May 5, 1959 B. M. POOL 2,884,721

EXCAVATING APPARATUS

Filed Nov. 23, 1956 2 Sheets-Sheet 1

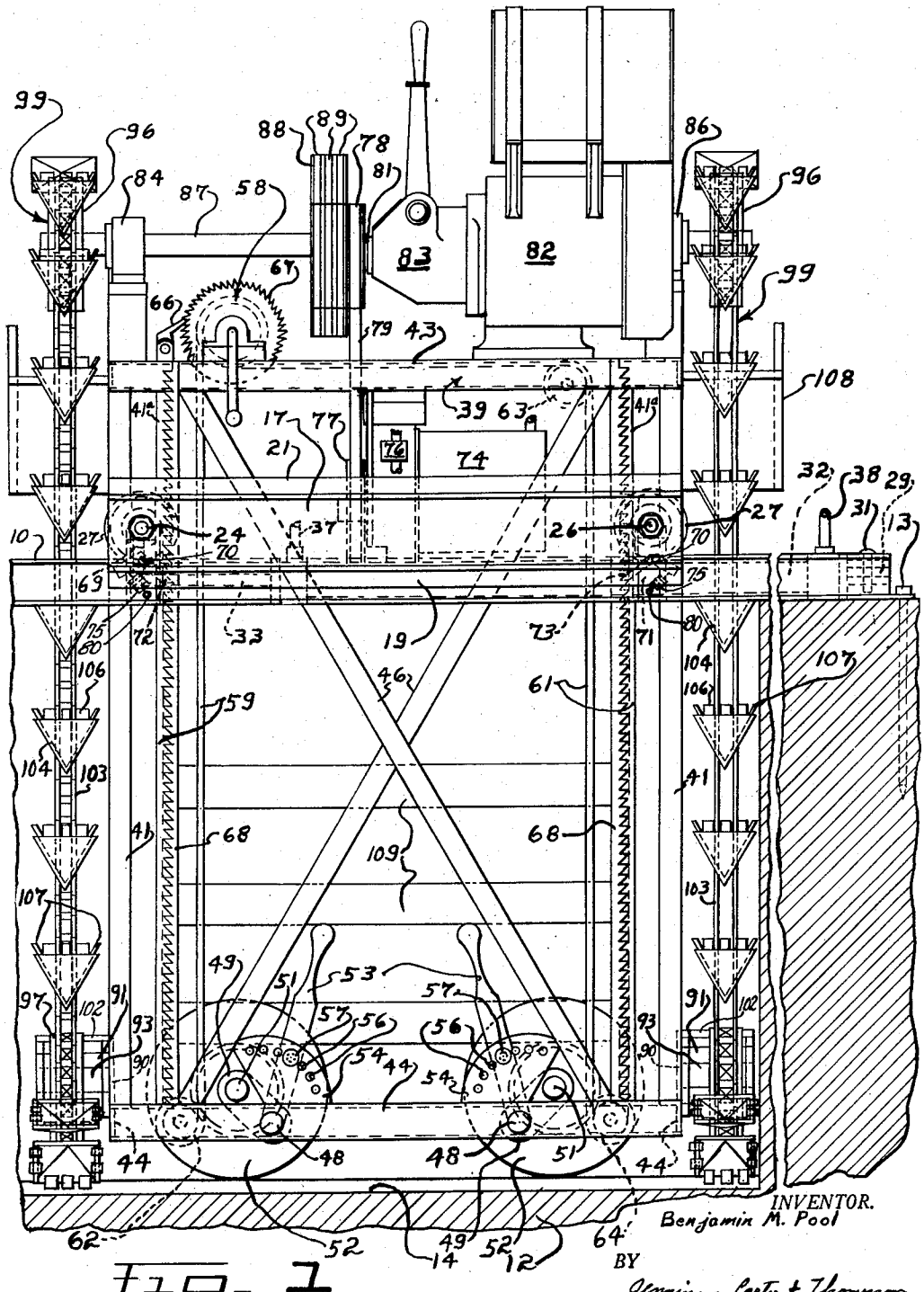


Fig. 1

INVENTOR.
Benjamin M. Pool
BY
Jennings, Carter & Thompson
Attorneys

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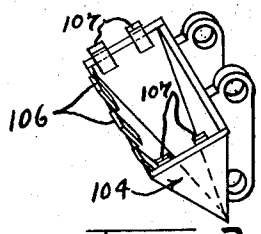


Fig. 3

Fig. 2

INVENTOR.
Benjamin M. Pool

BY

Jennings, Carter & Thompson

Attorneys

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EXCAVATING APPARATUS

Benjamin M. Pool, Montgomery, Ala.

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7 Claims. (Cl. 37—85)

This invention relates to excavating apparatus and more particularly to apparatus for digging substantially rectangular shaped openings into the ground, such as graves and like openings.

An object of my invention is to provide excavating apparatus of the character designated in which the supporting means therefor is positioned inwardly of the digging or cutting elements whereby the aparatus may be transferred through narrow passageways, such as the passageways between graves in cemeteries, and at the same time the apparatus is adapted for digging openings of the required length, depth and width.

Another object of my invention is to provide excavating apparatus of the character designated in which the supporting means therefor travels on the bottom surface of the opening being dug, whereby the depth of the cut being made by the cutting elements may be easily adjusted by varying the vertical position of the supporting means relative to the excavator frame.

Another object of my invention is to provide excavating apparatus of the character designated in which the cutting elements are positioned outwardly of the portion of the apparatus which travels vertically, whereby they are always in view of the operator, thus avoiding damage to the apparatus where rocks and like objects are encountered.

A further object of my invention is to provide excavating apparatus of the character designated in which the cutting elements are provided with outwardly extending cutters along the leading edges and sides thereof whereby the cutting is done from the bottom and the side toward which the apparatus is moving.

A further object of my invention is to provide excavating apparatus of the character designated which shall be simple of construction, economical of manufacture and adapted for digging openings into the ground in a minimum of time and with a minimum of labor.

Apparatus embodying features of my invention is illustrated in the accompanying drawings forming a part of this application, in which:

Fig. 1 is a side elevational view with parts broken away and in section;

Fig. 2 is an end elevational view, partly broken away and in section; and,

Fig. 3 is a perspective view showing one of the cutter elements removed from the apparatus.

Referring now to the drawings for a better understanding of my invention, I show elongated guide rails 10 and 11 which are anchored to the ground 12 by suitable pins 13 along opposite sides of the opening being dug indicated generally at 14. Mounted for rotation on the guide rails 10 and 11 is a supporting frame 16 which comprises elongated side members 17 and 18 at opposite sides thereof. Suitable reinforcing angles 19 and 21 are secured to the side member 17. In like manner reinforcing angles 22 and 23 are secured to the side member 18, as shown. Connecting the side members

17 and 18 adjacent the ends thereof are axle members 24 and 26. Mounted on the axles 24 and 26 are flanged rollers 27 which ride on the rails 10 and 11.

Secured to the guide rail 10 as by welding at 28 is an inwardly extending bracket 29. Pivotally connected to the bracket 29 by means of a pin 31 is one end of a fluid pressure operated cylinder 32 having a piston rod 33. Secured to the free end of the piston rod 33 is an upstanding bracket 34 which in turn is connected to the axle 24 as by welding at 36. Fluid under pressure is introduced into opposite ends of the cylinder 32 by conduits 37 and 38 whereby reciprocatory motion is imparted to the supporting frame 16.

Mounted for vertical movement within the confines of the supporting frame 16 is an excavator frame 39. The excavator frame 39 comprises vertical corner frame members 41 and 42 at opposite sides thereof which are connected at the tops and bottoms thereof by transverse frame members 43 and 44, respectively. As shown in the drawings, positioned on opposite sides of the axles 24 and 26 from the frame members 41, 42 are vertically extending guide members 41*a* and 42*a* which are connected to the upper and lower frame members 43 and 44. The frame members 41 and 42 together with their associated guide members 41*a* and 42*a* define vertical guideways for the axles 24 and 26. Suitable brace members 46 and 47 are provided at the sides and ends respectively of the excavator frame. Mounted for pivotal movement on the lower frame member 44 inwardly of the corners of the excavator frame 39 are pins 48 which carry brackets 49. Mounted for rotation on suitable short shafts 51 adjacent the free ends of the brackets 49 are wheels 52, which preferably are of the pneumatic type. Rigidly secured to the pins 48 and the brackets 49 are upstanding handle members 53. Mounted on the bottom members 44 alongside the handle members 53 are arcuate brackets 54 having a plurality of openings 56 therein for receiving a laterally projecting pin 57 carried by the handle member 53. It will thus be seen that movement of the handle members 53 about their pivot points causes the wheels 52 to be raised or lowered whereby they can be locked in selected vertical positions relative to the excavator frame 39 by inserting the pin 57 in the proper opening 56.

Mounted on the upper transverse frame members 43 of the excavator frame 39 is a winch 58 having cables 59 and 61 adjacent each side thereof. The cables 59 extend downwardly under pulleys 62 mounted at one end of the bottom member 44 and then extend upwardly to the shaft 24 to which they are secured. The cables 61 extend from their respective ends of the winch 58 over sheaves 63 mounted adjacent the ends of the upper frame members 43 opposite the winch 58 and then pass downwardly under sheaves 64 mounted at the ends of the bottom frame members 44 opposite the sheaves 62. The cables 61 then extend upwardly to the shaft 26 to which they are secured. Mounted for pivotal movement on the upper frame member 43 adjacent the winch 58 is a pawl 66 which is adapted to engage a suitable ratchet 67 mounted on the winch 58.

Connecting the upper and lower frame members 43 and 44 inwardly of each end of the excavator frame 39 are vertical racks 68. Secured to the axles 24 and 26 are depending brackets 69 and 71, respectively. Pivotally connected to the depending brackets 69 and 71 on pins 70 are pawl members 72 and 73, respectively, which are adapted to engage the racks 68 whereby the excavator frame 39 does not tilt as the apparatus is moved back and forth by the fluid pressure operated cylinder 32. Springs 75 are connected to the brackets 69 and 71 by

pins 80 and to the pawl members 72 and 73 to hold the pawl members in engagement with the racks 68.

Fluid under pressure is supplied to the conduits 37 and 38 of the cylinder 32 by a self-contained pump and reservoir indicated generally at 74. A suitable control valve 76 connects the unit 74 with the conduits 37 and 38 whereby the fluid is introduced selectively at opposite ends of the fluid pressure operated cylinder 32, thus imparting reciprocatory motion to the supporting frame 16 and the excavator frame 39 carried therewith. The control valve 76 may be of a type to automatically reverse the flow of fluid at the extreme ends of the cylinder 32, such as a valve controlled by a mechanical trip linkage or a fluid pressure pilot circuit which automatically reverse the flow of fluid in the conduits 37 and 38. The pump of the self-contained unit 74 is provided with a pulley 77 which is in driving relation with a second pulley 78 by means of a suitable belt 79. The pulley 78 is mounted on a drive shaft 81 which is operatively connected to a power unit, such as an internal combustion engine 82, by a clutch reduction unit 83. Mounted for rotation in bearings 84 and 86 at the top of the excavator frame 36 is a shaft 87. Mounted on the shaft 87 opposite the pulley 78 is a pulley 88. The pulleys 78 and 88 are connected to each other by suitable belts 89.

Frame members 90 extend between the frame members 41 and 42 above the frame members 44. Mounted for rotation in suitable U-bracket bearings 91 and 92 secured to the frame members 90 adjacent the lower ends of the excavator frame 39 are short shaft members 93 and 94, respectively. Mounted at the ends of the shaft 87 and outwardly of the excavator frame 39 are drive sprockets 96. Mounted on the shafts 93 and 94 are sprockets 97 and 98, respectively. Passing around the sprockets 96, 97 and 98 are endless bucket elevators indicated generally at 99. Mounted at each end of the excavator frame 39 intermediate the sprockets 97 and 98 is an idler spracket 101 which is supported in a suitable U-shaped bearing member 102 secured to frame member 90.

Each bucket elevator 99 comprises an endless sprocket chain 103 which carries a plurality of buckets 104. Mounted at the leading edge of each bucket 104 is an outwardly projecting cutter element 106 which is adapted to engage the bottom of the opening 14 being dug. Mounted at each side of the buckets 104 are outwardly extending cutter elements 107. As shown in Fig. 1, the cutter elements 107 are in position for the ones thereof at the end of the excavator frame 39 toward which the apparatus is moving to operate and for the cutter elements 107 at the opposite end of the excavator frame to operate when the apparatus is traveling in the opposite direction. That is to say, the cutter elements 107 at the left of the buckets 104 shown in Fig. 1 operate when the apparatus is traveling toward the left and the cutter elements 107 at the right side of the buckets 104 operate when the apparatus is traveling to the right.

A suitable inclined slide 108 is provided at one side of the apparatus to convey the dirt discharged by the buckets 104 to a point beyond the supporting frame 16. Also, runners 109 are attached to the side of the excavator frame adjacent the shaft 87 to bear against the adjacent wall of the opening 14 and thereby absorb the side thrust which the bucket elevators 99 exert in this direction.

From the foregoing description, the operation of my improved excavating apparatus will be readily understood. The guide rails 10 and 11 are anchored to the ground 12 by the pins 13 adjacent each side of the opening 14 to be dug. With the excavator frame 39 in the raised position, the apparatus is supported by the wheels 52 and is transported to the guide members 10 and 11 where the flanged rollers 27 ride upon the same. The wheels 52 are then adjusted to the proper elevation by moving the pin 57 to the proper opening 56, whereby the

cutter elements 106 dig into the ground the depth desired. The upstanding bracket 34 is connected to the end of the piston rod 33 and fluid is introduced selectively at opposite ends of the cylinder 32 whereby reciprocatory motion is imparted to the apparatus. As the apparatus travels in one direction along the guide members 10 and 11, the cutter elements 106 and the cutter elements 107 at the side of the buckets 104 toward which the apparatus is moving, dig into the earth and fill the buckets 104. The dirt in the buckets 104 is discharged onto the slide 108 whereby the dirt is conveyed to a point beyond the supporting frame 16.

In view of the fact that with both bucket elevators 99 the cutter elements 107, at the sides of the buckets 104 toward which the apparatus is moving dig into the earth, one pass of the apparatus equal to the length thereof digs an area twice the length thereof. The engagement of the pawls 72 and 73 with the racks 68 prevent the excavator frame 39 from tilting as the apparatus is reciprocated. Accordingly, when the wheels 52 at the end of the excavator frame toward which the apparatus is moving reach the point where the earth has been dug, the wheels at the opposite end of the apparatus support the same, thereby preventing tilting. The runners 109 attached to the side of the excavator frame adjacent the shaft 87 bear against the adjacent wall of the opening 14 being dug, thus absorbing the side thrust which the bucket elevators will exert in this direction. The downward feed of the excavator frame 39 is by gravity and the depth of each cut made by the cutter elements is regulated by setting the pins 57 in the proper openings 56. As the digging proceeds, the pawl 66 is held out of engagement with the ratchet wheel 67 whereby the excavator frame 39 will move downwardly as the digging proceeds. The reciprocatory motion of the apparatus imparted by the piston rod 33 is continued until the opening 14 is of the desired depth.

To remove the excavator frame 39 from the opening 14, the pawl members 72 and 73 are released manually from engagement with the racks 68 and are held in released position by suitable retaining members (not shown) and the winch 58 is turned whereby the cables 59 and 61 are wound thereon thus lifting the excavator frame 39 relative to the supporting frame 16. The pawl 66 is then moved into engagement with the ratchet 67 to prevent downward movement of the excavator frame after it has been raised. The entire apparatus is then rolled beyond the end of the opening 14 and the wheels 52 are lowered below the plane of the lowermost cutter elements 106 by adjusting the handles 53 to the proper positions. The apparatus is then transported on the wheels 52. The apparatus may be transported by any suitable means or may be self-propelled by providing a suitable drive connection between the power unit 82 and the wheels 52.

To prevent damage to the cutter elements, the sprockets 96 are connected to the shaft 87 by suitable shear pins 110 which serve as overload safety devices.

From the foregoing, it will be seen that I have provided improved excavating apparatus which is particularly adapted for use in close places where the apparatus must be of a minimum width. By providing the cutter elements outwardly of the excavator frame and providing support means which are positioned wholly within the confines of the excavator frame, the cutter elements are always in clear view of the operator. Also, by providing cutters at the sides of the buckets of the elevators, the layer of earth removed is equal to twice the distance of travel of the apparatus.

While I have shown my invention in but one form, it will be obvious to those skilled in the art that it is not so limited but is susceptible of various changes and modifications without departing from the spirit thereof, and I desire, therefore, that only such limitations shall be

placed thereupon as are specifically set forth in the appended claims.

What I claim is:

1. In excavating apparatus adapted to dig a substantially rectangular-shaped opening in the ground, a mobile supporting frame, means imparting continuous reciprocatory motion to said supporting frame as the digging proceeds, an excavator frame carried by said supporting frame and adapted for vertical movement relative thereto, endless bucket elevators mounted for rotary movement at each end of the excavator frame, outwardly extending cutter elements at the leading edge of each bucket of said elevators, other outwardly extending cutter elements at the sides of each of said buckets in position for the ones thereof at the side toward which the apparatus is moving to make a cut substantially at right angles to the cut made by said cutter elements at the leading edge of the buckets and for said other cutter elements at the opposite side to make a cut substantially at right angles to the cut made by said cutter elements at the leading edge of the buckets when the apparatus is moving in the opposite direction, and means within the confines of said excavator frame supporting the excavator frame at selected elevations from the bottom of the opening being dug.

2. In excavating apparatus adapted to dig a substantially rectangular-shaped opening in the ground, elongated guide members adapted to be anchored to the ground, a supporting frame adapted for movement along said guide members, means imparting continuous reciprocatory motion to said supporting frame as the digging proceeds whereby it travels back and forth along said guide members, an excavator frame carried by said supporting frame and adapted for vertical movement relative thereto, endless bucket elevators mounted for rotary movement at each end of the excavator frame, outwardly extending cutter elements at the leading edge of each bucket of said elevators, other outwardly extending cutter elements at the sides of each of said buckets in position for the ones thereof at the side toward which the apparatus is moving to make a cut substantially at right angles to the cut made by said cutter elements at the leading edge of the buckets and for said other cutter elements at the opposite side to make a cut substantially at right angles to the cut made by said cutter elements at the leading edge of the buckets when the apparatus is traveling in the opposite direction, and means within the confines of said excavator frame supporting the excavator frame at selected elevations from the bottom of the opening being dug.

3. Excavating apparatus as defined in claim 2 in which the means imparting reciprocatory motion to the supporting frame comprises a fluid pressure actuated member anchored at one end thereof to one of the elongated guide members and at the other end thereof to said supporting frame.

4. Excavating apparatus as defined in claim 2 in which the means supporting the excavator frame at selected elevations from the bottom of the opening being dug comprises wheels mounted for vertical adjustment inwardly of the corners of said excavator frame.

5. In excavating apparatus adapted to dig a substantially rectangular-shaped opening in the ground, elongated guide members adapted to be anchored to the ground along opposite sides of the opening to be dug, a supporting frame adapted for movement along said guide members, means imparting continuous reciprocatory motion to said supporting frame as the digging proceeds whereby it travels back and forth along said guide members, an excavator frame within the confines of the supporting frame and adapted for vertical movement relative thereto, supporting wheels for the excavator frame mounted for vertical adjustment inwardly of the corners of said excavator frame, endless bucket elevators mounted for rotary movement at each end of the excavator frame, outwardly extending cutter elements at the leading edges of each bucket of said bucket elevators, other outwardly extending cutter elements at the sides of each of said buckets in position for the ones thereof at the side toward which the apparatus is moving to make a cut substantially at right angles to the cut made by said cutter elements at the leading edge of the buckets and for said other cutter elements at the opposite side to make a cut substantially at right angles to the cut made by said cutter elements at the leading edge of the buckets when the apparatus is traveling in the opposite direction, and lift means mounted on said excavator frame and connected to said supporting frame for raising and lowering the excavator frame relative to the supporting frame.

6. Excavating apparatus as defined in claim 5 in which the lift means comprises a winch mounted on the excavator frame, sheaves mounted for rotation adjacent the lower ends of said excavator frame, and flexible cables secured at one of their ends to said winch and passing from said winch under said sheaves with the other ends of said cables secured to the supporting frame.

7. In excavating apparatus adapted to dig a substantially rectangular-shaped opening in the ground, elongated guide members adapted to be anchored to the ground along opposite sides of the opening to be dug, a supporting frame adapted for movement along said guide members, means imparting reciprocatory motion to said supporting frame whereby it travels back and forth along said guide members, an excavator frame within the confines of the supporting frame and adapted for vertical movement relative thereto, supporting wheels for the excavator frame mounted for vertical adjustment inwardly of the corners of said excavator frame, endless bucket elevators mounted for rotary movement at each end of the excavator frame, outwardly extending cutter elements at the leading edges of each bucket of said bucket elevators, other outwardly extending cutter elements at the sides of each of said buckets in position for the ones thereof at the side toward which the apparatus is moving to operate and for said other cutter elements at the opposite side to operate when the apparatus is traveling in the opposite direction, lift means mounted on said excavator frame and connected to said supporting frame for raising and lowering the excavator frame relative to the supporting frame, vertically extending rack members mounted adjacent opposite ends of said excavator frame, and pawl members pivotally mounted on the supporting frame in position to engage said racks whereby the excavator frame is held against tilting.

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