

Sept. 3, 1929.

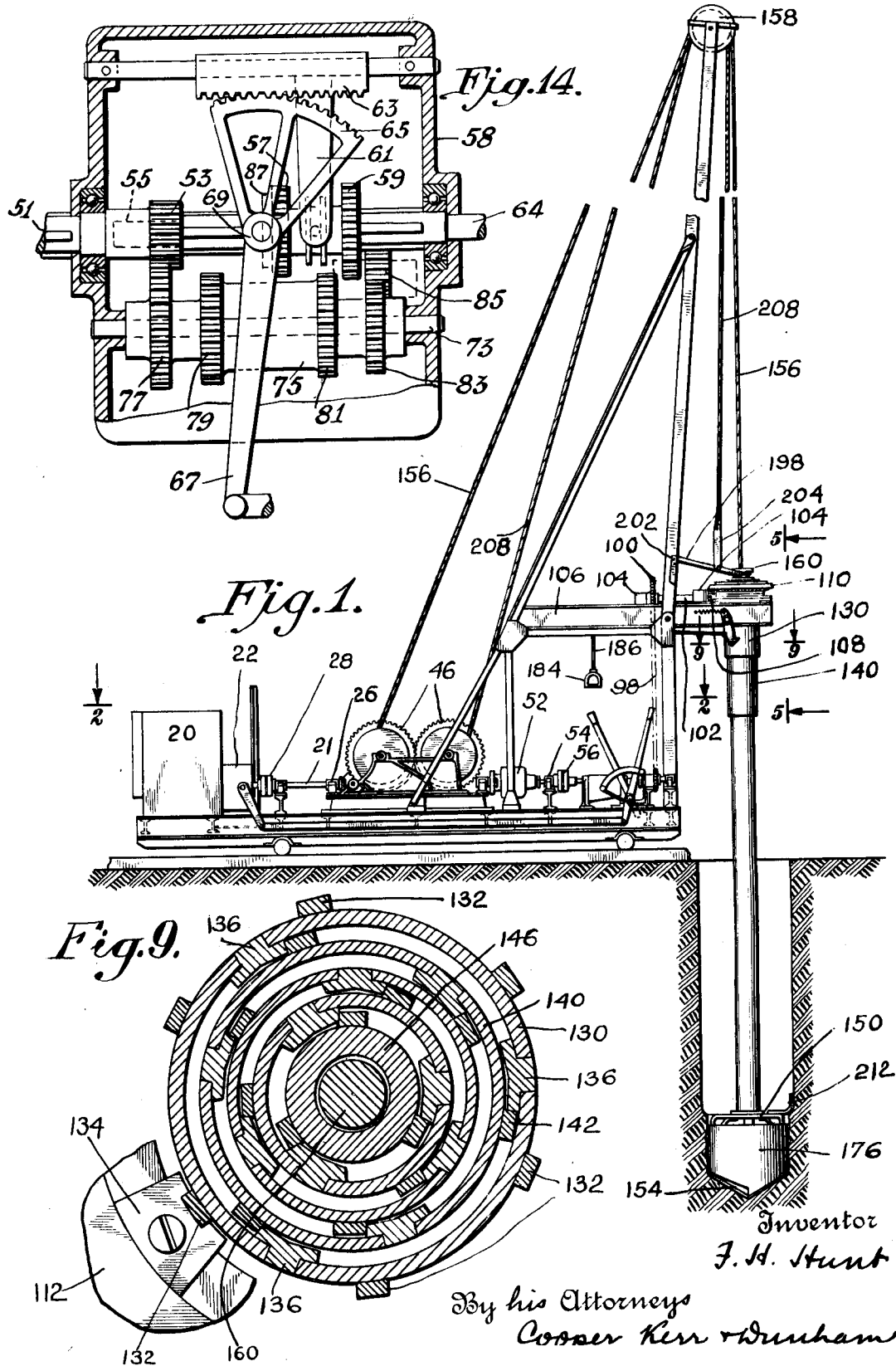
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1,726,565

EXCAVATING APPARATUS

Filed Dec. 7, 1926

5 Sheets-Sheet 1



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5 Sheets-Sheet 2

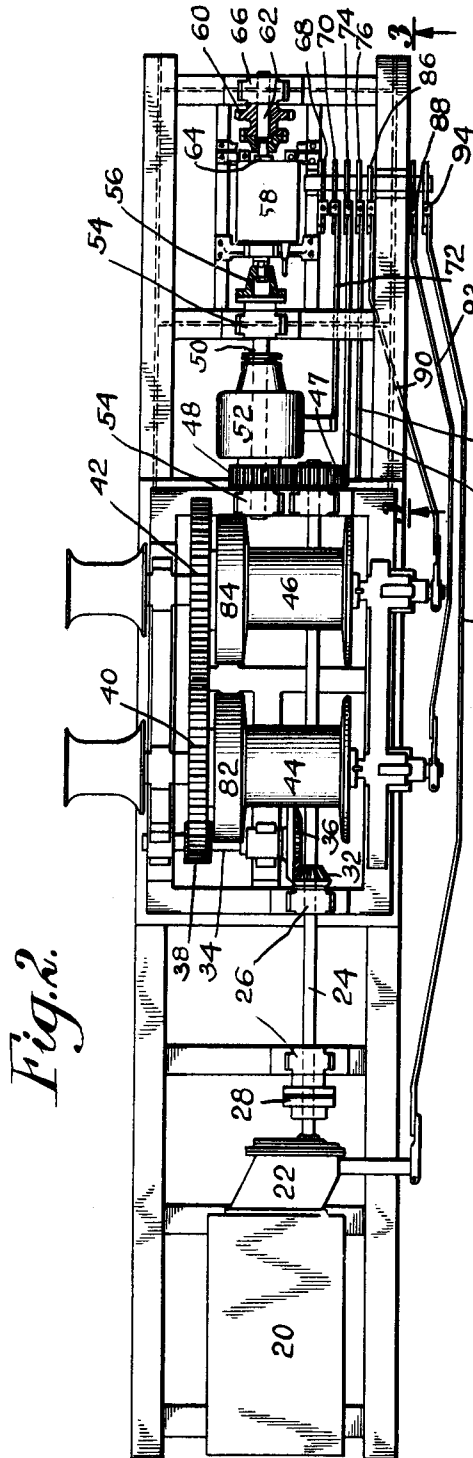


Fig. 2.

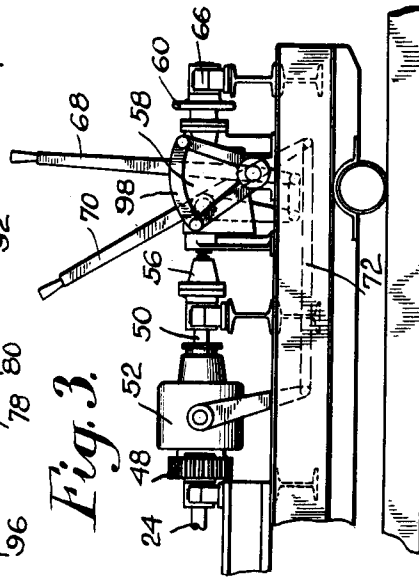


Fig. 3.

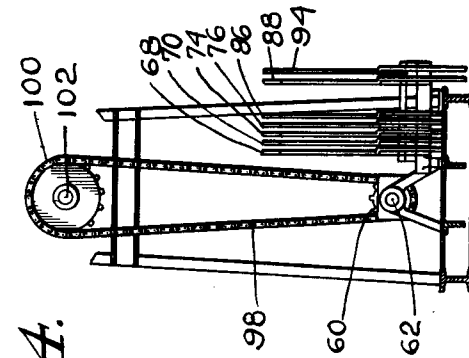


Fig. 4.

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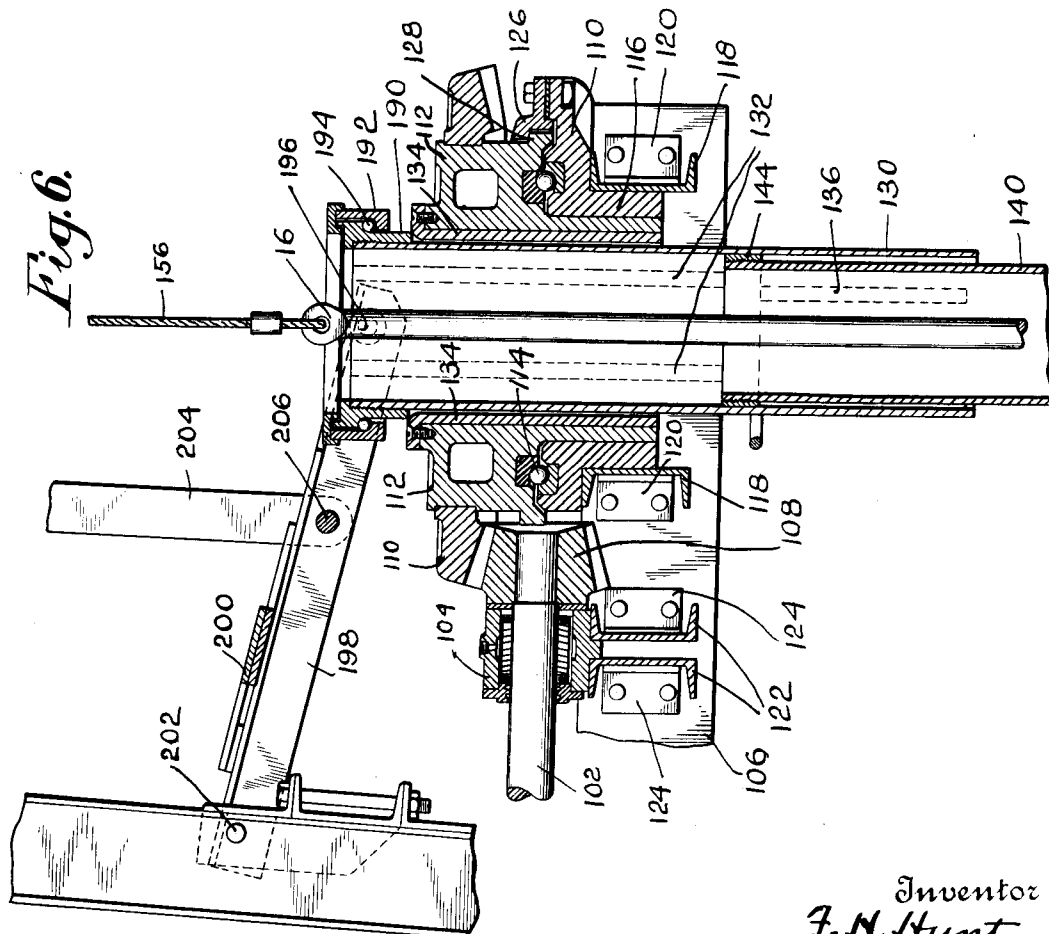
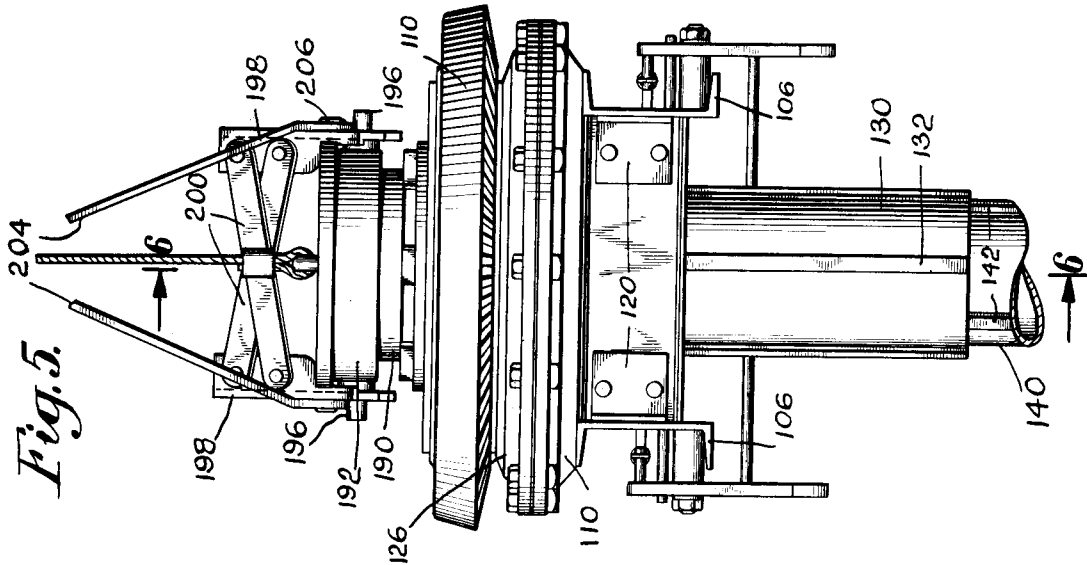
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5 Sheets-Sheet 4

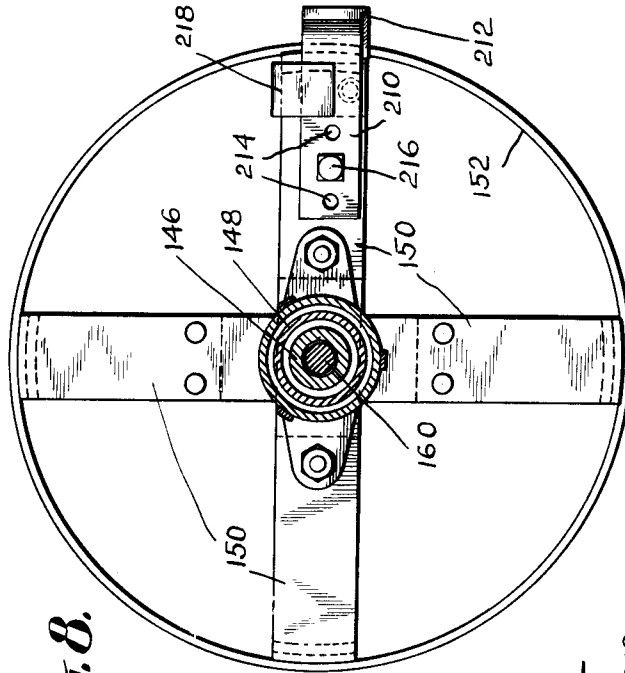


Fig. 8.

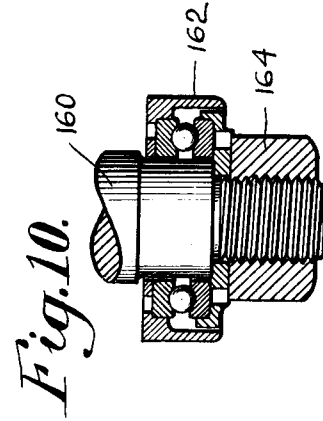


Fig. 10.

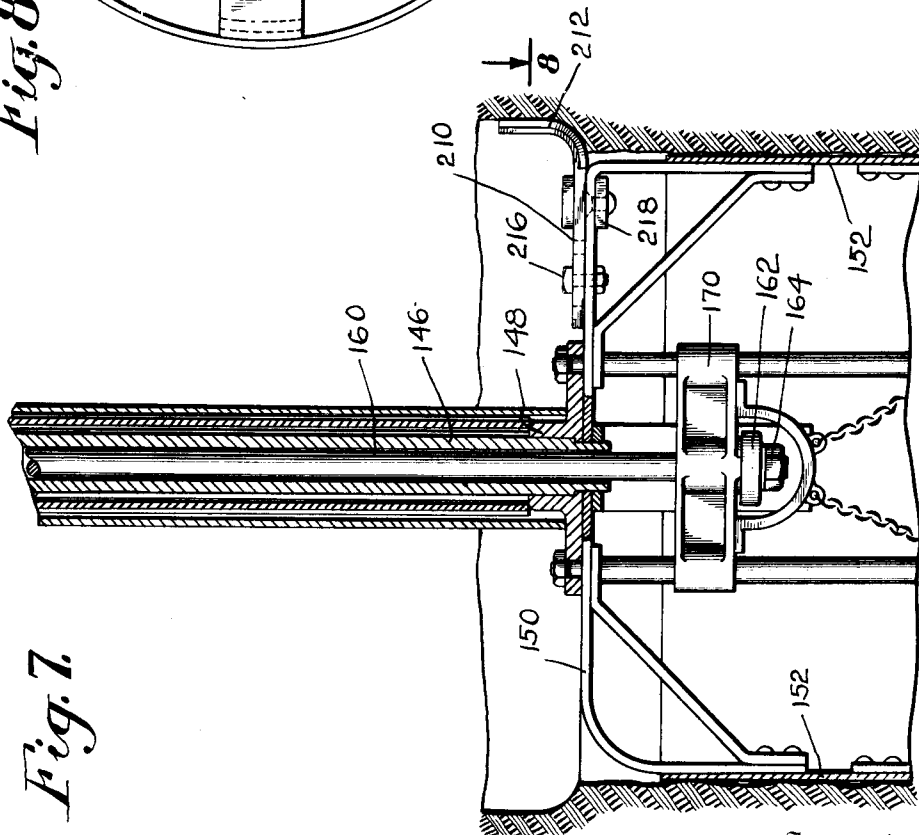


Fig. 7.

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Fig. 11.

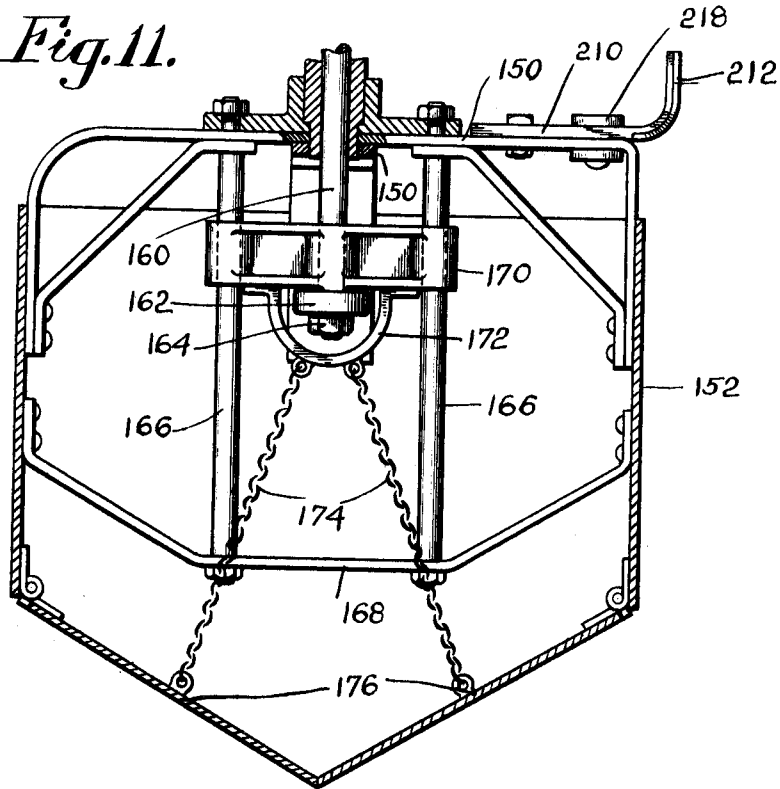


Fig. 12.

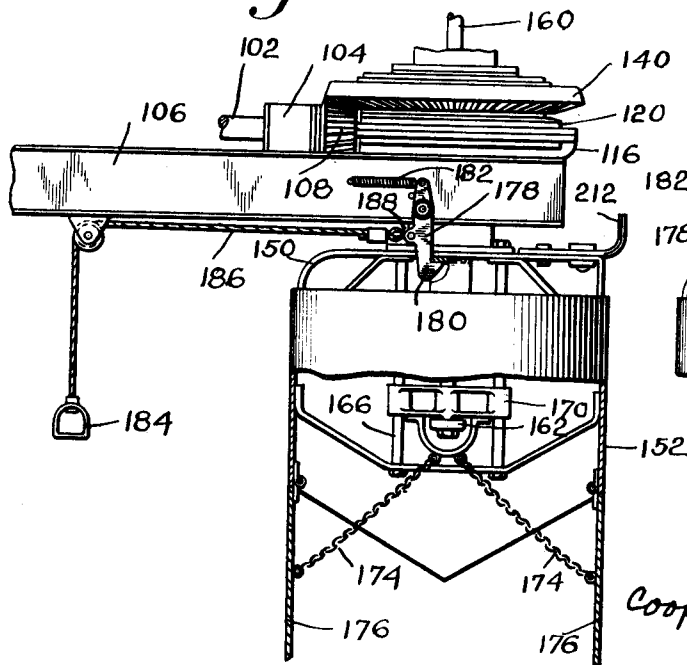
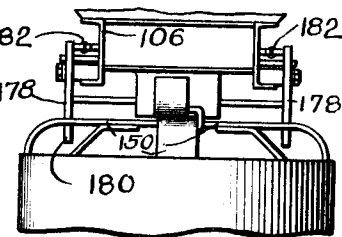


Fig. 13.



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EXCAVATING APPARATUS.

Application filed December 7, 1926. Serial No. 153,087.

This invention covers improvements in apparatus disclosed in copending application of Hunt and Ropp, Serial No. 104,582, filed April 26, 1926, entitled "Method of and apparatus for forming a mold for a column with a base."

The object of the invention is to so improve the design and arrangement of the machine as to greatly enhance the convenience of operation and efficiency thereof.

To this and other ends the invention comprises the novel features and combinations of elements hereinafter described, and shown in the drawings, which by way of illustration show what I now consider to be the preferred form of the invention.

Fig. 1 is a side view of the whole machine showing the principal operative units.

Fig. 2 is an enlarged plan view on line 2—2 of Fig. 1, showing some operative units and the lever controls therefor.

Fig. 3 is a side view of a portion of Fig. 2, on line 3—3.

Fig. 4 is an end view of a portion of Fig. 3, with the overhead shaft and drive therefor.

Fig. 5 is an enlarged view of bucket drive mechanism, on line 5—5 of Fig. 1.

Fig. 6 is a cross section of Fig. 5, on line 6—6.

Fig. 7 is an enlarged cross section of the excavating bucket and the lower end of the telescopic device or "kelly" for driving the bucket.

Fig. 8 is a top plan view of Fig. 7.

Fig. 9 is an enlarged cross section of the kelly on line 9—9 of Fig. 1.

Fig. 10 is a detail of lower end of bucket shaft.

Fig. 11 is a detail view of the mechanism for operating the bucket gates.

Fig. 12 shows the mechanism by which the operator controls the bucket gates.

Fig. 13 is a side view of a portion of Fig. 12.

Fig. 14 is a cross-section of the three-speed and reverse transmission.

In Figs. 1 and 2, 20 designates a motor or source of power, generally in the form of a multicylinder gasoline or oil engine. Gear box 22 contains reduction gearing and a clutch, through which shaft 24 is driven. Shaft 24 is supported in bearings 26 on the frame of the machine. A flexible coupling 28 is used for connecting shaft 24 to the shaft 30 which projects from gear box 22. This coupling permits a certain amount of weaving or warping of the supporting structure

without adverse effect on the running qualities of the shafting, which otherwise might heat in the bearings and cause trouble.

Mounted on shaft 24 adjacent the middle bearing 26 is a bevel pinion 32, arranged to drive a short cross shaft 34 through bevel gear 36. Shaft 34 is supported for rotation in suitable bearings on the frame of the machine, and by means of a spur pinion at 38 drives gears 40 and 42 which operate hoisting drums 44 and 46 respectively through clutches (not shown) of the type usually employed in hoisting machines.

The extreme end of shaft 24 is provided with a gear 47 which drives a similar gear 48 in the opposite direction of rotation from gear 47. Passing through gear 48 is a shaft 50 on which is mounted a friction clutch represented conventionally at 52. By means of clutch 52 shaft 50 may be allowed to stand still or be caused to rotate in unison with gear 48. Shaft 50 is supported for rotation in bearings 54 on the frame of the machine.

The free end of shaft 50 is connected by means of a flexible coupling 56 to a projecting shaft 51 of the speed changing transmission enclosed in housing 58, which preferably provides three forward and one reverse speeds for sprocket 60, which is fast on a short shaft 62. One end of shaft 62 is coupled to and supported by the driving shaft 64 of the transmission, and the other end is supported by bearing 66 on the machine.

Details of the transmission are shown in Fig. 14. Wide pinion 53 is fast on the inner end of shaft 51. The end of shaft 51 is counter-bored as at 55 to provide a bearing for the inner end of shaft 64. Splined on shaft 64 is a unit comprising gears 57 and 59 shiftable lengthwise of shaft 64 by the train of mechanism comprising arm 61, rack 63, quadrant 65, arm 67 fast to quadrant 65 and pivoted at 69, link 71, and shifter lever 68.

Parallel to shaft 64 within case 58 is a shaft 73 upon which is mounted for rotation a sleeve 75 to which are fast gears 77, 79, 81 and 83. In mesh with gear 83 at the rear thereof is the reverse pinion 85. On the left side of gear 57 is a set of clutch jaws 87 adapted to engage the right hand ends of the teeth of pinion 53. Gear 77 is in mesh with pinion 53—therefore sleeve 75 with gears 77, 79, 81 and 83, also reverse pinion 85, rotate whenever pinion 53 rotates.

With the above structure in mind the oper-

ation of the device will readily be understood. High speed is provided when clutch 87 is engaged with teeth of pinion 53 whereby shaft 64 turns at the same speed as shaft 51, sleeve 75 rotating idly. To provide the intermediate speed, gear 57 is placed in engagement with gear 79, whereby shaft 64 is driven from pinion 53 through gears 77, 79 and 57. To provide the low speed, gear 59 is shifted into mesh with gear 81 and the power passes from pinion 53 through gears 77, 81 and 59. To provide reverse speed, gear 59 is placed in mesh with reverse pinion 85, whereby shaft 64 is turned in reverse direction through pinion 53, gears 77, 83, reverse pinion 85, and gear 59.

For the convenience of the operator the seven levers operating the above described units are located in a group at the control station of the machine. Lever 68 controls the shifting of gears in the transmission; lever 70 controls friction clutch 52 by means of rod 72; levers 74 and 76, by rods 78 and 80 and other well known mechanism not shown, control the brakes 82 and 84 on hoisting drums 44 and 46 respectively; levers 86 and 88 through rods 90 and 92 respectively, operate the clutches controlling drums 46 and 44; lever 94 through rod 96 controls the clutch in gear box 22. Each lever is provided with a quadrant 98, and latch (not shown) of usual form to hold the lever in desired position.

Sprocket 60 is geared by chain 98 to sprocket 100, fast to shaft 102 which is supported in bearings 104 at a considerable distance above shaft 62. Bearings 104 are supported by the horizontal frame members 106, which also support other mechanism to be described.

Fast on the end of shaft 102 is a bevel pinion 108 (Figs. 1 and 6) enmeshed with bevel gear 110. Gear 110 is secured to the hub member 112 which is mounted for rotation on the ball bearing designated generally as 114, the upper race being set into hub 112 and the lower race into the member 116. Member 116 rests upon, and is bolted to, beams 118, which in turn are bolted or riveted to beams 106 by means of angles 120.

In like manner bearing 104 is carried on beams 122 secured to beams 106 by angles 124. A suitable retaining and dirt-excluding flange 126 is bolted to the upper surface of the rim of member 116 and engages a rim 128 turned on the lower outer circumference of hub 112.

It will be understood from the above that when pinion 108 is rotated, gear 110 and hub 112 rotate on ball bearing 114, the bearing 114 being supported by member 116 which is bolted fast to the frame of the machine.

As hub 112 rotates it turns with it the telescopic shaft which drives the digging bucket. Such a shaft is known in the trade as a "kelly" and will hereinafter be so designated.

The upper section of the kelly comprises a tube 130 (Figs. 5, 6, 9 and 10). Welded to the outer surface of the tube and extending lengthwise thereof are six keys 132. These keys are fitted to slide vertically in keyways in six bronze slippers 134, which in turn are fitted in and fast to hub 112. When hub 112 turns, tube 130 also turns, due to engagement of keys 132 in the keyways of slippers 134, but the keys are slidable vertically in the slipper keyways, thus permitting tube 130 to be displaced vertically, relatively to hub 112 for a purpose which will appear.

Welded into vertical slots in the lower end of tube 130 are three internally projecting keys 136. These internal keys do not extend the full length of tube 130, but only for sufficient distance to secure anchorage enough to the tube to enable them to safely transmit power to the bucket through the lower sections of the kelly. The dotted outline in Fig. 6 indicates the lengths of internal keys 136.

Inside tube 130 is the next lower section of the kelly, comprising the tube 140 provided with three vertical keys 142 extending the length of the tube and spaced to engage the internal keys 136 of tube 130, whereby when tube 130 is rotated tube 140 will be forced to turn with it. The upper end of tube 140 is provided with an external circumferential rim or flange 144, for the purpose of engaging the tops of keys 136 as indicated in Fig. 6, thereby serving to limit the telescopic movement of section 140 downwardly in section 130.

In similar manner, each section of the kelly drives the tube within it, the excavating bucket being attached to and driven by the innermost tube, which is of course the lowermost section when the kelly is extended, as it is when operating in a deep hole.

The lower end of the inner section 146 is provided with a flange 148, which is bolted to one of the two bails 150 of the bucket (Fig. 7).

The kelly adapts its length to any depth of hole, within its capacity, and whenever gear 112 turns the kelly is turned with it to rotate the bucket. Bucket 152 is provided on its bottom with cutters 154, to dig into the earth when the bucket is rotated. The detritus from the cutters enters the bucket, and whenever the bucket is filled it is raised above the ground level and dumped.

The hoisting of the bucket is accomplished by means of one of the hoisting drums, for instance drum 44, around which is wound one end of cable 156. This cable passes over one of the head sheaves 158 and its free end is attached to the upper end of the center rod 160 which passes downwardly through the kelly and is provided at its lower end with a ball bearing 162 held in place by nut 164. As the bucket rotates to the right while dig-

ging, nut 164 is provided with a left thread in order that there will be a constant tendency to tighten, instead of to loosen, the nut.

The mechanism just described is also used to open and close the bucket for dumping purposes, as will be understood from Figs. 11, 12 and 13. In the drawings, no attempt is made to show details of the gate structure, because it is intended to cover those features in another application. For purposes of illustration the drawing shows double gates, swinging both ways, because that is the preferred form, but a single gate may be controlled in the same manner as the double gate.

Supported vertically in the upper part of the bucket are two parallel guide rods 166. The upper ends of rods 166 are fast to a bail 150 and the lower ends fast to cross brace 168 provided for the purpose. Slidably mounted on rods 166 is the crosshead 170. Rod 160 passes downwardly through the crosshead and the upper side of bearing 160 bears against the under side of the crosshead. Attached to the under side of the crosshead is the downwardly extending semi-circular yoke 172 which surrounds bearing 162 and nut 164. Attached to yoke 172 are chains 174 extending to each bucket gate 176.

The operative position of the above described parts is shown in Fig. 11. When it is desired to dump the bucket, it is hoisted by means of drum 44, line 156 and rod 160, to the position shown in Fig. 12, in which position bail 150 is engaged by the two spring controlled latches 178, pivoted on beams 106 and so placed that their hook ends 180 will automatically engage the under side of bail 150 when the bail is drawn past them. The latches are actuated by coil springs 182 anchored to beams 106.

If when the bucket is hoisted the bail is not properly aligned to engage latches 178, the bucket is rotated to proper position by gear 110, under control of the operator.

After the latches have engaged the bail, cable 156 is slacked off, permitting the weight of the bucket and contents to be carried by the latches. Still further slacking of cable 156 permits rod 160 to lower to the position shown in Fig. 12, thereby relieving the tension in chains 174 and permitting gates 176 to open, urged by their own weight and the weight of the contents of the bucket. If the crosshead should bind on rods 166 the weight of rod 160 resting on yoke 172 serves to loosen it.

To close the bucket again, rod 160 and chains 174 are raised by cable 156 until the gates are closed (Fig. 11). Then rod 160 is raised still further to lift bail 150 from latch hooks 180. Then the operator draws down handle 184 which is placed conveniently for that purpose. Handle 184 is connected by cable 186 and bail 188 to both latches 178,

therefore when handle 184 is drawn down the latch hooks 180 are drawn from underneath bail 150 and the bucket is again carried by cable 156 and is free to descend at the will of the operator to resume digging operation.

It will be noted that the dumping of the bucket is under easy control of the same operator who controls the other operations of the machine.

As already described, the bucket is rotated, while digging, by power transmitted to it through the telescopic kelly. The kelly is of comparatively small diameter, especially its lower sections. On account of the small diameter, the pressure on the keys by which the power is transmitted from one section of the kelly to another is very great, so great in fact as to prevent the kelly from following the bucket as it digs its way downwardly.

If means were not provided to overcome that condition it would be necessary to relieve the pressure at frequent intervals to permit the kelly to follow the bucket. While digging, the kelly is in effect a solid shaft, the sections, being unable to move relatively to each other.

To meet this condition the following devices are provided. (Figs. 1, 2, 5 and 6.) As already described, the upper kelly section 130 is comparatively short; and is provided with vertical keys on its outer surface, arranged to slide in keyways in slippers 134. The outer diameter of section 130 is sufficient so that even when the maximum power is being transmitted there is insufficient pressure on the keys 132 to prevent sliding, especially since the sleeves 134 are bronze, and may be kept well lubricated because they are readily accessible.

Threaded onto the upper end of section 130 is a collar 190, shaped on its outer side in the form of a ball race. Surrounding collar 190 is ring 192, the inner surface of which is provided with a ball race. Balls 194, with the races on rings 190 and 192, serve to form a ball bearing.

Ring 192 is provided with a pair of horizontally projecting trunnions 196 which pass through holes in the angle iron frame 198. Frame 198 is tied together by angle braces 200, and is pivoted on the frame of the machine at 202. Near the middle of frame 198 is attached a pair of links 204, pivoted on a pin 206 extending through frame 198. The upper ends of links 204 are brought together and attached to cable 208 which passes over a head sheave 158 to hoisting drum 46.

It is evident that when cable 208 is wound onto its drum, frame 198 will be swung upwardly around its pivot 202 and section 130 of the kelly will be raised, and with it all kelly sections supported by it. The ball bearing above described permits section 130 to turn relatively to frame 198.

In service the procedure is as follows: The empty bucket is lowered to the bottom of the

hole. Then by means of drum 46 and cable 208, frame 198 is raised to its elevated position, drawing with it kelly section 130. The bucket is then rotated to begin digging, and cable 208 is slacked off. Thus the digging operation begins with the upper end of section 130 in a position well above ring gear 110. As soon as digging begins, all the lower kelly sections become practically locked together but as the bucket digs its way into the earth the kelly is permitted to follow the bucket downwardly because the keys of section 130 slide through the slippers 134. As previously explained, this slipping is possible on account of the relatively large diameter of sleeve 130, and because the keyways in slippers 134 may be lubricated.

The vertical travel of sleeve 130 is more than the depth of the bucket so that one setting of the sleeve is sufficient to allow the bucket to be filled. When the bucket is filled it is raised, dumped, and the above described operations repeated.

While the digging operation is taking place, considerable pressure is required on top of the bucket to insure digging at proper speed. This pressure is supplied by the kelly. Any desired fraction of the weight of the kelly is allowed to rest on the bucket by the simple expedient of keeping proper tension on cable 156 by means of the brake on drum 44. Another important feature of my apparatus will be understood from Figs. 7 and 8. It is often desirable to dig a hole larger than the diameter of the bucket. This can be done by a reaming operation. Resting on the top of one of the bucket bails 150 is the reamer 210 having an upturned cutting edge 212. The reamer is drilled with a plurality of holes 214, through any one of which a pivot bolt 216 may be placed to provide the desired projection of the reamer beyond the shell of the bucket. A very substantial U-shaped clip 218 is secured to the under side of bail 150, extending up behind and above the reamer. As the bucket rotates, clockwise in Fig. 8, the cutting edge 212 reams the hole

previously cut by the bucket to the desired larger diameter, clip 218 holding the reamer in cutting position. The detritus cut by the reamer falls into the bucket. Whenever the reamer is not used it is removed or simply swung clockwise on its pivot bolt 216 until its cutting edge does not project beyond the bucket. If the direction of rotation of the bucket is reversed, the reamer will automatically turn inwardly on its pivot pin 216 until it clears the wall of the hole.

It will be noted that the diameter of gear 110 is less than the diameter of the bucket, thereby permitting this outfit to drill holes close to or in contact with existing walls or buildings.

Another important feature is the fact that beams 106 supporting the rotary table are elevated sufficiently to permit dumping the bucket into a conveyor well above the ground level, and to permit inserting lining cylinders into the drilled hole without moving the machine from drilling position.

It is to be understood that the invention is not limited to the specific construction herein illustrated and described but may be embodied in other forms without departure from its spirit.

I claim—

1. In a machine of the class described, in combination, a rotatable digging bucket, apparatus for rotating said bucket to dig a hole, a torsion member operatively interconnecting said rotating apparatus and said bucket, and means independent of said torsion member under control of the operator for applying any desired portion of the weight of said member to said bucket for the purpose of feeding said bucket downwardly to dig a hole.

2. The invention set forth in claim 1, in which said means may be used to hoist said bucket bodily from the hole it has dug.

In testimony whereof I hereto affix my signature.

FRANCIS H. HUNT.