United States Patent

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[54] **WHEEL EXCAVATORS FOR DIGGING CHANNELS AND TRENCHES HAVING VARIABLY ANGLED SLOPES**

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[51] **Int. Cl.** **E02f 5/04,** E02f 5/08

[58] **Field of Search** ..... 37/DIG. 16, 80 A, 87, 91, 94–97

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[57] **ABSTRACT**

A wheel excavator for digging channels featuring different angles of slope and having bottoms of a different width of simple design comprising inclined screw conveyers for making slopes of the channel. Each of the screw conveyers bears with its lower portion against a slider arranged in linear guides facilitating the screw conveyer to move relative to a rotor, and the upper portion of each screw conveyer, by means of a variable-length brace rod, being connected to the frame. At the lower end of the screw conveyer, or on the buckets of the rotor, cutters are mounted for cutting the ground between the rotor and the screw conveyers.

4 Claims, 7 Drawing Figures

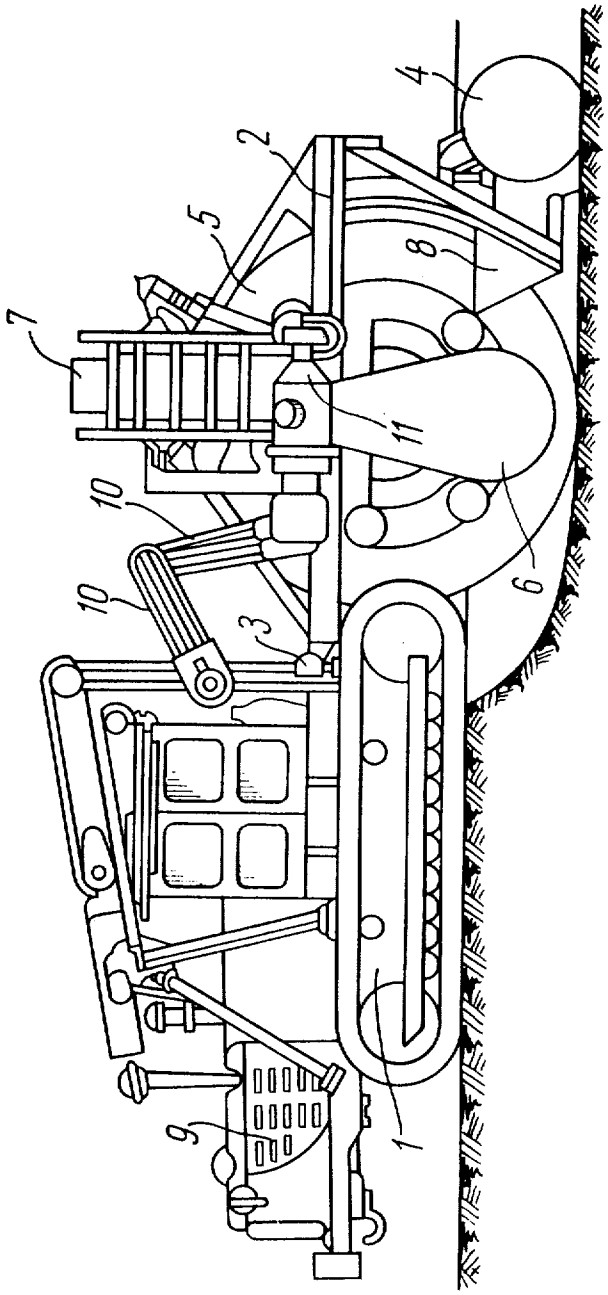


FIG. 1

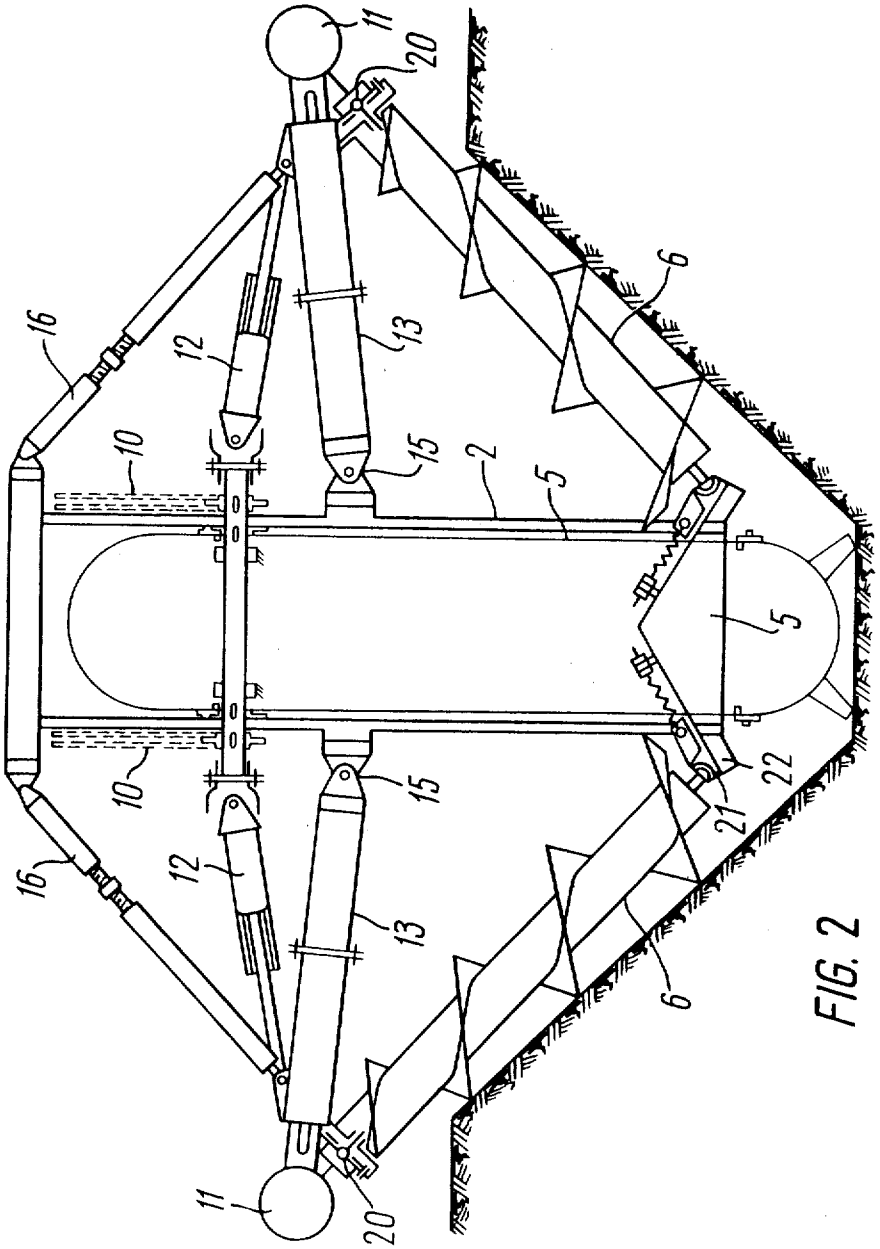
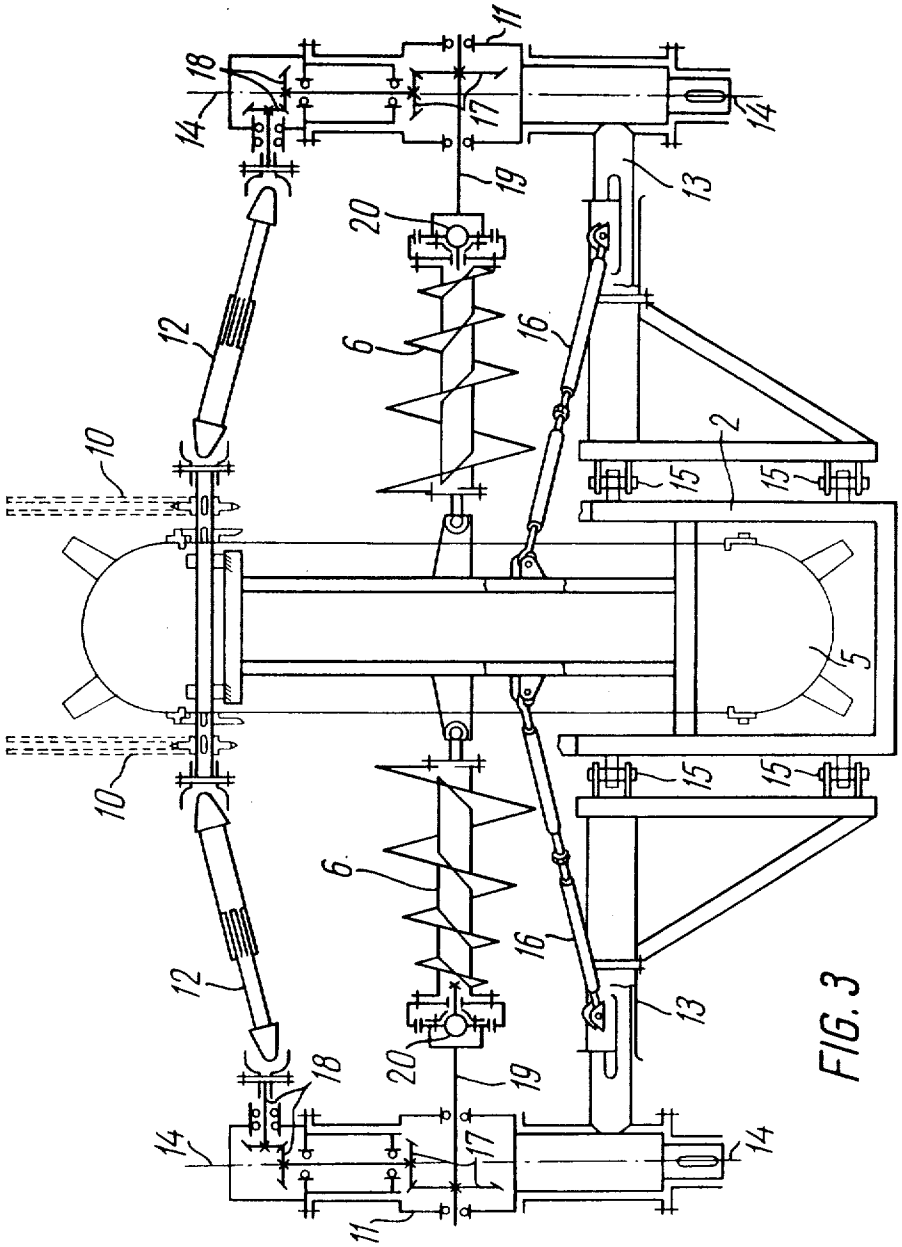


FIG. 2


11
18
14
17
19
13
20
12
6
16
2
15
10
5
FIG. 3

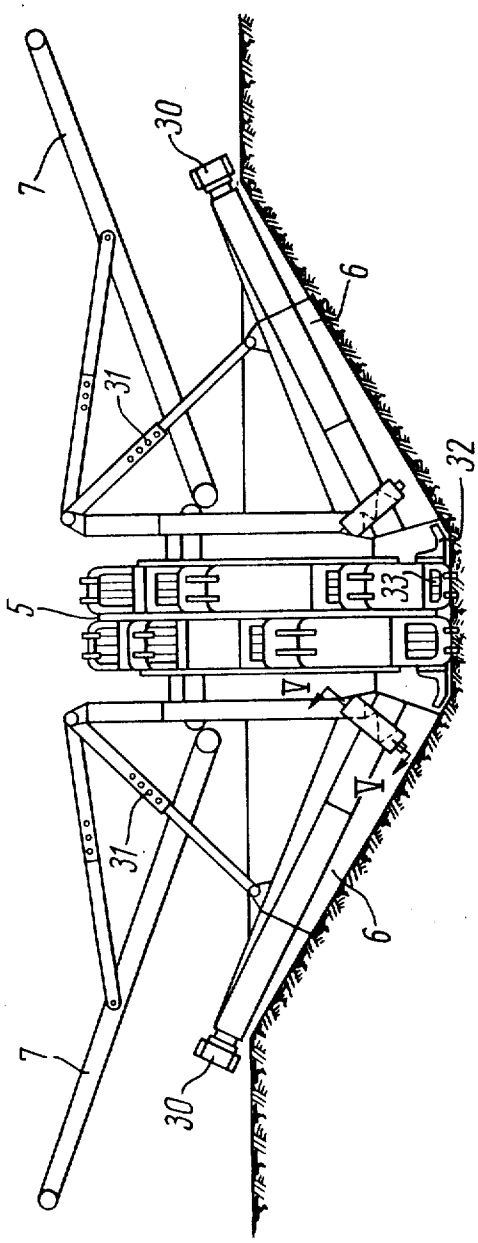


FIG. 4

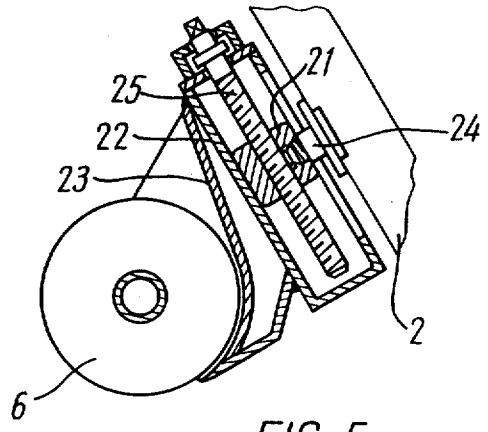


FIG. 5

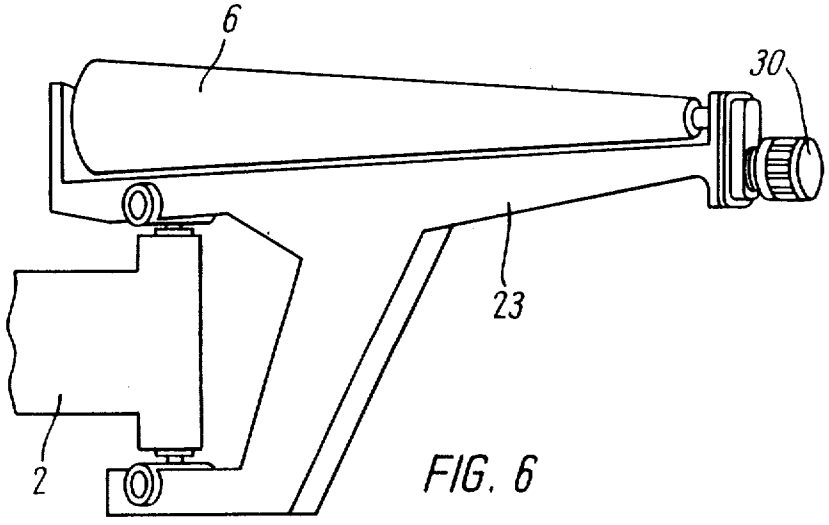


FIG. 6

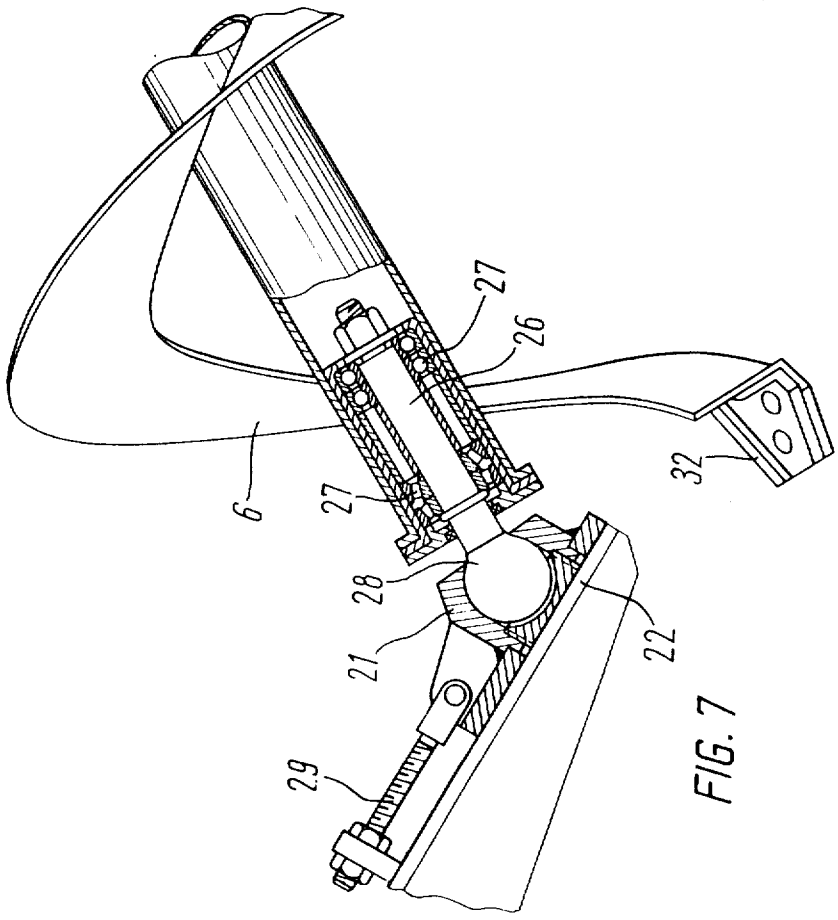


FIG. 7

WHEEL EXCAVATORS FOR DIGGING CHANNELS AND TRENCHES HAVING VARIABLY ANGLED SLOPES

The present invention relates to wheel excavators intended for digging irrigation channels and trenches with slopes for pipelines laid in unstable grounds.

Known in the art are excavators manufactured by the American firms "Parsons", "Buckeye" and "Barber Breene", which excavators comprise a tractor whose frame carries a rotor at both sides of which there are arranged working tools making the slopes of the channels being digged.

The above-said working tools are made in the form of conical cutters rotating about their longitudinal axis and mounted on the frame without the possibility of changing their position in space relative to the frame.

Such excavators do not provide for digging channels of different width.

Excavators are also known in which the working tools are made in the form of inclined screw conveyers used for making channels with sloped walls. These screw conveyers are mounted on the frame with the possibility of changing their angle of inclination and the distance between the screw conveyers and the frame. This distance is changed by moving aside the rotor buckets and, simultaneously, the lower supports of the screw conveyers. In this case the upper driving portion of the screw conveyers is secured to perforated frames for fixing the screw conveyers in different positions.

For working out the ground remaining in the space between the rotor and the screw conveyers the above-mentioned excavators are provided with cutters mounted in the lower portion of these screw conveyers.

Although these excavators allow channels of different shape to be digged, they are complex in manufacture and operation as these excavators are provided with a collapsible rotor and also with additional cutters on the ends of the screw conveyers.

A principal object of the invention is to provide an excavator which would ensure digging of channels featuring different angles of slope and having bottoms of a different width.

Another object of the invention is to provide an excavator which alongside with a comparatively simple construction is convenient and reliable in operation.

According to these and other objects the proposed wheel excavator comprises a tractor, a frame secured to the tractor, a rotor mounted on the frame, inclined screw conveyers for making slopes of a digged channel mounted on this frame at both sides from the plane of rotation of the rotor and capable of moving relative to this plane, at least one engine powering the tractor, rotor and screw conveyers, reduction gears transmitting the torque from the said engine to the screw conveyers, each of said reduction gears being coupled with the upper portion of a corresponding screw conveyer, rotary cutters for cutting the ground between the rotor and the screw conveyer, linear guides, sliders, each serving as a frame lower support for the screw conveyer and positioned on the said linear guides with a possibility of moving the screw conveyers relative to the rotor, the upper portions of the screw conveyers being connected to the frame through variable-length coupling members.

In the proposed excavator the cutters for cutting the ground between the rotor and the screw conveyers can be mounted on the rotor.

The above cutters can also be mounted on the screw conveyers.

Each screw conveyer can be connected with the slider through a ball joint. In this case the linear guides are fixed to the frame, while the slider is connected to the frame through a lead screw.

Each screw conveyer can be connected to the slider through a lead screw passed therethrough, in which case the linear guides are connected to the screw conveyer and the slider is connected to the frame.

If the transmission of the rotor is used for powering the screw conveyers, each reduction gear may be mounted with the possibility of rotation about its longitudinal axis on a bracket having an adjustable outreach, one end of the bracket being mounted on the rotor frame and capable of turning relative to the plane of rotation of the rotor, whereas the other end of the bracket is suspended from this frame through a variable-length brace rod. In this case the reduction gear is connected to the above transmission through a variable-length cardan shaft.

Further, objects and advantages of the invention will be apparent to those skilled in the art to which the invention pertains from the following description of a certain embodiment thereof described with reference to the accompanying drawings, forming a part of this application, in which:

FIG. 1 is a general view of the excavator according to the invention;

FIG. 2 is a schematic front view of the working tools of the excavator in which the screw conveyer are powered by the rotor transmission;

FIG. 3 is the same, top view;

FIG. 4 shows the basic working tools of the excavator the screw conveyers of which are provided with individual drives;

FIG. 5 represents a cross section taken along the line V—V of FIG. 4;

FIG. 6 illustrates the support of the screw conveyer, top view in FIG. 4.

FIG. 7 illustrates another version of the support of the screw conveyer, a front view.

Referring now to the drawings, the excavator consists of a tractor **1** (FIG. 1), a frame **2** secured to the tractor **1** through a joint **3** and resting on wheels **4**. The frame **2** carries a rotor **5** at both sides of which there are mounted two inclined screw conveyers **6** and two belt conveyers **7**. Mounted on the frame **2** behind the rotor **5** (in the direction of movement of the tractor) are cleaning cutters **8**.

The rotor **5** and the screw conveyers **6** can be driven by engine **9** of the tractor **1** through its transmission (not shown in the drawing) and chain drives **10** (FIGS. 1, 2, 3). In this case the screw conveyers **6** are powered through reduction gears **11** by means of cardan shafts **12**.

The reduction gears **11** are mounted on variable-length brackets **13** (FIGS. 2 and 3) and are capable of revolving about their longitudinal axes **14**—**14** (FIG. 3). One end of the bracket **13** is secured to the frame **2** through cylindrical joints **15** with a possibility of turning in a vertical plane end the other end of the bracket is secured to a variable-length telescopic brace rod **16**.

Each reduction gear **11** is provided with bevel gearwheels **17** and **18** driven by the telescopic cardan shaft **12**.

The output shaft 19 of the gear-wheels 17 serves as an upper support of the screw conveyer 6 coupled thereto through a ball joint 20.

The rotor 5 and the screw conveyers 6 can be powered from individual electric motors (FIG. 4) secured on the upper end of the screw conveyers. The electric motor of the rotor is not shown in the drawing.

Sliders 21 (FIGS. 2,5,7) interacting with guides 22 serve as the lower supports of the screw conveyers 6.

One constructive version of the lower support of the screw conveyer 6 is shown in FIGS. 5 and 6. The screw conveyer 6 is mounted on an additional frame 23. Rigidly secured to the additional frame 23 are cylindrical guides 22. The slider 21 through a neck 24 is connected to the frame 2 with the possibility of turning about the axis of the neck 24.

A lead screw 25 is passed through the slider 21. On turning the lead screw 25, the screw conveyer 6 together with the guide 22 is displaced relative to the frame 2.

Another version of the support of the screw conveyer is shown in FIG. 7.

The screw conveyer 6 in its lower portion has a neck 26 mounted in bearings 27. The lower part of the neck 26 is made in the form of a ball joint 28 resting upon the slider 21. The latter is moved along the guides 22 of the frame 2 with the help of a lead screw 29.

The lower supports of the screw conveyers is accomplished in accordance with one of the above versions regardless to the construction of the drive of these conveyers.

If individual drives are employed, the other end of the screw conveyers is suspended from the frame 2 through a telescopic brace rod 31 (FIG. 4).

Secured to the blades of the screw conveyer 6 are cutters 32 (FIG. 7) which, when rotated, cut away the ground remaining between the rotor and the screw conveyers.

The cutters 32 can also be secured to the buckets 33 (FIG. 4) of the rotor according to the constructive features of the excavator.

The above-described excavator operates in the following manner.

When the tractor 1 (FIG. 1) moves forwards, the torque from the engine 9 through the transmission and chain drives 10 is transmitted to the rotor 5 and to the cardan shafts 12 (FIGS. 2,3); thereafter, the torque through the bevel gear-wheels 17 and 18 of the reduction gear 11 is transmitted to the screw conveyers 6.

When rotated, the rotor 5 cuts an initial trench while the inclined screw conveyers 6 develop the slopes of the channel and transfer the worked out ground downwards, to the buckets of the rotor 5.

The buckets of the rotor 5 lift the ground and discharge it onto the conveyers 7 moving the ground to dumps.

The ground remaining within the space between the rotor and the screw conveyers is cut away by the rotary cutters 32 mounted either on the screw conveyer 6 or on the buckets 33 of the rotor 5.

The screw conveyers 6 may be provided with individual drives 30 (FIG. 4) mounted directly on the screw conveyer in its upper portion.

The cleaning cutter 8 mounted behind the rotor 5 shapes the cross section of the channel being digged, this shaping being a final operation.

In order to change the width of the channel at its bottom the lower supports of the screw conveyers are moved aside from the rotor by turning the lead screws 25 (FIG. 5) or 29 (FIG. 7) with the help of a wrench. In this case the screw conveyers 6 are moved in a vertical plane relative to the plane of rotation of the rotor due to the travel of the sliders 21 along the guides 22 (FIGS. 5 and 7).

To obtain the necessary angle of slope, the screw conveyers are turned by using the telescopic brace rods 16 (FIGS. 2, 3) or 31 (FIG. 4) about the ball joints 8 (FIG. 7) or the necks 24 (FIG. 5).

The proposed excavator makes it possible to dig channels up to 3 m deep with the bottom of 0.4 to 2.5 m wide and to provide for the slopes of 1:1 to 1:1.75.

The excavator features a simple construction, is reliable in operation and has a high output capacity: up to 8,000 m^3 of ground per hour.

What is claimed is:

1. A wheel excavator for digging a channel comprising a tractor, a frame connected to said tractor, a rotor secured on said frame, inclined screw conveyers for making slopes of said channel, which screw conveyers are mounted on said frame at both sides of the plane of rotation of the rotor and which are capable of displacing relative to said rotor, at least one engine powering the tractor, rotor and screw conveyers, reduction gears transmitting the torque from said engine to said screw conveyers, each of said reduction gears being connected to the upper portion of a corresponding screw conveyer, cutters mounted on said rotor, which cutters protrude laterally of said rotor for cutting ground between the rotor and the screw conveyers, linear guides mounted on said frame adjacent the bottom of said rotor, sliders serving as lower supports for the screws conveyers on the frame and being disposed on said guides so as to provide for movement of the screw conveyers relative to the rotor, the lower ends of said screw conveyers being mounted to said sliders by ball joints, variable-length brace rods for adjustably connecting the upper portion of the screw conveyers to said frame.

2. An excavator as claimed in claim 1, in which the torque from said engine is transmitted successively from the rotor to the screw conveyers, each screw conveyer with its upper portion bearing upon a reduction gear secured to a variable-outreach bracket and being capable of turning about its longitudinal axis, one end of said bracket being mounted on the frame with a possibility of turning relative to the plane of rotation of the rotor and the other end being suspended from the same frame through one of said variable-length brace rods, the reduction gear being connected to said transmission through a variable-length cardan shaft.

3. A wheel excavator for digging a channel comprising a tractor, a frame connected to said tractor, a rotor secured on said frame, inclined screw conveyers for making slopes of said channel, which screw conveyers are mounted on said frame at both sides of the plane of rotation of the rotor and which are capable of displacing relative to said rotor, at least one engine powering the tractor, rotor and screw conveyers, reduction gears transmitting the torque from said engine to said screw conveyers, each of said reduction gears being connected to the upper portion of a corresponding screw conveyer, cutters mounted on said screw conveyers for

cutting ground between the rotor and the screw conveyers, linear guides mounted on said frame adjacent the bottom of said rotor, sliders serving as lower supports for the screw conveyers on the frame and being disposed on said guides so as to provide for movement of the screw conveyers relative to the rotor, the lower ends of said screw conveyers being mounted to said sliders by ball joints, variable-length brace rods, for adjustably connecting the upper portion of the screw conveyers to said frame.

4. An excavator as claimed in claim 3, in which the torque from said engine is transmitted successively from the rotor to the screw conveyers, each screw conveyer with its upper portion bearing upon a reduction gear secured to a variable-outreach bracket and being capable of turning about its longitudinal axis, one end of said bracket being mounted on the frame with a possibility of turning relative to the plane of rotation of the rotor and the outer end being suspended from the said frame through one of said variable-length brace rods, the reduction gear being connected to said transmission through a variable-length cardan shaft.

* * * * *