Oct. 20, 1970 E. MENZI 3,534,877

EXCAVATING APPARATUS

Filed Jan. 27, 1969 4 Sheets-Sheet 1

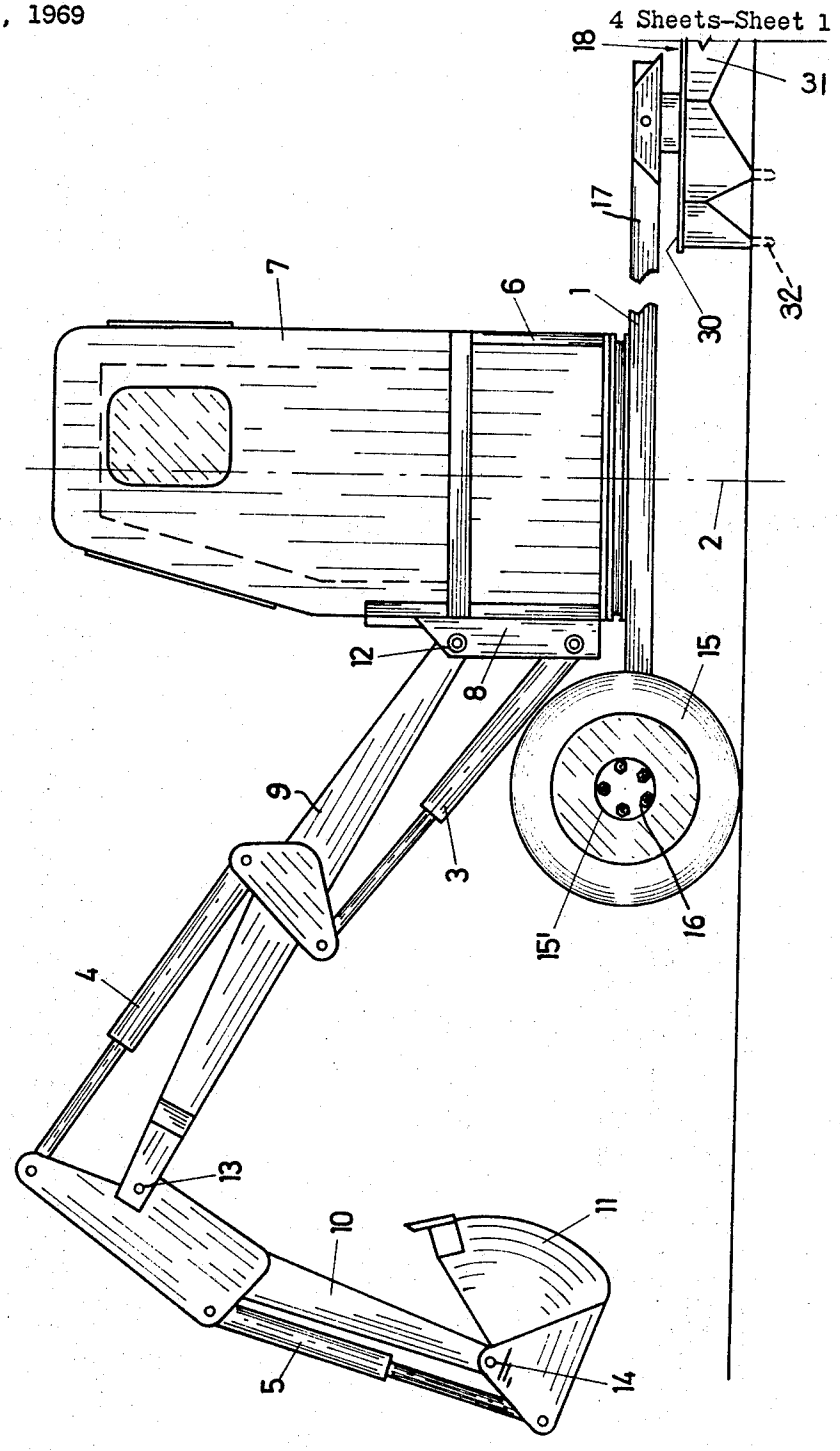

Fig. 1

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EXCAVATING APPARATUS

Filed Jan. 27, 1969 4 Sheets-Sheet 2

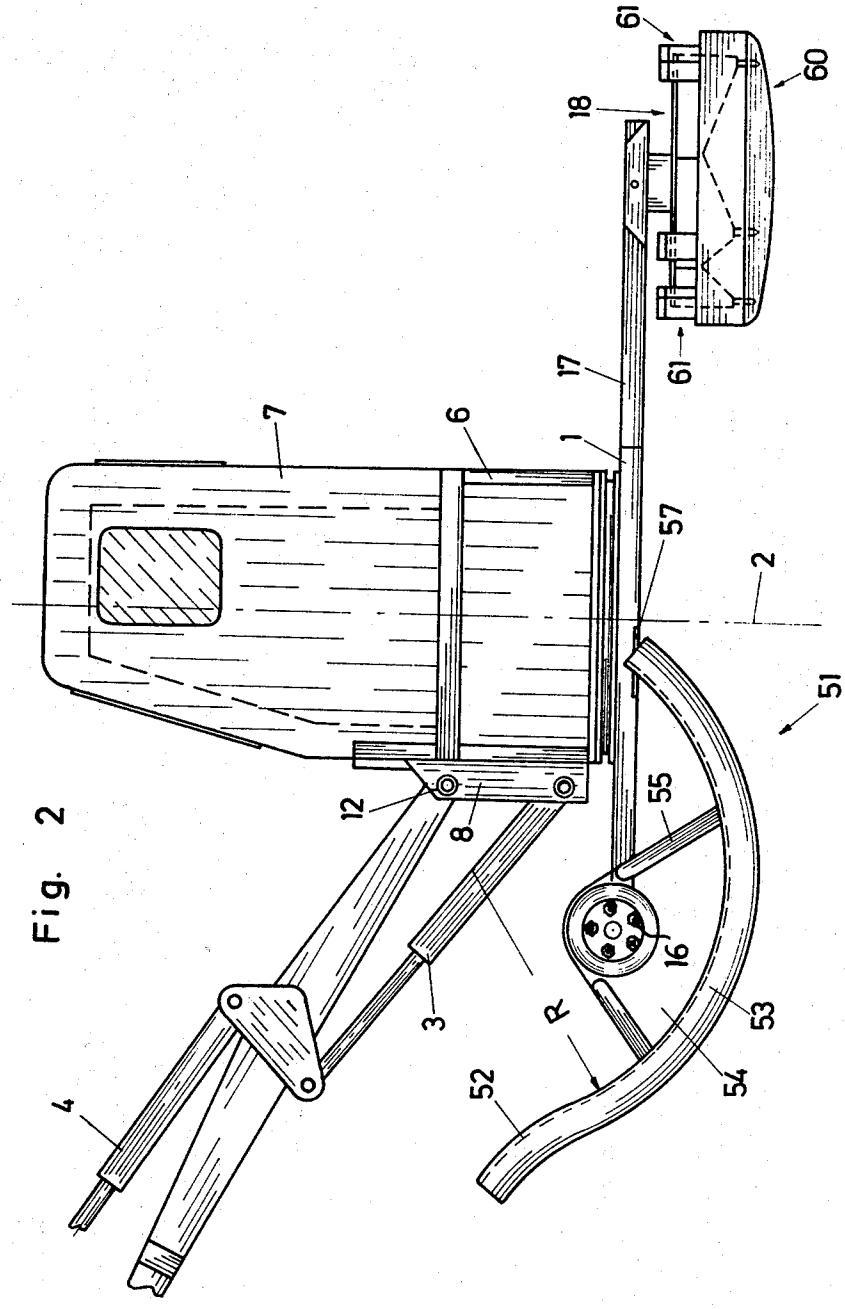

Fig. 2

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EXCAVATING APPARATUS

Filed Jan. 27, 1969 4 Sheets-Sheet 3

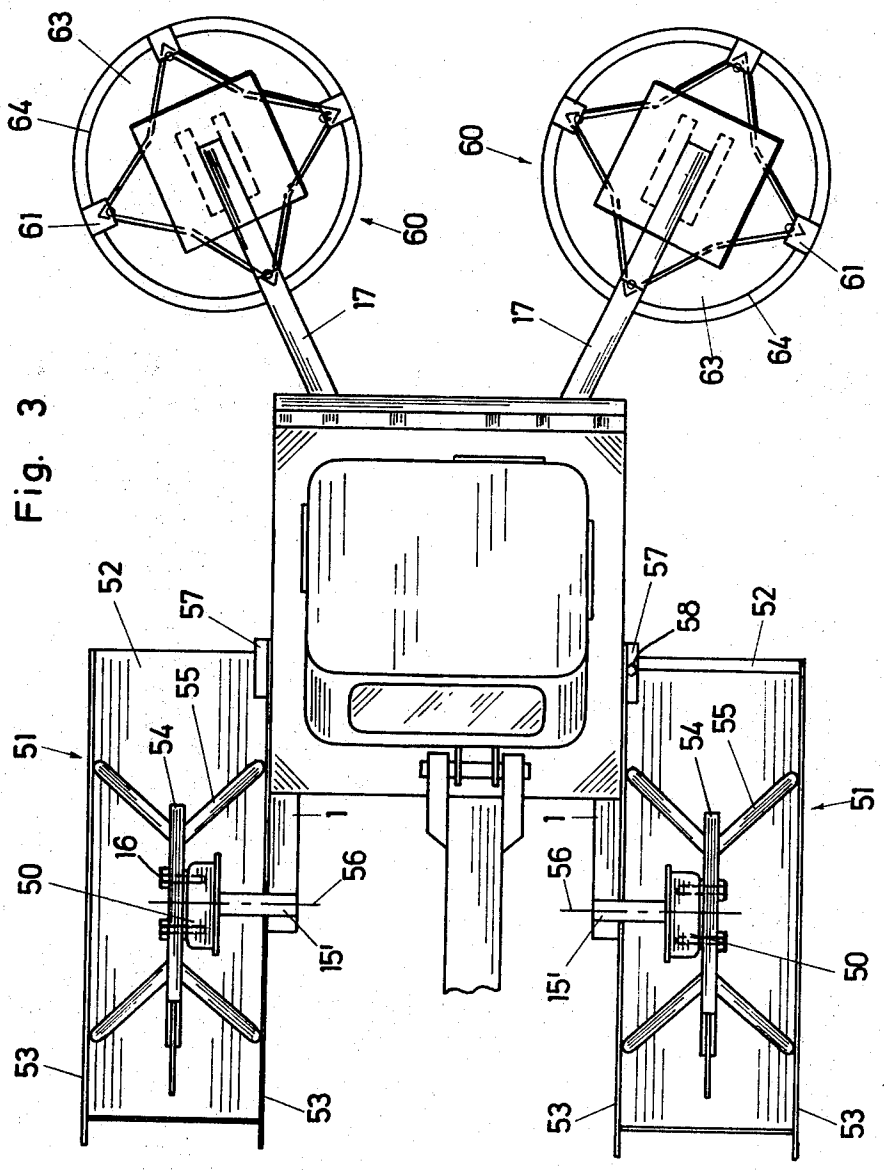

Fig. 3

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Oct. 20, 1970 E. MENZI 3,534,877

EXCAVATING APPARATUS

Filed Jan. 27, 1969 4 Sheets-Sheet 4

Fig. 5

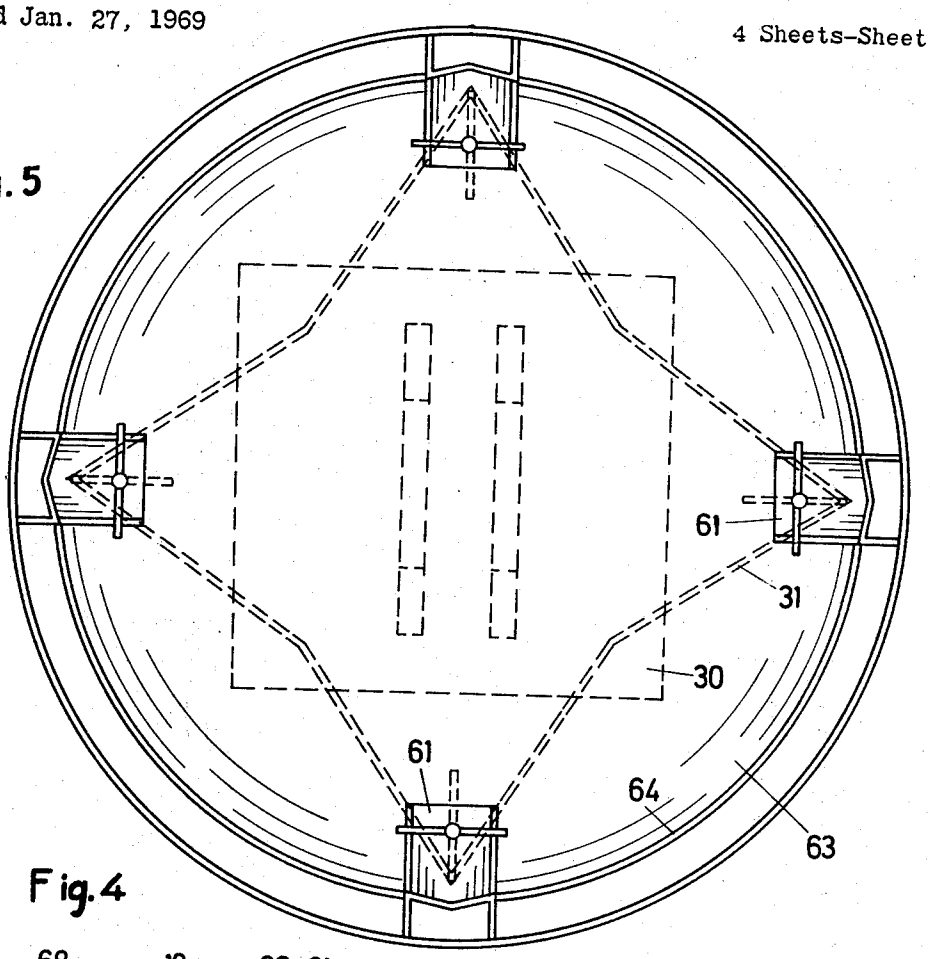
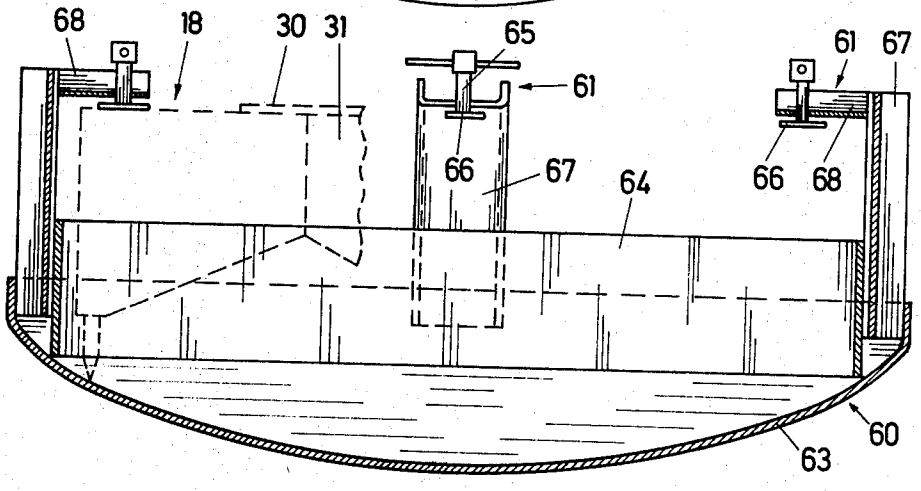


Fig. 4



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3,534,877

EXCAVATING APPARATUS

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Claims priority, application Austria, Jan. 30, 1968, A 929/68
Int. Cl. E02f 3/30
U.S. Cl. 214—138 11 Claims

ABSTRACT OF THE DISCLOSURE

An excavating apparatus for digging drainage ditches having a chassis, a rotatable platform on the chassis, a bucket-carrying jib hinged to the platform, a pair of front wheels, and soil-engaging gripper feet at the rear end is equipped with wide runners which may replace the wheels on the front axles and with spherically dished, trough-like covers which may be fastened over the gripper feet when the apparatus is to operate in swampy terrain.

BACKGROUND OF THE INVENTION

This invention relates to excavating apparatus, and particularly to an improved vehicular excavator.

It is common practice to mount the shovel or other excavating tool of an excavating apparatus at one end of a jig or similar elongated arm arrangement whose other end is hingedly fastened to a platform rotably mounted on a frame. The frame is horizontal in the normal operating position of the apparatus and carries ground-engaging elements such as wheels or soil-engaging feet which support the frame during excavating operations and during movement of the apparatus over the ground.

This invention is more specifically concerned with an improvement in an excavator normally equipped with idler wheels at one end of the frame and with soil-engaging feet of the type disclosed in my copending application Ser. No. 788,994 filed on December 31, 1968.

An excavator of the type described is most useful in digging trenches for pipe lines and the like in firm soil. It can propel itself along the trench as work progresses even though its wheels are not driven, and it can be used in rough terrain in which even caterpillar tracks do not provide adequate traction. The method of propelling such an excavator will be described in more detail hereinafter. It is not suitable for digging trenches, such as drainage ditches in swamps, where the wheels would sink in the soft ground, and the soil gripping feet cannot be anchored firmly in the semi-fluid surface.

The primary object of the invention is a modification of the afore-described vehicular excavator which permits the same to be used both on firm ground capable of supporting the weight of the apparatus on wheels, and on swampy terrain in which wheels would sink.

SUMMARY OF THE INVENTION

According to the instant invention, the releasably mounted wheels of the excavator are temporarily replaced by runners which are attached to the axle assemblies normally carrying the wheels. Each runner has a ground-engaging face of convexly arcuate cross-section, the radius of curvature and the axial width of the runner face being greater than the corresponding dimensions of the replaced wheel so that the weight of the excavator is distributed over a wider area. The soil-engaging gripper feet are not normally needed for digging ditches in swampy soil which offers relatively little resistance to the excavating tool. They are therefore each enveloped in a trough-shaped cover which is fastened to the excavator

frame in a position in which the bottom of the trough is interposed between the associated foot and the ground in the normal operating position of the apparatus.

Other features, additional objects, and many of the attendant advantages of this invention will readily become apparent from the following detailed description of a preferred embodiment when considered in connection with the appended drawing.

BRIEF DESCRIPTION OF THE DRAWING

In the drawing:

FIG. 1 shows an excavator of the invention in side elevation, the excavator being equipped with wheels and its soil-gripping feet being exposed for use on firm ground;

FIG. 2 shows the excavator of FIG. 1 with runners replacing the wheels, and a cover partly enveloping each gripper foot;

FIG. 3 shows the apparatus of FIG. 2 in plan view;

FIG. 4 illustrates one of the covers for the gripper feet in the apparatus of FIG. 2 in elevational section on a larger scale, and the corresponding gripper foot in fragmentary phantom view; and

FIG. 5 is a plan view of the device of FIG. 4.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring initially to FIG. 1, there is seen an excavator having on horizontal chassis or frame **1** on which a platform **6** is rotatable about a vertical axis **2**. The platform encloses a diesel engine and the pump and sump of a hydraulic pressure system conventional in excavating equipment, and not shown. An operator's cab **7** is arranged atop the platform **6** and encloses the nonillustrated controls for the hydraulic system and the engine. The front of the platform **6** carries a fixedly attached, heavy, upright channel **8**.

A jib **9** is attached to the channel **8** by a pivot **12** for angular movement in a normally vertical plane, and can be swung in that plane by a hydraulic jack **3** hingedly fastened to the channel **8** and to the jig **9**. An arm **10** attached to the free end of the jib **9** by another pivot **13** can be swung by a hydraulic jack **4** in the afore-mentioned plane, and a jack **5** is interposed between the arm **10** and an excavating shovel **11** attached to the arm **10** by a pivot **14**. The front end of the frame **1** is supported on two rubber-tired wheels **15** mounted on coaxial axle assemblies **15'** by means of bolts **16** in a manner usual in motorcars or trucks. The structure described so far is basically conventional.

Two booms **17** on the frame **2** which project rearwardly and in opposite lateral directions beyond the platform **6**, as is better seen in FIG. 3, carry respective soil-engaging gripper feet **18** more fully illustrated and described in my afore-mentioned application. Each gripper foot **18** is hingedly fastened to the associated boom **17** and consists mainly of a square, horizontal plate **30** from which a skirt **31** depends. A spike **32** projects downward from each of the four corners of the skirt **31**.

FIGS. 2 and 3 show the excavator **1** modified for use on swampy terrain. The wheels **15** are replaced by runners **51**. Each runner includes a steel plate **52** much wider than the soil engaging face of the tire on the replaced wheel **15**, and long enough to extend in an arc of about 120° about the axis of curvature of the plate **52**. The radius of curvature R of the circular portion of this arc, more than 90° long, is greater than the outer diameter of the wheel **15**, and the axis of curvature at the inner end of the radius R is well above the axis of rotation of the hub **50** of the axle assembly **15'** and offset to the rear from the hub axis.

Ribs or flanges 53 project in a radially outward direction from both longitudinal adges of the plate 52. A flat, approximately sector-shaped plate 54 is welded at right angles to the plate 52 and is attached to the wheel hub 50 by the bolts 16 which are also employed for fastening the wheel 15 to the hub 50. The plate 54 is reinforced by four bars 55 welded to the concave inner face of the plate 52 near the ribs 53, as best seen in FIG. 3, and to the plate 54 near the hub 50. The rear end of the plate 52 engages an abutment 57 on the frame 2 which prevents the runner 51 and the hub 50 of the axle assembly 15' from rotating counterclockwise about the axis of rotation 56 of the latter on the frame 2, as viewed in FIG. 3, and a bolt 58 further fastens the plate 52 to the abutment 57 to prevent clockwise movement. The stresses to be absorbed by the abutment 57 are relatively low because the plate 52 is close to the axis 56, and much nearer to this axis than to its axis of curvature. The chassis 2 and its center of gravity are near the ground.

One of the two identical covers 60, which envelop the spikes 32 and much of the skirt 31 when the excavator is equipped for work in swampy terrain, is shown in more detail in FIGS. 4 and 5. The cover has a spherically dished, heavy sheet metal bottom 63. Four channels 67 are equiangularly spaced about the circumference of the bottom 63, and their inwardly directed webs engage the narrow cylindrical side wall 64 of the cover 60 so that the cover as a whole has the approximate shape of a circular, upwardly open trough. The channels 67 carry respective releasable fasteners 61 for the four corners of the associated gripper foot 18. Each fastener 61 consists of a horizontal bracket 68 directed toward the vertical axis of symmetry of the cover 60, a vertical spindle 65 threadedly mounted on the bracket 68, and a foot plate 66 on the lower end of he spindle.

When the cover 60 is mounted over a gripper foot 18, shown in phantom view in FIGS. 4 and 5, the foot plates 66 are pressed down on the four corners of the skirt 31 by the spindles 65 so that the spikes 32 abuttingly engage the inner face of the bottom 63. The bottom 63, the side wall 64, and the channels 67 are welded to each other so that the cover 60 is rigid. The enveloped gripper foot 18 further reinforces the cover.

When equipped with wheels 15 or runners 51, the excavator is moved forward as work progresses, by turning the platform 6 180° from the position seen in the drawing. The arm 10 is then positioned vertically down, and the shovel 11 is pressed against the ground by the jack 3 until the gripper feet 18 with or without the covers 60 are lifted from the soil. If the jack 4 is thereafter retracted, the chassis 2 moves forward by a step on the wheel 15 or runners 51 while the arm 10 pivots about the point of contact between the shovel 11 and the ground.

This method of propulsion, while not rapid, is capable of being performed on very rough terrain, and even in swampy terrain although the bucket 11 may sink somewhat into the soft ground. The operator controls the jacks 3, 4, 5 from his cab 7, and need not leave the cab while the excavator travels in the stepwise fashion described. After the frame 2 has beeen moved by as many steps as may be desirable, the platform 6 is again swung around to the normal position shown in the drawing, and excavation work may proceed in the usual manner. It is understood, of course, that the shovel may also be operated when the jig 9 is not located in the upright median plan of the chassis 1. If such operation is contemplated, the booms 17 are preferably hinged to the remainder of the frame 1.

If the excavator has to be moved between widely separated locations, it is preferably transported on a low-bed trailer, and may be raised to the trailer platform without external lifting devices. The trailer platform is positioned across the front end of the excavator, and under the shovel 11 while the excavator is in the position

shown in FIG. 1. The jack 3 is then retracted until the excavator rests on the shovel 11 and on the gripper feet 18 which are still on the ground while the wheels 15 are above the level of the trailer platform. The trailer is then moved forth and back in short arcs until its platform is under the wheels 15 whereupon the jib 9 is raised to lower the wheels 15 to the trailer platform and thereafter swung 180° about the axis 2. The gripper feet 18 are next lifted from the ground, and the excavator is shifted forward on the trailer platform on the wheels 15 until the feet 18 can be set down on the platform, the procedure being substantially as described with reference to the stepwise movement of the machine on the ground.

When the excavator is equipped with the wheels 15, and is desired to operate on very soft ground, as in a swamp, the platform 6 is swung 90° from the illustrated position, the shovel 11 is placed on the ground laterally of the chassis 1, and one wheel 15 and the corresponding gripper foot 18 are lifted from the ground. The wheel may then be replaced by a runner, a cover 60 slipped over the foot 18, and the same procedure is followed on the other side. The runners and covers are firmly fastened by means of the bolts 16 and fasteners 61.

The covers 60 give buoyancy to the rear end of the excavator on swampy ground, and the runners distribute the weight of the front end over a sufficient area to permit the excavator to operate normally and to propel itself as described above, the runners sliding over the surface of the soil. If they should sink to some extent, they rise again to the surface because of their illustrated configuration, as the machine is moved forward by the jib 9 and its jacks 3, 4, 5.

The illustrated gripper feet 18 are preferred and have been found to operate successfully with and without the covers 60, but differently shaped gripper feet have been illustrated and described in my earlier-filed application referred to above, and may be substituted for the feet 18. The necessary modifications of the covers 60, and particularly of the fasteners 61 will be obvious. A single gripper foot may be adequate for light service, particularly with widely spaced wheels 15 or runners 51, and other modifications and variations of the illustrated apparatus will readily suggest themselves to those skilled in the art on the basis of the above teachings.

What I claim is:

1. In an excavating apparatus including a frame which extends horizontally in the normal operating position of said apparatus, the frame having a front end and a rear end; a platform rotatable on said frame; elongated carrier arm means having one terminal portion hingedly fastened to said platform; an excavating tool on the other terminal portion of said arm means; and ground-engaging means on said frame for supporting said frame during excavating and during movement of the apparatus over the ground; the improvement in the ground-engaging means which comprises:

(a) a pair of axle assemblies on one of said ends, said assemblies having respective axes;

(b) a wheel associated with each of said axle assemblies and having an annular ground-engaging face;

(c) a runner alternatively associated with each of said axle assemblies, said runner having a ground engaging face of convexly arcuate cross-section, the ground-engaging face of said runner having a greater radius of curvature and a greater width in the direction of the axis of curvature than the round-engaging face of the wheel associated with the same axle assembly;

(d) mounting means for alternatively mounting the associated wheel and associated runner on each axle assembly, said mounting means permitting rotation of the mounted wheel about the axis of said assembly and including means for preventing rotation of the mounted runner about the axis of the axle assembly;

(e) a soil-engaging gripper element fixedly mounted on the other end of said frame;

(f) a trough-shaped cover having a bottom and an open side opposite said bottom; and

(g) fastening means for fastening said cover to said frame in a position in which the cover envelops a portion of said element, and said bottom is interposed between the element and the ground in said normal operating position of the apparatus.

2. In an apparatus as set forth in claim **1**, each axle assembly including a hub rotatably mounted on said frame, said runner including a first arcuate plate member having said ground-engaging face, and a second plate member fastened to said first plate member and extending substantially in a plane transverse to the axis of curvature of said ground-engaging face of the runner, said mounting means fastening said second plate member to said hub in the mounted condition of the runner.

3. In an apparatus as set forth in claim **1**, a circumferentially elongated rib projecting in a radially outward direction from said ground-engaging face of said runner.

4. In an apparatus as set forth in claim **1**, said ground-engaging face of said runner extending in an arc of at least 90° about said axis of curvature.

5. In an apparatus as set forth in claim **4**, said axis of curvature being upwardly spaced from the axis of the associated axle assembly in the mounted condition of the runner when said apparatus is in the normal operating position thereof.

6. In an apparatus as set forth in claim **5**, said axis of curvature being horizontally offset toward one of said ends from the axis of the associated axle assembly in said condition of the runner and said position of the apparatus.

7. In an apparatus as set forth in claim **1**, said bottom having a convexly curved outer face.

8. In an apparatus as set forth in claim **7**, said cover having an annular wall of substantially circular cross section extending from said bottom to said open end.

9. In an apparatus as set forth in claim **7**, cooperating guide means on said element and on said cover for guiding said element inward of said cover into a predetermined position.

10. In an apparatus as set forth in claim **9**, said fastening means including a fastening member threadedly engaging said cover for movement toward and away from a position in which the fastening member abuttingly engages said element for securing the same in said predetermined position.

11. In an excavating apparatus including a frame which extends horizontally in the normal operating position of said apparatus, the frame having a front end and a rear end; a platform rotatable on said frame; elongated carrier arm means having one terminal portion hingedly fastened to said platform; an excavating tool on the other terminal portion of said arm means; and ground-engaging means on said frame for supporting said frame during excavating and during movement of the apparatus over the ground; the improvement in the ground-engaging means which comprises:

(a) a pair of axle assemblies on one of said ends, said assemblies having respective axes extending in a common direction, each assembly including a member freely rotatable on said frame about the axis of said assembly and adapted to carry a wheel;

(b) a runner alternatively associated with each of the axle assemblies, said runner having a ground-engaging face of concavely arcuate cross section about an axis of curvature;

(c) mounting means for releasably mounting each runner on the rotatable member of the associated axle assembly in a position in which said axis of curvature extends in said common direction and is offset from the axis of the axle assembly;

(d) cooperating abutment means on said runner and on said frame preventing rotation of the mounted runner and of the associated rotatable member about the axis of the associated axle assembly;

(e) a soil-engaging gripper element fixedly mounted on the other end of said frame;

(f) a trough-shaped cover having a bottom and an open side opposite said bottom; and

(g) fastening means for fastening said cover to said frame in a position in which the cover envelops a portion of said element, and said bottom is interposed between the element and the ground in said normal operating position of the apparatus.

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HUGO O. SCHULZ, Primary Examiner

U.S. Cl. X.R.

280—14; 212—145