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(54) Digger machine and relative device for the lifting of the excavation material

(57) Digger machine of the road type suitable to make excavations in the ground (11), including a digging tool (13) associated with moving means (12), the machine comprising a lifting device (17) associated with said digging tool (13) and able to lift the material produced by the excavation, carrying it from the level at which it is produced to a height with respect to the ground (11) such that it can easily be diverted or directed onto an appropriate means of removal and/or collection (22, 23).

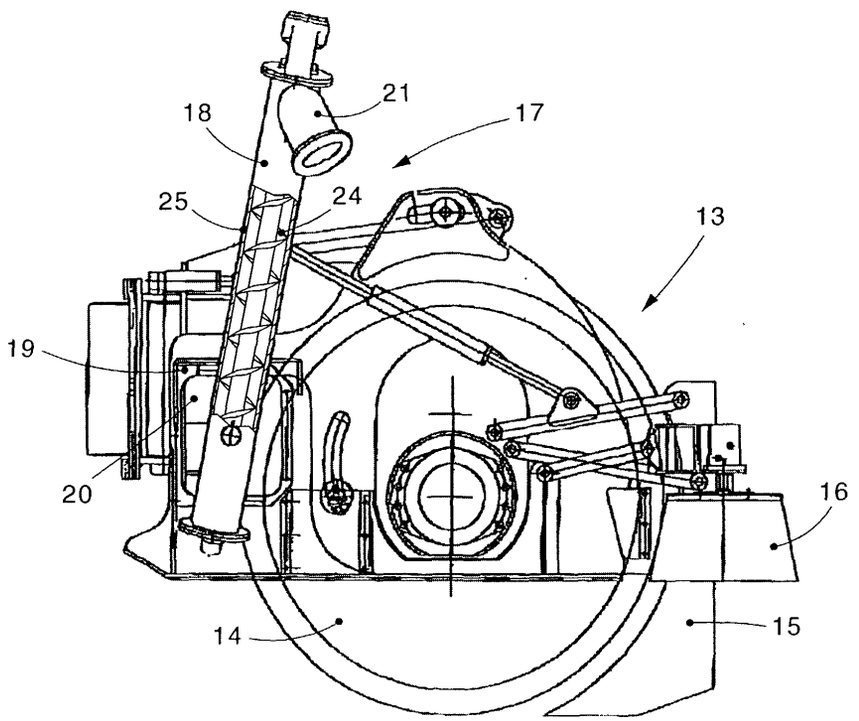

fig. 2

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Description

FIELD OF THE INVENTION

[0001] The invention concerns a digger machine equipped with a device to lift the material resulting from the excavation.

[0002] The invention also concerns a device to lift the excavation material applied to a digger machine.

[0003] The digger machines to which the invention is applied are preferably but not exclusively of the type with a digging tool comprising a milling disk or chain associated with moving means.

BACKGROUND OF THE INVENTION

[0004] The state of the art includes digging equipment of the road type consisting of a traction device, normally a tractor with tracks or tires or similar, at the rear of which a milling disk or chain is coupled, suitable to make an excavation in the ground to position electrical cables, pipes, optical fibres, water pipes or other such equipment.

[0005] Conventional digger machines generally have problems caused by the difficulty of continuously removing the material produced by the excavation process. Normally, this material is deposited at the edges of the excavation, and at most is distanced laterally from the edges by means of brushes which form piles of material at the sides of the excavation.

[0006] It is therefore always necessary to make a subsequent pass with suitable cleaning and/or suction equipment, which have to lift the excavation material from the ground and collect and/or discharge it in suitable containers. All this entails problems in terms of additional time and cost, the use of specialized equipment and relative work force, and sometimes the cleaning operations do not have satisfactory results.

[0007] The present Applicant has devised and embodied this invention to overcome the shortcomings of the state of the art and to obtain further advantages.

SUMMARY OF THE INVENTION

[0008] The invention is set forth and characterized in the main claims, while the dependent claims describe other innovative characteristics of the invention.

[0009] The main purpose of the invention is to achieve a digger machine equipped with an auxiliary device suitable to lift the excavation material from the ground as it is gradually produced by the excavation process, so as to allow it to be easily removed and immediately discharged into a suitable container means.

[0010] A digger machine according to the invention, of the type equipped with a digging tool with a milling disk or chain, comprises a lifting device with an Archimedean screw arranged in a position substantially adjacent to said milling disk or chain.

[0011] The Archimedean screw device, which can be selectively activated in co-ordination with the advance of the digger machine and with the activation of the digging tool, is suitable to continuously lift the excavation material, take it from the level of the ground where it is produced to a height such that it can be easily diverted or directed onto an appropriate removal and/or collection means.

[0012] The removal and/or collection means can preferably be a conveyor belt, or any other means suitable for the purpose.

[0013] In one embodiment of the invention, the Archimedean screw device is arranged substantially orthogonal with respect to the ground where the excavation is made.

[0014] According to a variant, the device is inclined on one side with respect to the substantially vertical plane containing the milling disk or chain.

[0015] In a preferential embodiment, the axis of the Archimedean screw device is inclined by about 8÷12° with respect to the vertical whereas, in an even more preferential embodiment, the Archimedean screw device is inclined by about 10° with respect to the vertical.

[0016] The Archimedean screw device according to the invention comprises an inlet mouth for the material to be lifted, arranged in substantial proximity with the ground where the excavation is made and facing one side of the digging tool; diversion means are advantageously provided in front of the digging tool in order to direct the excavation material produced and lifted by said tool towards said mouth.

[0017] The outlet of the Archimedean screw device is associated advantageously with conveyor means, for example a belt, provided to transfer the excavation material substantially continuously towards a suitable means of transport, for example a truck or other type of movable means which precedes the digger machine.

[0018] In other embodiments, the outlet of the Archimedean screw device can be directly connected with a collection means moving at the side of the digger machine.

[0019] The Archimedean screw device according to the invention is advantageously associated with motor means equipped with a gear change in order to regulate its functioning according to the speed of advance of the digger machine, the speed of rotation of the tool and the depth and/or width of the excavation, which determine the quantity of material to be removed.

[0020] According to a variant, the Archimedean screw device is associated with means to regulate the height from the ground and/or the inclination with respect to the ground.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] These and other characteristics of the invention will become clear from the following description of a preferential form of embodiment, given as a non-re-

strictive example with reference to the attached drawings wherein:

Fig. 1 is a side view of a digger machine according to the invention associated with a means of transport to collect the excavation material;
Fig. 2 is a partly sectioned side view of the lifting device associated with a digging tool;
Fig. 3 is a partly sectioned front view of Fig. 2.

DETAILED DESCRIPTION OF PREFERENTIAL EMBODIMENT

[0022] In the attached Figures, the number 10 denotes in its entirety a digger machine of the road type according to the invention, able to make excavations in the ground 11 to lay electrical cables, optical fibres, water pipes or similar.

[0023] The machine 10 is of a substantially conventional type, and is formed in this case by a tractor 12 with tracks to the rear of which a digging tool 13 is connected, in this case formed by a milling disk 14.

[0024] It comes within the field of the invention to provide that the milling disk 14 can be replaced by a milling chain or other similar digging tool, and that the tractor 12 with tracks can be replaced by a drive means with tires or other type suitable for the purpose.

[0025] The machine 10 also comprises, behind the milling disk 14, a plowshare element 15 which collaborates in the excavation process, and a pair of brushes 16, arranged substantially at the level of the ground 11, the function of which is to distance the excavation material laterally from the edges of the excavation.

[0026] The machine 10 also comprises a device 17 to lift the excavation material, which consists of a vertical or substantially vertical Archimedean screw 18, arranged in front of the milling disk 14, substantially in cooperation with its circumference and slightly displaced sideways with respect thereto.

[0027] The Archimedean screw 18 substantially consists of a screw 24 inserted inside a pipe 25 to contain the material which has been lifted.

[0028] In this case, the axis 18a of the Archimedean screw 18 is inclined with respect to the vertical by an angle α of between 8 and 12°, advantageously around 10°.

[0029] The Archimedean screw 18 is located, with respect to the milling disk 14, in such a manner so as to have the lower mouth, whereby the excavation material enters, arranged slightly above the level of the ground 11 and facing one side of the milling disk 14. The Archimedean screw 18 is mounted on the structure of the digging tool 13 by means of a flange 19 associated with a shaped plate 20 which functions substantially as a guard to divert the excavation material generated by the milling disk 14 towards the mouth of the Archimedean screw 18.

[0030] At its upper end, the Archimedean screw 18 has an outlet mouth 21 from which the excavation material is discharged and possibly directed towards appropriate collection and removal means. In this case, the outlet mouth 21 is associated with a conveyor belt 22 the function of which is to convey the material removed continuously by the Archimedean screw 18 and to unload it on a truck 23, which advances in front of the digger machine 10.

[0031] It is obvious that the embodiment shown here to remove and collect the excavation material lifted by the Archimedean screw 18 is only an example, since the conveyor belt 22 and the truck 23 can be replaced by any other appropriate device or system to convey, unload and collect the excavation material, associated with the outlet mouth 21 of the Archimedean screw 18.

[0032] From the above description it is therefore clear that the lifting device 17 allows to continuously raise the excavation material to a height such as to render the collection and removal operations easier and more convenient; such operations would otherwise be extremely complex and at times even impossible, since they would have to take place substantially at ground level.

[0033] In this way, subsequent cleaning operations and operations to remove the material are no longer necessary, which entails considerable advantages both in terms of time and in terms of manpower and specialized equipment.

[0034] It is obvious however that modifications and/or additions can be made to the digger machine 10 as described heretofore, without departing from the spirit and scope of the invention.

[0035] For example, the lifting device 17 can be equipped with alarm systems or systems to signal malfunctions or blockages. Moreover, the tractor 12 can be of the radio controlled type so that operations can be remote controlled.

[0036] It is also obvious that, although the invention has been described with reference to a specific example of a digger machine, comprising a tractor 12 with tracks and a milling disk 14, a skilled person shall certainly be able to apply the lifting device 17 to any type of digger machine 10 whatsoever and the relative tool 13, even different from those described, which share the problem of lifting the excavation material with respect to the level of the ground 11.

[0037] All these equivalent applications shall therefore come within the field and scope of the invention.

Claims

1. Digger machine of the road type suitable to make excavations in the ground (11), including a digging tool (13) associated with moving means (12), the machine being **characterized in that** it comprises a lifting device (17) associated with said digging tool (13) and able to lift the material produced by the excavation, carrying it from the level at which it is pro-

duced to a height with respect to the ground (11) such that it can easily be diverted or directed onto an appropriate means of removal and/or collection (22, 23).

2. Digger machine as in Claim 1, **characterized in that** said lifting device (17) consists of a substantially vertical Archimedean screw (18) with an inlet mouth for the material arranged slightly above the level of the ground (11) and facing one side of the digging tool (13), and an outlet mouth (21) associated with said removal and/or collection means (22, 23).

3. Digger machine as in Claim 2, **characterized in that** said Archimedean screw (18) comprises at least a screw element (24) inserted inside a tubular element (25) to contain the material.

4. Digger machine as in Claim 2, **characterized in that** said Archimedean screw (18) is arranged substantially orthogonal with respect to the ground (11) on which the excavation is made.

5. Digger machine as in Claim 2, **characterized in that** said Archimedean screw (18) is arranged inclined on one side with respect to the substantially vertical plane containing the digging tool (13).

6. Digger machine as in Claim 5, **characterized in that** said Archimedean screw (18) is inclined by an angle (α) of between 8 and 12°, advantageously about 10°, with respect to the substantially vertical plane containing the digging tool (13).

7. Digger machine as in Claim 1, **characterized in that** it comprises diversion means (20) co-operating with said inlet mouth of the Archimedean screw (18) and able to divert the excavation material produced by the digging tool (13) towards the inside of said Archimedean screw (18).

8. Digger machine as in Claim 7, **characterized in that** said diversion means comprise a shaped plate (20) associated with flange means (19) to assemble said lifting device (17) to the structure of the digging tool (13).

9. Digger machine as in Claim 1, **characterized in that** said removal and/or collection means comprise at least a conveyor belt (22) associated with the outlet mouth (21) of said Archimedean screw (18).

10. Digger machine as in Claim 9, **characterized in that** said conveyor belt (22) can be associated at the end with a self-propelled collection means (23) advancing in front of said digger machine (10).

11. Digger machine as in Claim 1, **characterized in that** said digging tool (13) is a milling disk or chain (14) and **in that** said lifting device is arranged in front of and substantially in co-operation with the circumference of said milling disk or chain (14).

12. Digger machine as in Claim 1, **characterized in that** said moving means consist of a tractor (12) with tracks or tires.

13. Digger machine as in Claim 12, **characterized in that** said tractor (12) with tracks or tires is able to be driven by remote control means.

14. Lifting device for the excavation material produced by a digging tool (13) of a digger machine (10), the device being **characterized in that** it comprises Archimedean screw means (18) arranged in a position substantially adjacent to said digging tool (13) and able to lift the material generated by the excavation to a height with respect to the ground such that it can easily be diverted or directed onto an appropriate means of removal and/or collection (22, 23).

15. Device as in Claim 14, **characterized in that** said Archimedean screw means (18) are inclined by an angle (α) of between 8 and 12° with respect to the vertical plane containing said digging tool (13).

16. Device as in Claim 15, **characterized in that** said Archimedean screw means (18) are inclined by an angle (α) of 10° with respect to the vertical plane containing said digging tool (13).

17. Device as in Claim 14, **characterized in that** said Archimedean screw means (18) are arranged substantially vertical.

18. Device as in Claim 14, **characterized in that** said Archimedean screw means (18) comprise at least a screw element (24) inserted inside a tubular element (25) to contain the material.

19. Device as in Claim 14, **characterized in that** said Archimedean screw means (18) comprise an inlet mouth for the excavation material arranged slightly above the level of the ground (11) and facing one side of said digging tool (13) and an outlet mouth (21) associated with said removal and/or collection means (22, 23).

20. Device as in Claim 14, **characterized in that** it comprises diversion means (20) co-operating with said inlet mouth and able to divert the excavation material generated by the digging tool (13) towards the inside of said Archimedean screw means (18).

21. Device as in Claim 14, **characterized in that** said Archimedean screw means (18) are associated with motor means equipped with gear changes to regulate the functioning thereof according to the speed of advance of the digger machine (10), the speed of rotation of the tool (13) and the depth and/or width of the excavation.

22. Device as in Claim 14, **characterized in that** said Archimedean screw means (18) are associated with means to regulate the height and/or inclination.

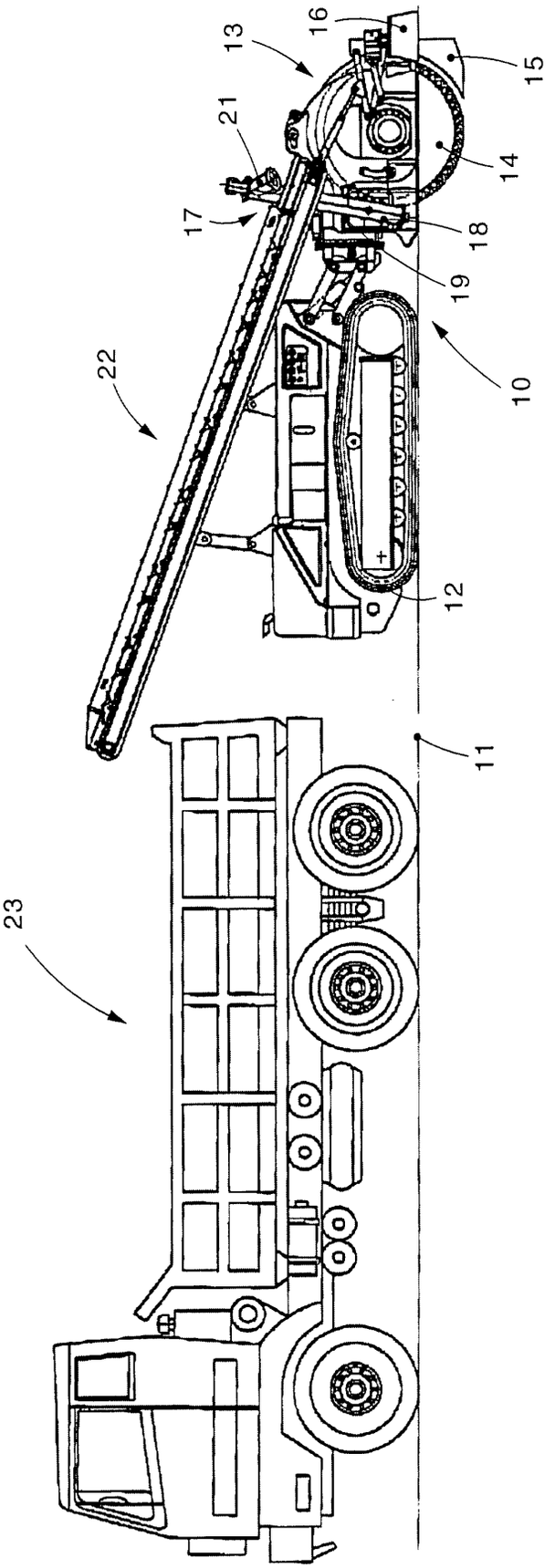

fig. 1

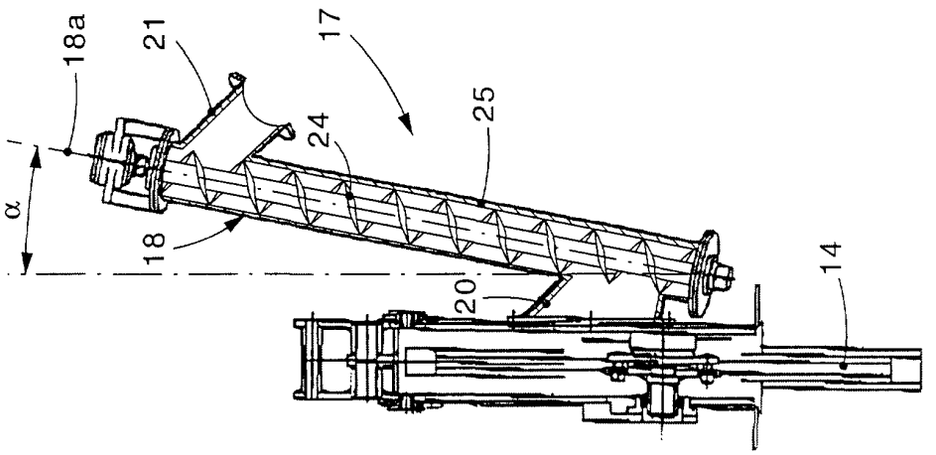

fig. 3

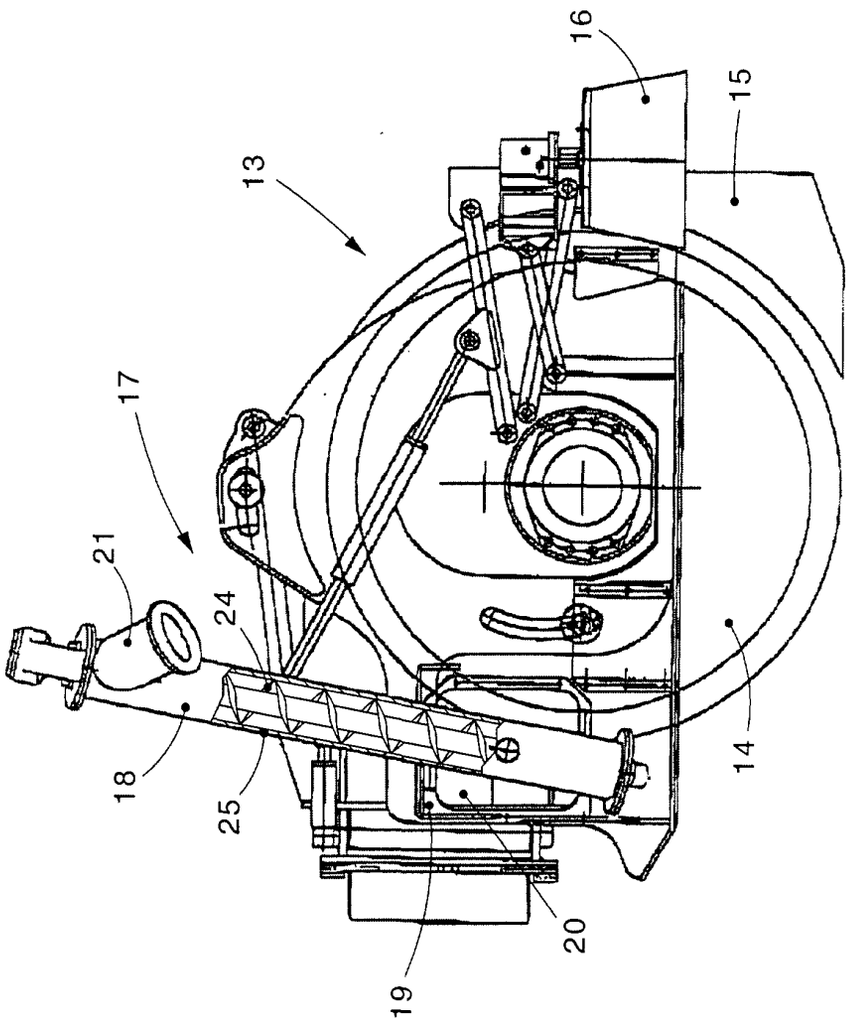

fig. 2

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 00 83 0841

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	22 February 2002	Guthmuller, J

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 00 83 0841

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