêtes tranchantes (21, 22, 23) configurées de manière à tailler les flancs du canal **et en ce que** les arêtes tranchantes à l'extrémité avant du conteneur comprennent une arête tranchante inférieure (23) dans l'alignement d'une paroi inférieure du conteneur et deux arêtes tranchantes verticales (21, 22) dans l'alignement des parois latérales verticales du conteneur. 10
2. Dispositif selon la revendication 1, **caractérisé en ce que** l'arête tranchante inférieure forme une partie d'une pièce de coupe allongée démontable. 15
3. Dispositif selon l'une quelconque des revendications précédentes, **caractérisé en ce que** le rotor (3) est monté de manière à pouvoir tourner autour d'un arbre horizontal fixé contre une paroi latérale verticale (12) du conteneur. 20
4. Dispositif selon l'une quelconque des revendications précédentes, **caractérisé en ce que** les éléments de coupe (30) présentent la forme d'une pelle. 25
5. Dispositif selon l'une quelconque des revendications précédentes, **caractérisé en ce que** chaque élément de coupe présente une première partie (31) avec une arête tranchante (33) et une seconde partie (32) qui forme un angle (34) avec la première partie, ceci de telle sorte que le sol séparé peut être entraîné sous cet angle. 30
6. Dispositif selon la revendication 5, **caractérisé en ce que** le rotor (3) présente un axe de rotation (R) **et en ce que** l'arête tranchante (33) de chaque élément de coupe est sensiblement parallèle à l'axe de rotation (R). 35
7. Dispositif selon l'une quelconque des revendications 40

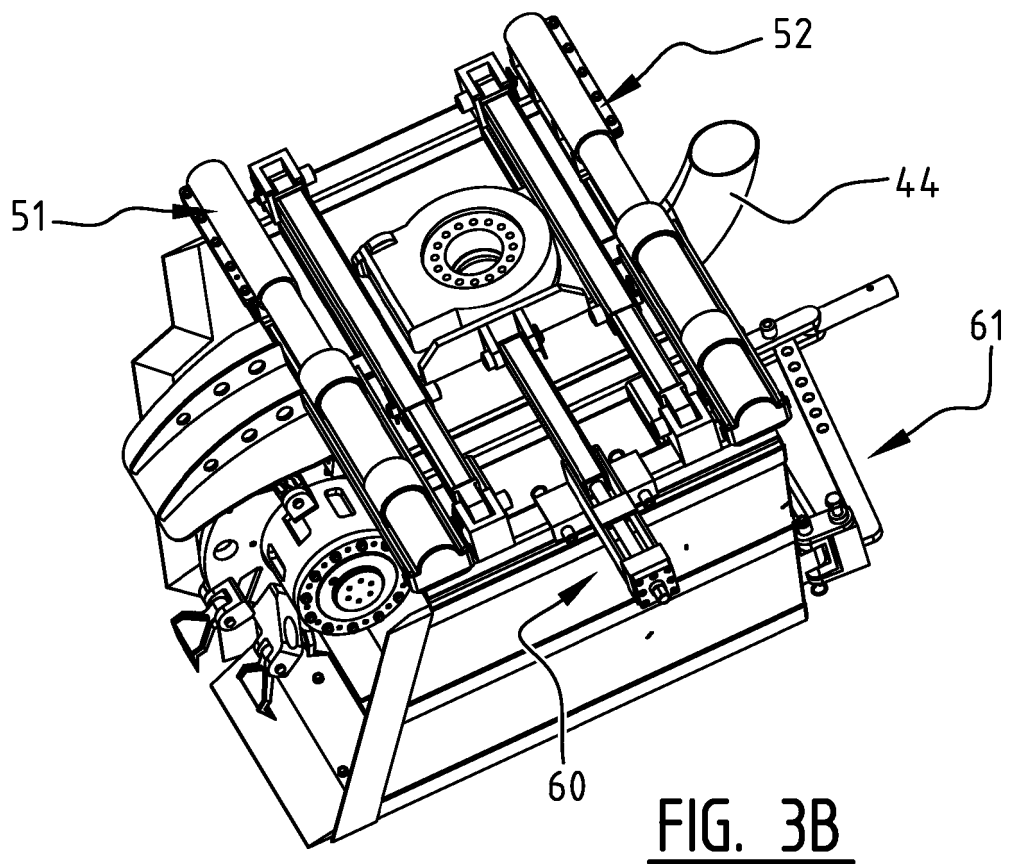
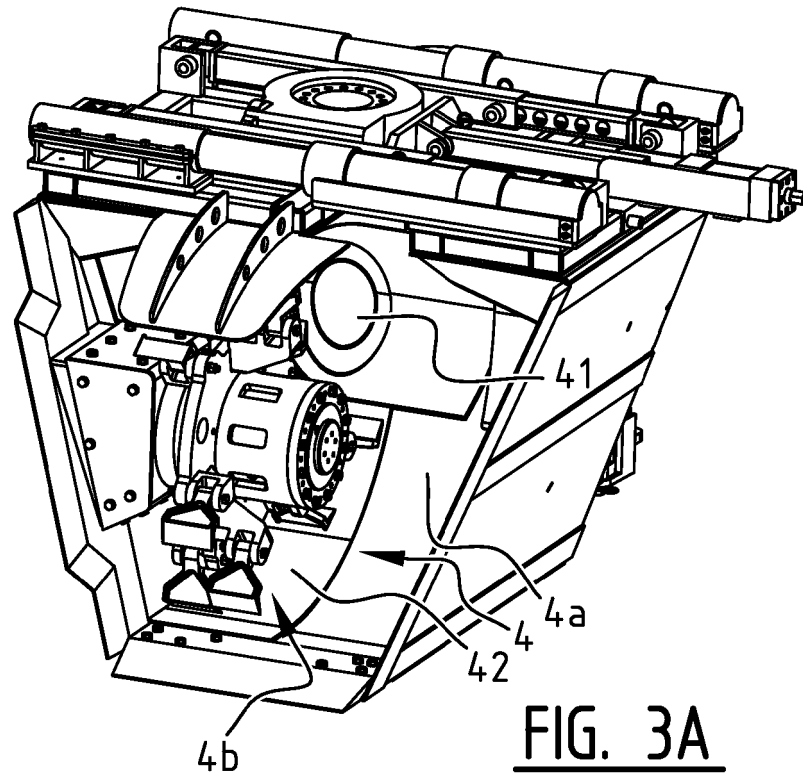
précédentes, **caractérisé en ce que** le rotor présente un axe de rotation et **en ce que** chaque élément de coupe est monté de manière à pouvoir pivoter autour d'un axe (S) parallèle à l'axe de rotation (R).

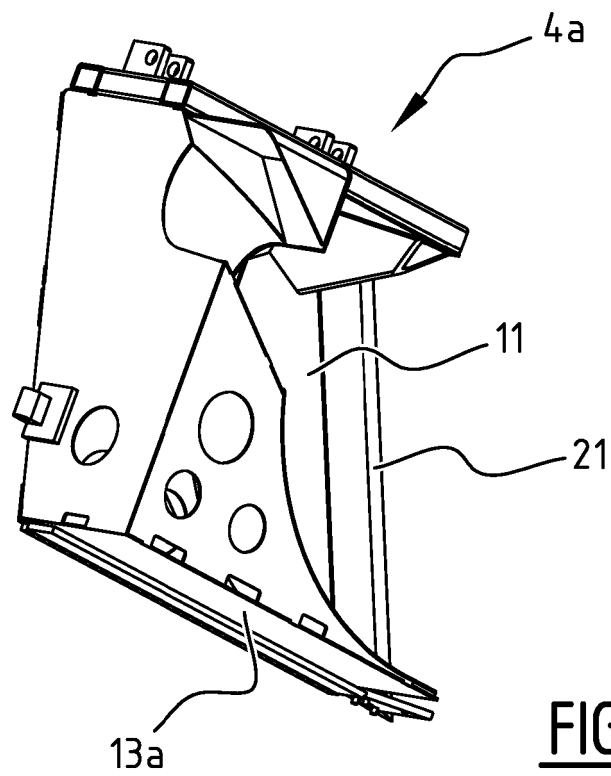
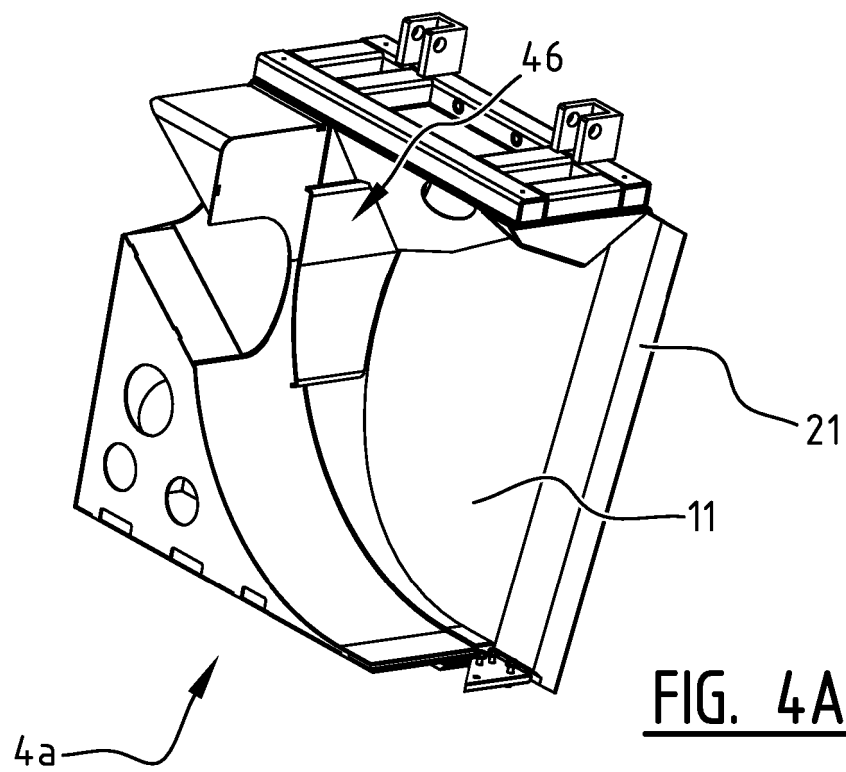
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8. Dispositif selon l'une quelconque des revendications précédentes, **caractérisé en ce que** le rotor (3) comprend une plaque de rotor centrale (35) et **en ce que** les éléments de coupe sont agencés sur des supports (36) répartis le long de la périphérie de la plaque de rotor centrale, de préférence, de chaque côté de la plaque de rotor (35). 10
9. Dispositif selon la revendication 8, **caractérisé en ce que** les éléments de coupe sont agencés de manière à pouvoir pivoter sur les supports. 15
10. Dispositif selon l'une quelconque des revendications précédentes, **caractérisé en ce que** les parois latérales verticales (11, 12) s'étendent de manière oblique vers le haut sous un angle (16) correspondant sensiblement à un angle d'inclinaison désiré des flancs du canal. 20
11. Dispositif selon l'une quelconque des revendications précédentes, **caractérisé en ce que** le conteneur est formé à partir d'une première partie avec la première paroi latérale verticale (11) et une première partie de paroi inférieure (13a) et d'une seconde partie avec la seconde paroi latérale verticale (12) et une seconde partie de paroi inférieure (13b), dans lequel la première et la seconde partie de paroi inférieure peuvent être montées dans différentes positions l'une par rapport à l'autre de telle sorte que la largeur de la paroi inférieure formée par les première et seconde parties de paroi inférieures est réglable. 25
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12. Dispositif selon la revendication 11, **caractérisé en ce que** des moyens de guidage (51, 52) sont agencés entre la première partie et la seconde partie dans le but de guider la première partie par rapport à la seconde partie au cours du réglage de la largeur. 40
13. Dispositif selon la revendication 11 ou 2, **caractérisé en ce que** le dispositif comprend des moyens de verrouillage (60, 61) destinés à verrouiller la première partie par rapport à la seconde partie. 45
14. Dispositif selon l'une quelconque des revendications précédentes, **caractérisé en ce que** l'extrémité arrière du conteneur comporte une pièce de guidage (4) avec une paroi de guidage (42) s'étendant progressivement vers le haut dans le but de guider le sol séparé vers le haut ; dans lequel la paroi de guidage s'étend vers le haut suivant un trajet sensiblement parallèle à une partie du trajet suivi par les éléments de coupe. 50
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REFERENCES CITED IN THE DESCRIPTION

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