Oct. 3, 1967 H. O. CRUM 3,344,539

VERTICAL EXCAVATOR

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Fig. 1

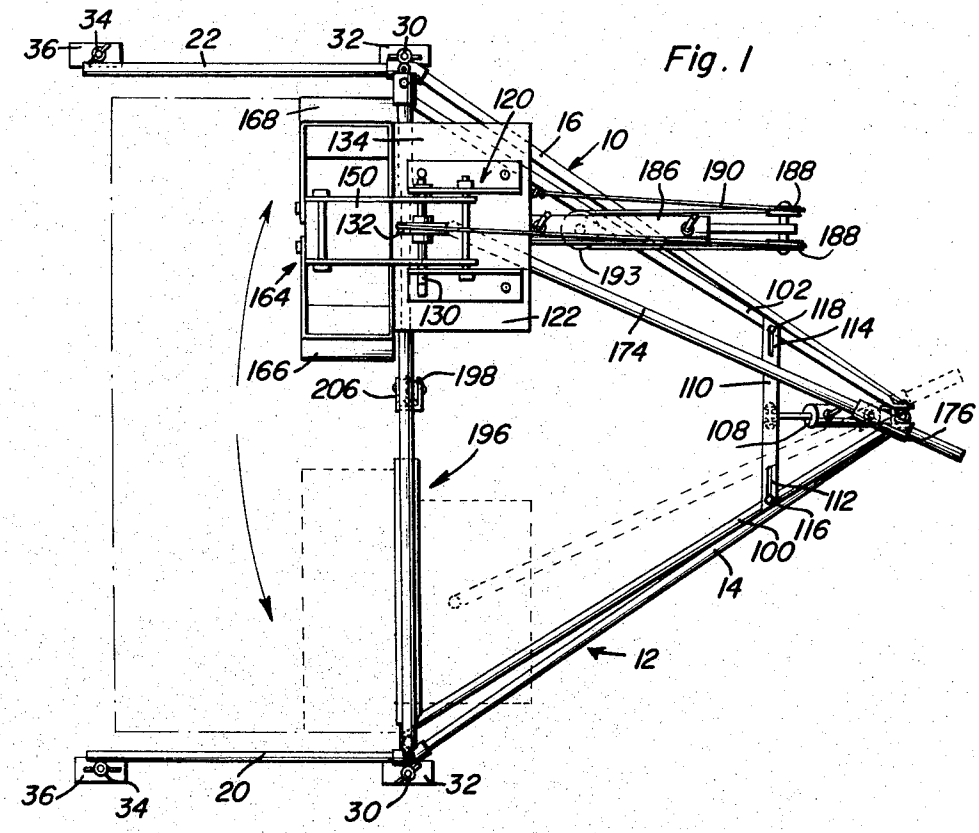
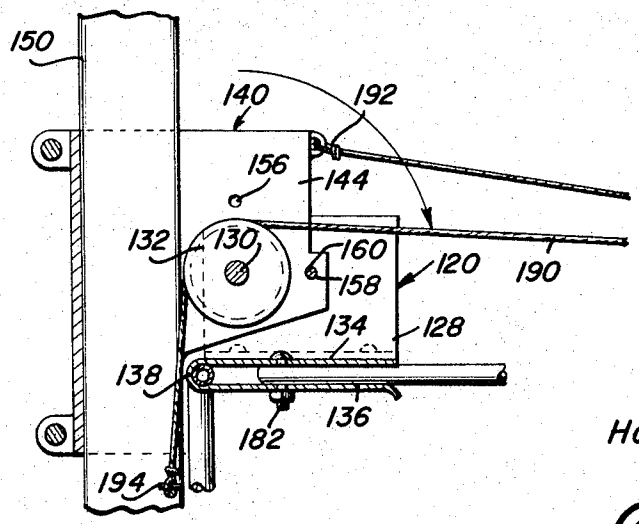


Fig. 9



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VERTICAL EXCAVATOR

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Fig. 2

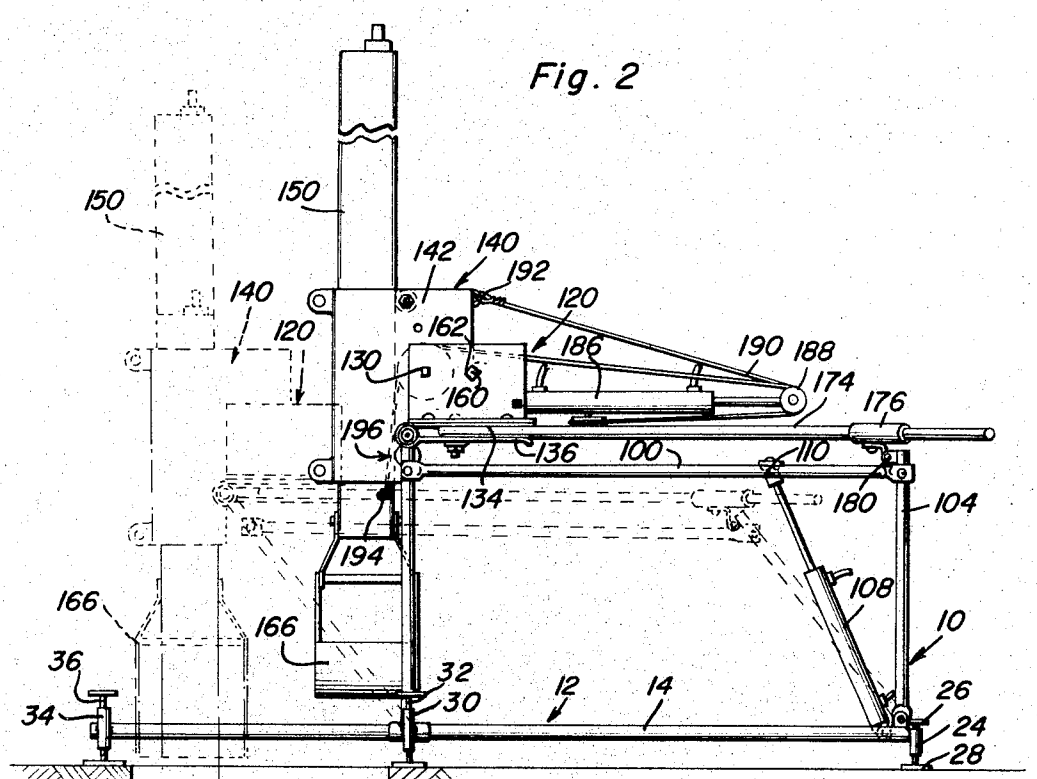
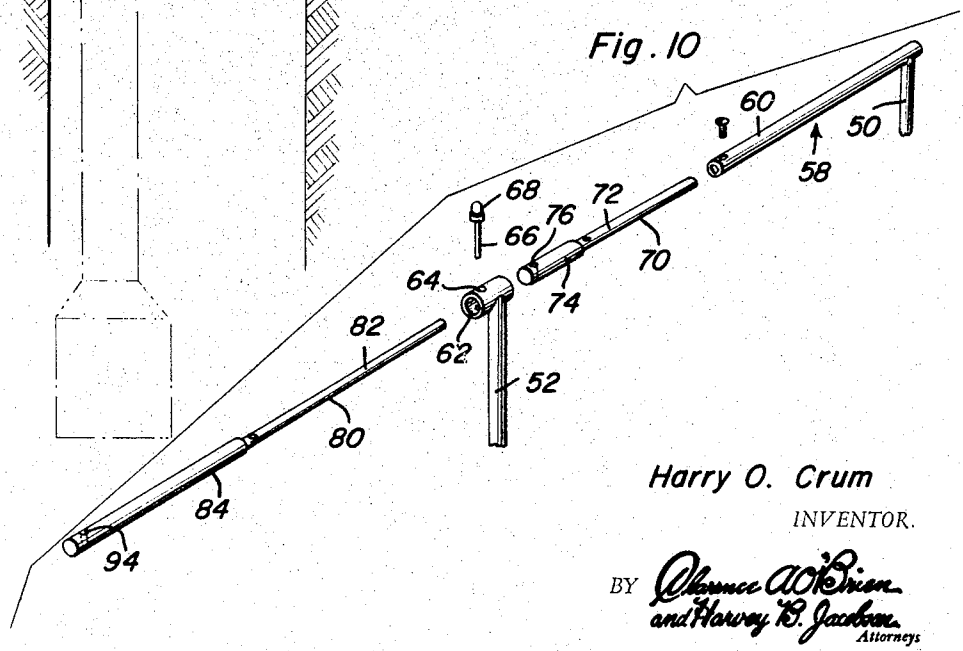


Fig. 10



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VERTICAL EXCAVATOR

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Fig. 3

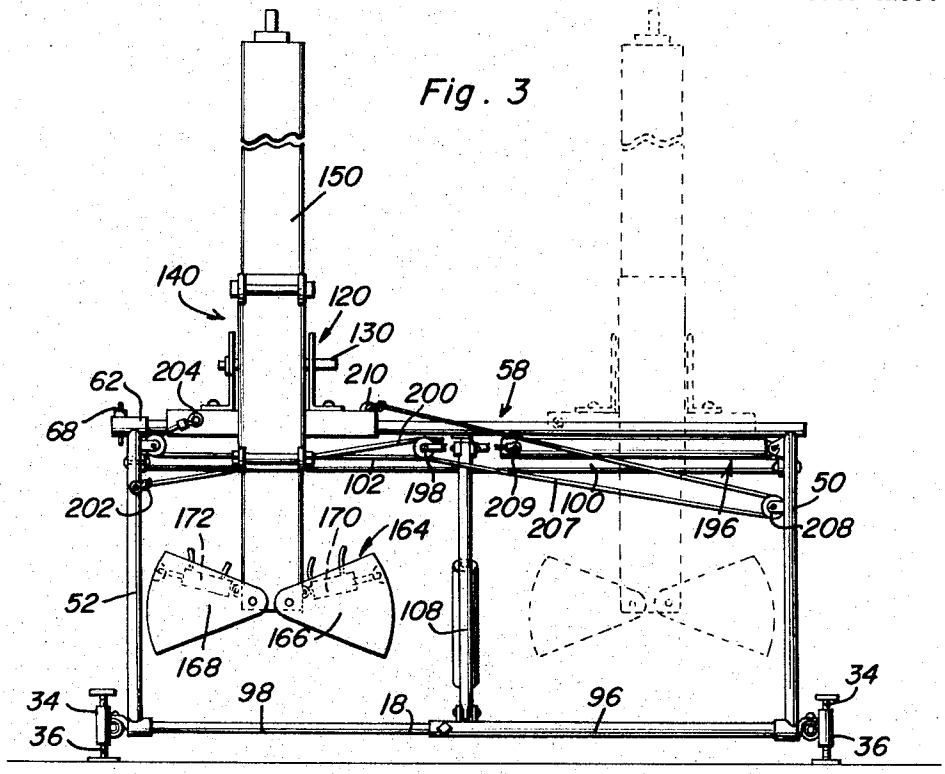


Fig. 6

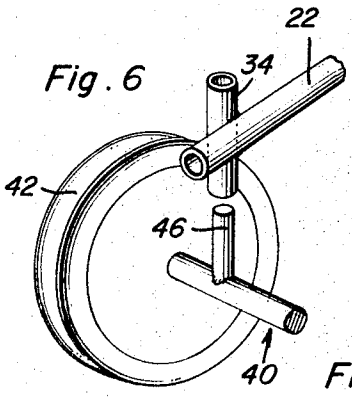


Fig. 7

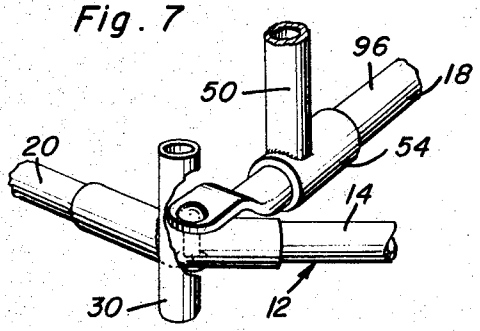
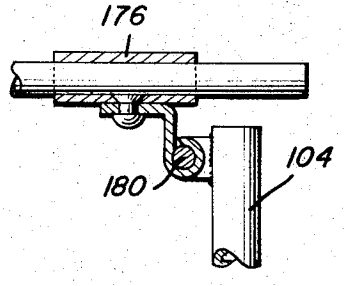


Fig. 8



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VERTICAL EXCAVATOR

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Fig. 4

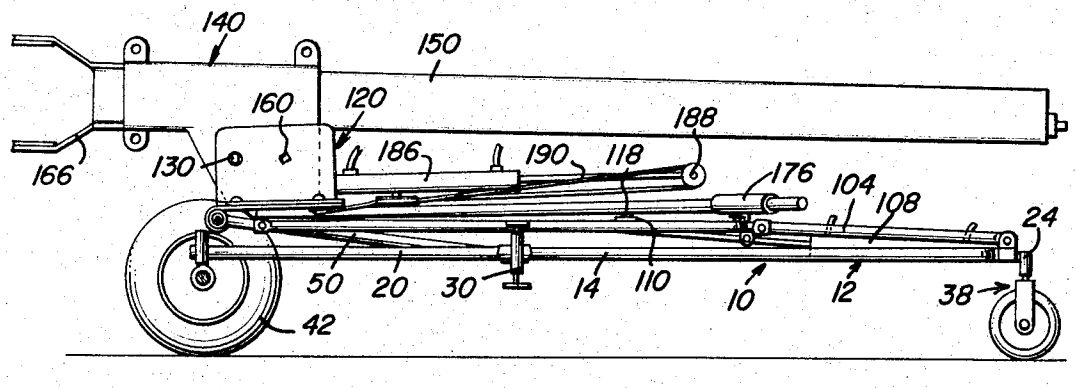
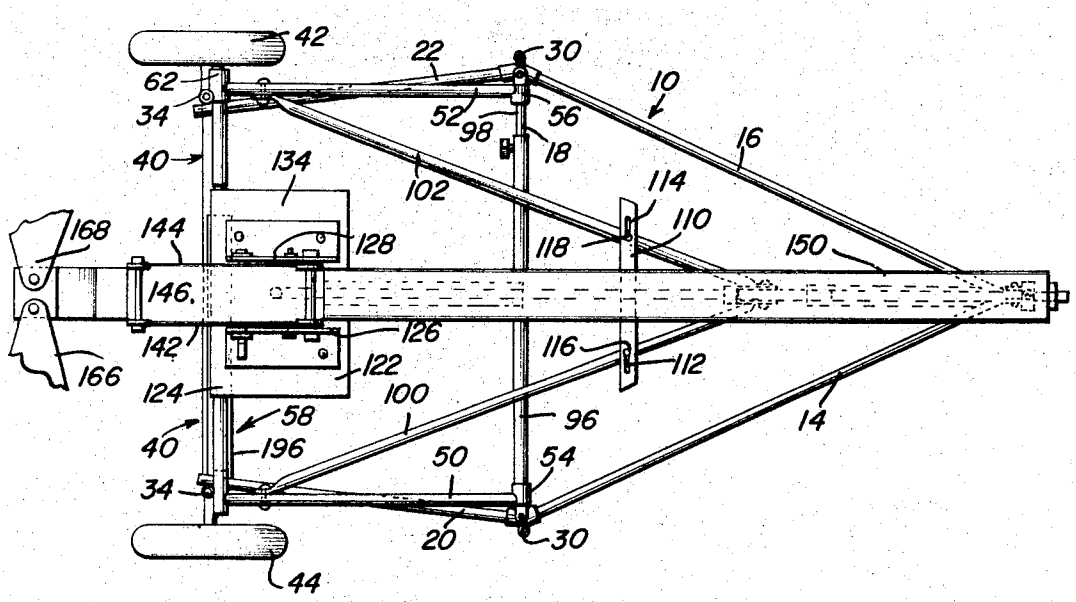


Fig. 5



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United States Patent Office 3,344,539 Patented Oct. 3, 1967

3,344,539

VERTICAL EXCAVATOR

Harry O. Crum, Woodward, Iowa, assignor, by direct and mesne assignments, of thirty-three and one-third percent to James J. Kelley, Jr., and thirty-three and one-third percent to William Kehres, both of Monroe, Mich.

Filed Aug. 13, 1964, Ser. No. 389,346
10 Claims. (Cl. 37—103)

ABSTRACT OF THE DISCLOSURE

A vertical excavator including a frame portion which may be stationarily positioned from the ground adjacent a portion of the ground in which a hole is to be dug, the frame portion supporting a mounting assembly therefrom which is shiftable horizontally in right angularly disposed directions relative to the frame portion and which supports a vertically elongated boom therefrom for vertical reciprocation relative thereto and provided with digging means on its lower end portion.

This invention relates to a vertical excavator and more specifically to an apparatus which is designed primarily for digging excavations which are relatively small in plan area. The vertical excavator of the instant invention is particularly well adapted to dig graves and is constructed in a manner whereby it may be readily transported from one location to another and set up in operative position with little effort.

The vertical excavator of the instant invention includes a main frame provided with removable ground-engaging wheels and further includes guide means defining an elongated guideway which is pivotally supported from the frame of the excavator for movement between a substantially horizontally disposed inoperative position and a substantially vertically disposed operative position. An elongated boom is slidably supported from the guide means for longitudinal reciprocation longitudinally along the guideway defined thereby and one end of the boom is provided with digging means. The guide means is further supported for reciprocal movement along a path extending transversely of the frame of the vertical excavator and the portion of the frame of the excavator to which the support means is pivotally secured is swingable through an arc about an axis generally paralleling the axis of rotation of the guide means relative to the portion of the frame to which it is pivotally secured. In this manner, the guideway in which the elongated boom is reciprocal may be pivoted to a vertically disposed position and shifted in right angularly disposed vertical planes. Therefore, the digging means carried by the lower end of the elongated boom may not only be raised and lowered upon the vertical adjustment of the boom relative to the guide means but also laterally adjusted along two right angularly disposed vertical planes, the depth of the excavations made by the excavator being limited only by the length of the boom.

The main frame of the vertical excavator is generally horizontally disposed and includes front and rear ends, the front end being adapted to be connected to a towing vehicle and the rear end including removable ground-engaging wheels whereby the excavator may be trailed as a trailer. Still further, the main frame of the vertical excavator is provided with a plurality of adjustable jack means at points spaced about its periphery whereby the main frame of the excavator may be levelled as desired and adapted to conform to uneven ground when the ground-engaging support wheels are removed and the excavator is disposed in an operative position to dig an excavation.

The main object of this invention is to provide an efficient and readily operable excavator primarily designed to dig excavations of limited plan area.

Another object of this invention, in accordance with the immediately preceding object, is to provide a vertical excavator including means adapting it to be trailed behind a towing vehicle whereby the excavator will be reasonably portable and thus readily moved from one location to another behind a towing vehicle.

Still another object of this invention is to provide a vertical excavator constructed in a manner whereby a vertically disposed and vertically adjustable support boom including digging means on its lower end portion may be readily laterally adjusted in two right angularly disposed vertical planes.

Another object of this invention is to provide a vertical excavator in accordance with the preceding objects and including means whereby the guide means for the vertically adjustable boom may be pivoted between positions with the boom vertically disposed and the boom horizontally disposed.

A final object of this invention to be specifically enumerated herein is to provide a vertical excavator which will conform to conventional forms of manufacture, be of simple construction and easy to use so as to provide a device that will be economically feasible, long lasting and relatively trouble free in operation.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout, and in which:

FIGURE 1 is a top plan view of the vertical excavator of the instant invention;

FIGURE 2 is a side elevational view of the embodiment illustrated in FIGURE 1;

FIGURE 3 is a rear elevational view of the vertical excavator;

FIGURE 4 is a side elevational view of the vertical excavator shown with the ground-engaging support wheels mounted thereon and the digging boom of the excavator in a collapsed horizontally disposed position;

FIGURE 5 is a top plan view of the embodiment illustrated in FIGURE 4;

FIGURE 6 is a fragmentary enlarged perspective view showing the manner in which one portion of the ground-engaging support wheels may be removably secured to the main frame of the excavator;

FIGURE 7 is a detailed fragmentary perspective view of some of the structural details of the main frame of the excavator;

FIGURE 8 is a fragmentary side elevational view of a further portion of the excavator showing the details of its construction, portions being broken away and shown in vertical section;

FIGURE 9 is an enlarged vertical sectional view taken substantially upon a plane passing longitudinally of the main frame of the excavator and through the center of the guide means for the digging boom of the excavator; and

FIGURE 10 is a composite fragmentary exploded perspective view illustrating two alternate components of the excavator which may be utilized to vary the width of the main frame of the excavator.

Referring now more specifically to the drawings, the numeral **10** generally designates the vertical excavator of the instant invention. The excavator **10** includes a main frame generally referred to by the reference numeral **12** and it may be seen from a comparison of FIGURES 1 and 5 of the drawings that the main frame **12** includes a

pair of forwardly convergent elongated horizontal members **14** and **16** pivotally secured together at their forward ends in any convenient manner.

The rear ends of the members **14** and **16** are adjustably interconnected by means of an extendible elongated brace member **18**.

In addition, the rear ends of the members **14** and **16** have a pair of rearwardly directed and generally parallel arm members **20** and **22** rigidly secured thereto. The opposite ends of the extendible brace member **18** are pivotally secured to the junctures of the members **14** and **20** and the members **16** and **22**.

The apex defined by the forward ends of the members **14** and **16** includes a vertical sleeve **24** with which a screw jack **26** is operatively associated, the screw jack **26** including a lower ground-engaging portion **28**. Still further, the junctures defined by the inter section of the members **14** and **20** and the members **16** and **22** also include vertical sleeves **30** having screw jacks **32** corresponding to the screw jacks **26** operatively associated therewith. Finally, the free ends of the arm members **20** and **22** include vertical sleeves **34** with which screw jacks **36** are operatively associated, at least the screw jacks **26** and **36** being removable from the sleeves **24** and **34**.

When it is desired to transport the vertical excavator **10** by towing it behind a towing vehicle, a front dolly wheel assembly generally referred to by the reference numeral **38** is operatively supported from the sleeve **24** and a rigid transverse axle assembly generally referred to by the reference numeral **40** including ground-engaging wheels **42** and **44** and also a pair of upstanding rod members **46** may be secured to the rear ends of the arm members **20** and **22** by removing the screw jacks **36** from the sleeves **34** and inserting the upper ends of the upstanding rod members **46** into the lower ends of the sleeves **34**. Any suitable means may be provided for removably securing the upstanding rod members **46** within the sleeves **34** and it is to be noted that the dolly wheel assembly **38** includes an upstanding shank portion (not shown) which is removably securable within the front sleeve **24**.

A pair of generally parallel support arms **50** and **52** are provided with transverse sleeves **54** and **56**, respectively, on one pair of corresponding ends which are rotatably journaled on the opposite ends of the extendible brace member **18**. The free ends of the arms **50** and **52** are interconnected by means of an extendible brace member assembly generally referred to by the reference numeral **58** and which includes a large diameter tubular member **60** fixedly secured at one end to the free end of the arm **50** and a larger diameter sleeve member **62** secured to the free end of the arm **52**.

The sleeve member **62** includes a diametric bore **64** through which the shank portion **66** of a headed retaining pin **68** is receivable. The transverse brace member assembly **58** also includes a rod-like member **70** including a small diameter end portion **72** which is telescopically received in the free end of the tubular member **60** and a large diameter end portion **74** which is telescopically received in the sleeve **62**, the large diameter end portion **74** including a diametric bore **76** registrable with the bore **64** and through which the shank portion **66** may be secured. Still further, the transverse brace member assembly **58** includes a second rod-like member **80** to be utilized in lieu of the member **70** and which also includes a small diameter end portion **82** corresponding to the end portion **72** and a large diameter end portion **84** corresponding to the portion **74**, the large diameter end portion **84** also including a diametric bore **94** through which the shank portion **66** is receivable after the bore **94** is registered with the bore **64**. The adjacent ends of the tubular member **60** and large diameter end portion **74** are abuttingly engageable to limit movement of the arm members **50** and **52** toward each other. However, when it is desired to extend the brace member **18**, the arm members **50** and **52** must be spaced a greater distance apart and therefore the rod-like member **80** is utilized in lieu of the rod-like member **70** when the brace member **18** is in its extended position. The brace member **18** includes a first large diameter tubular section **96** and a second small diameter section or end portion **98** which is telescopically received in the adjacent end of the large diameter tubular portion **96**.

In any event, whether the transverse brace member assembly **58** is in the extended position utilizing the rod-like member **80** or the retracted position utilizing the rod-like member **70**, it is of a constant diameter throughout its entire length due to the large diameter end portions **74** and **84** being of the same outside diameter as the outside diameter of the tubular member **60**.

A pair of longitudinally extending and forwardly convergent brace members **100** and **102** are pivotally secured at their rear ends to the free ends of the support arms **50** and **52** a spaced distance from the transverse brace member assembly **58**. The forward ends of the brace members **100** and **102** are secured together and pivotally secured to one end of a link **104** which generally parallels the arms **50** and **52** and has its lower end pivotally secured to the juncture between the forward ends of the members **14** and **16**. Thus, it may be seen from FIGURE 2 of the drawings that the frame **12**, the arms **50** and **52**, the link **104** and the brace members **100** and **102** define a parallelogram linkage which maintains the brace members **100** and **102** in substantial parallel relation relative to the members **14** and **16**.

An extendible fluid motor **108** has one end pivotally secured to the juncture defined by the inner section of the forward ends of the members **14** and **16** and the other end pivotally secured to a transverse brace **110** extending between the brace members **100** and **102** a spaced distance rearwardly of their free ends. The brace member **110** is provided with a pair of longitudinal slots **112** and **114** in its opposite end portions in which upstanding pins **116** and **118** carried by the brace members **100** and **102** are slidingly received. In this manner, the fluid motor **108** may be actuated to raise and lower the brace members **100** and **102** relative to the main frame **12** and shift the transverse brace member **58** longitudinally of the main frame **12**.

A mounting assembly generally referred to by the reference numeral **120** is provided and includes a substantially planar plate-like portion **122** and a journal portion **124** which rotatably receives and is slidable longitudinally along the transverse brace member assembly **58**. The mounting assembly **120** includes a pair of upstanding longitudinally extending plates **126** and **128** between which a pivot shaft **130** carrying a pulley wheel **132** is rotatably journaled. The plate-like portion **122** includes an upper plate portion **134** and a lower plate portion **136** while the journal portion **124** is defined by a generally semi-cylindrical bight portion **138** interconnecting the upper and lower plate portions **134** and **136**.

A guide housing generally referred to by the reference numeral **140** is provided and includes a pair of opposite side plates **142** and **144** interconnected by means of a front wall **146**, the rear of the housing **140** being open and the latter defining an elongated guideway in which an elongated boom **150** is longitudinally reciprocal. The side plates **142** and **144** of the guide housing **140** are rotatably journaled from the outwardly projecting ends of the shaft **130** and thus it may be seen from FIGURE 9 of the drawings that the guide housing **140** may be pivoted from the vertically disposed position illustrated in FIGURE 2 of the drawings to the horizontally disposed position illustrated in FIGURE 4 of the drawings. The side plates **142** and **144** include two sets of horizontally aligned apertures **156** and **158** through which a locking pin **160** is selectively receivable, the locking pin **160** being passed through suitable horizontally aligned bores **162** formed in the side plates **126** and **128**. In this

manner, the guide housing **140** may be locked in either the vertical position illustrated in FIGURE 2 of the drawings or the horizontal position illustrated in FIGURE 4 of the drawings.

The lower end of the boom **150** includes conventional clam shell type digging means generally referred to by the reference numeral **164** including a pair of bucket halves **166** and **168** which are pivotally supported from the lower end of the boom **150** for movement toward and away from each other, fluid motors **170** and **172** being provided for pivoting the bucket halves **166** and **168**, respectively, relative to the boom assembly **150**.

With attention now invited to FIGURES 1, 2 and 8 of the drawings, there may be seen a guide bar **174** having one end slidably received through a sleeve **176** pivotally supported from the upper end of the link **104** by means of a pivot pin **180**. The end of the guide bar **174** remote from the sleeve **176** is pivotally secured between the upper and lower portions **134** and **136** of the plate-like portion **122** by means of a pivot fastener **182**. Further, it may be seen that an extendible fluid motor **186** is supported from the mounting assembly **120** at one end and includes a pair of sheaves **188** at its other end about which a flexible tension member **190** is passed. One end of the flexible tension member **190** is secured to the guide housing **140** as at **192** and the end of the flexible tension member **190** is passed about one of the sheaves **188**, about a third sheave **193** journalled from the motor **186**, and then about the other of the sheaves **188** before being passed over the pulley wheel **132** and then secured to the boom **150** as at **194**. Accordingly, it may be seen that the fluid motor **186**, when operatively connected to a suitable source of fluid under pressure, may be utilized to raise and lower the boom **150** relative to the guide housing **140**. Further, a fluid motor generally referred to by the reference numeral **196** is supported from the upper end of the arm **50** at one end and supports a sheave **198** at its other end about which an elongated flexible tension member **200** is passed. The opposite ends of the tension member **200** are secured to the arm **52** as at **202** and the plate-like portion **122** as at **204**. A second sheave **206** is also supported from the fluid motor **196** and an elongated flexible tension member **207** is passed about the sheave **206** and the sheave **208** supported from the arm **50**. One end of the member **207** is secured to the motor **196** as at **209** and the other end is secured to the plate-like portion **122** as at **210**. Accordingly, the fluid motor **196** may be utilized to shift the mounting assembly and the guide housing **140** longitudinally of the transverse brace member assembly **58** so as to move the digging means **164** between the free ends of the arm members **20** and **22**. Still further, the fluid motor **108** may be utilized to raise and lower the brace members **100** and **102** and to therefore shift the guide housing **140** longitudinally of the frame **12**.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be resorted to, falling within the scope of the invention as claimed.

What is claimed as new is as follows:

1. A vertical excavator comprising a generally horizontal main support frame including means adapted to engage and be stationarily supported from the ground, support means carried by said main frame, guide means pivotally and laterally shiftably supported from said support means for rotation about a horizontal axis and shifting along said axis and including means defining an elongated guideway extending transversely of said axis, elongated boom means slidably supported from said guide means for longitudinal reciprocation longitudinally along said guideway, means operatively connected between said guide means and said boom means for longitudinally adjustably positioning said boom means relative to said guide means, digging means carried by one end of said boom means, and means operatively connected between said support means and said guide means for shifting the latter along said axis relative to said support means.

2. The combination of claim **1** wherein said support means includes support arm means pivotally secured at one end to said main frame for rotation about an axis generally paralleling the first mentioned axis, said guide means being pivotally and shiftably supported from the free end portion of said arm means.

3. The combination of claim **2** including means connected between said guide means and said support means operable to releasably maintain said guide means in adjusted rotated position about its axis of rotation relative to said support means.

4. The combination of claim **1** wherein said support means includes support arm means pivotally secured at one end to said main frame for rotation about an axis generally paralleling the first mentioned axis, said guide means being pivotally and shiftably supported from the free end portion of said arm means, said arm means including an elongated transverse arm on its free end portion generally paralleling the axis of rotation of said arm means, said guide means being pivotally and slidably mounted on said arm.

5. The combination of claim **4** wherein said transverse arm is longitudinally extendible.

6. The combination of claim **1** wherein said digging means is of the clam shell type.

7. The combination of claim **1** wherein said support means includes support arm means pivotally secured at one end to said main frame for rotation about an axis generally paralleling the first mentioned axis, said guide means being pivotally and shiftably supported from the free end portion of said arm means, said arm means including an elongated transverse arm on its free end portion generally paralleling the axis of rotation of said arm means, said guide means being pivotally and slidably mounted on said arm, said main frame including a pair of generally parallel and horizontal elongated opposite side members interconnected at one pair of corresponding end portions by means of a transverse member and being free of connections with each other at the other pair of corresponding end portions, said support means defining a pair of elongated arms pivotally supported at one set of corresponding ends from said frame adjacent said one pair of end portions of said opposite side members and interconnected at a second set of end portions by means of said elongated transverse arm.

8. The combination of claim **7** wherein said elongated transverse arm and said transverse member are each longitudinally extendible.

9. The combination of claim **1** wherein said support means includes support arm means pivotally secured at one end to said main frame for rotation about an axis generally paralleling the first mentioned axis, said guide means being pivotally and shiftably supported from the free end portion of said arm means, said arm means including an elongated transverse arm on its free end portion generally paralleling the axis of rotation of said arm means, said guide means being pivotally and slidably mounted on said arm, said main frame including a pair of generally parallel and horizontal elongated opposite side members interconnected at one pair of corresponding end portions by means of a transverse member and being free of connections with each other at the other pair of corresponding end portions, said support means defining a pair of elongated arms pivotally supported at one set of corresponding ends from said frame adjacent said one pair of end portions of said opposite side members and interconnected at a second set of end portions by means of said elongated transverse

arm, said digging means being receivable between said other pair of ends of said side members.

10. A vertical excavator comprising a generally horizontal main support frame defining a longitudinal axis and including means adapted to engage and be stationarily supported from the ground, support means carried by said main frame, guide means supported from said support means for shifting laterally of said axis in a horizontal direction and including means defining an upstanding elongated guideway, elongated boom means slidably supported from said guide means for longitudinal reciprocation longitudinally along said guideway, means operatively connected between said guide means and said boom means for longitudinally adjustably positioning said boom means relative to said guide means, digging means carried by the lower end of said boom means, means operatively connected between said support means and said guide means for shifting the latter relative to said support means, said support means including support

arm means pivotally secured at one end to said main frame for rotation about an axis generally normal to the first mentioned axis, said guide means being shiftably supported from the free end portion of said arm means, said arm means including an elongated transverse arm on its free end portion generally paralleling the axis of rotation of said arm means, said guide means being slidably mounted on said transverse arm.

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