Oct. 29, 1929. C. H. RUTH 1,733,427

EXCAVATOR

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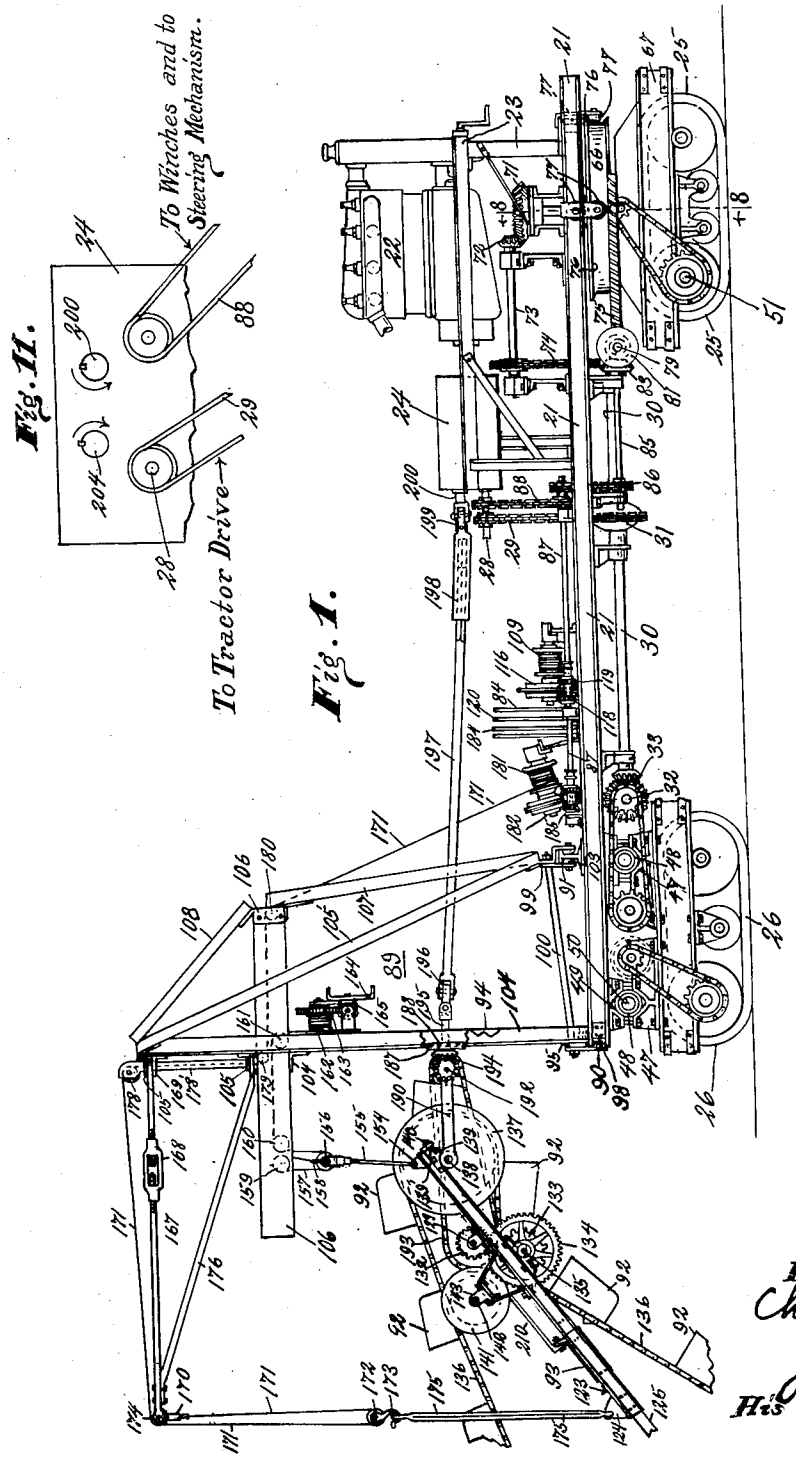


Fig. II.

Fig. I.

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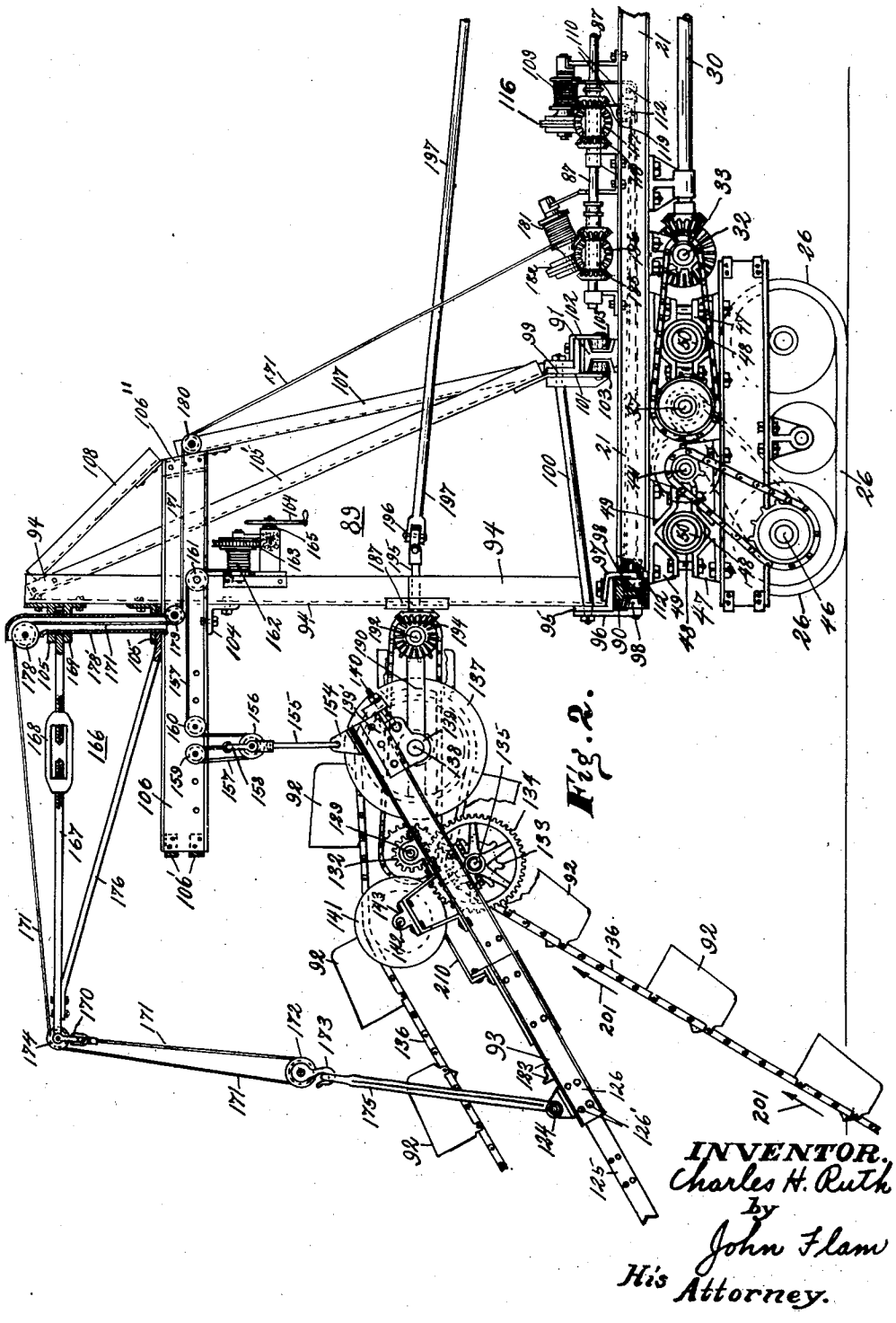


Fig. 2.

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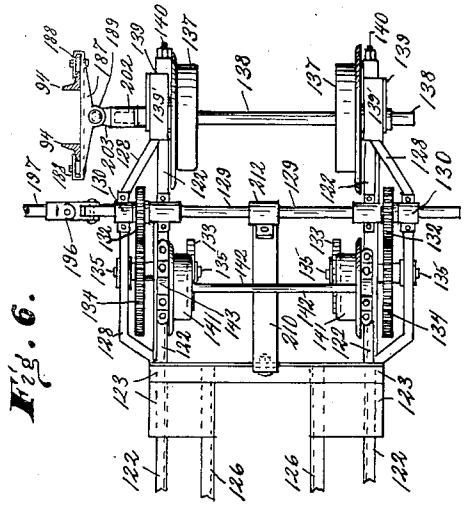


Fig. 6.

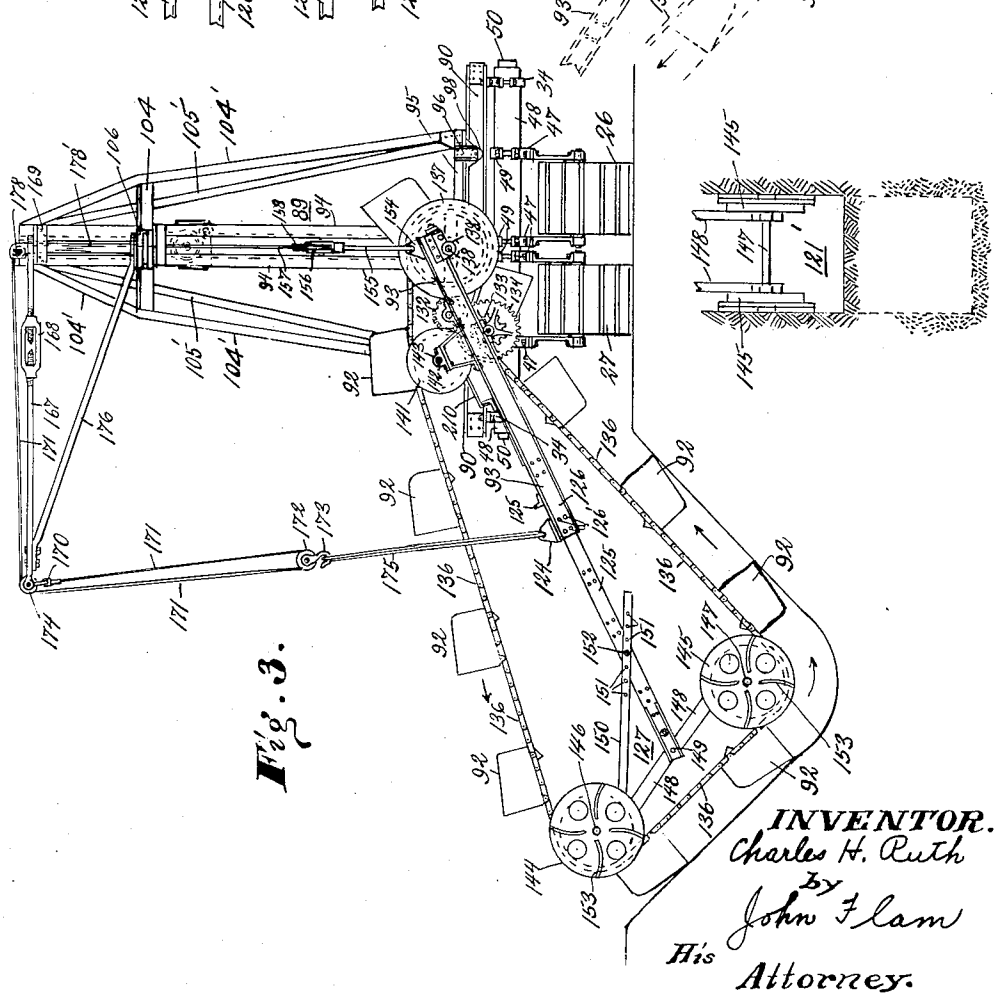


Fig. 3.

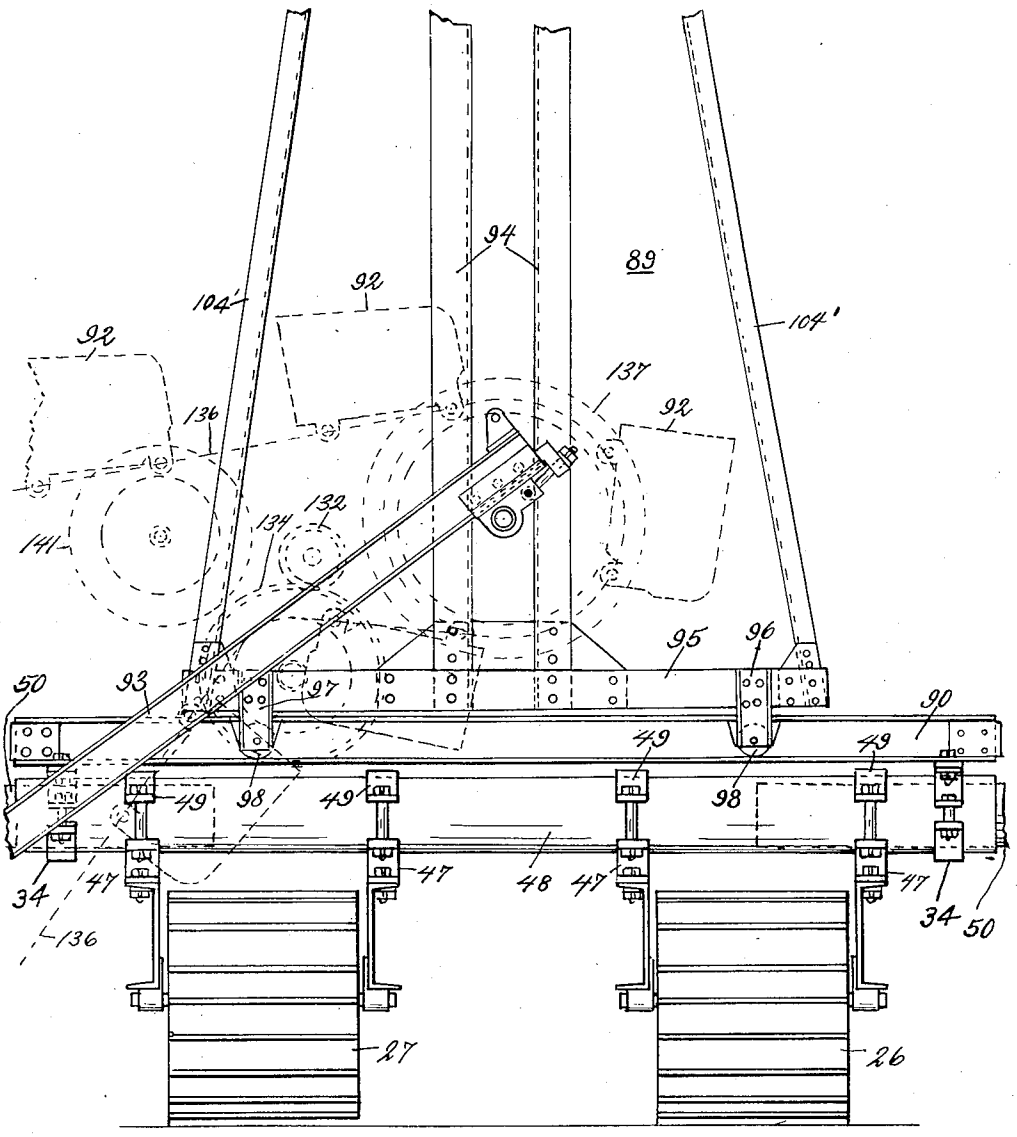
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Fig. 4.



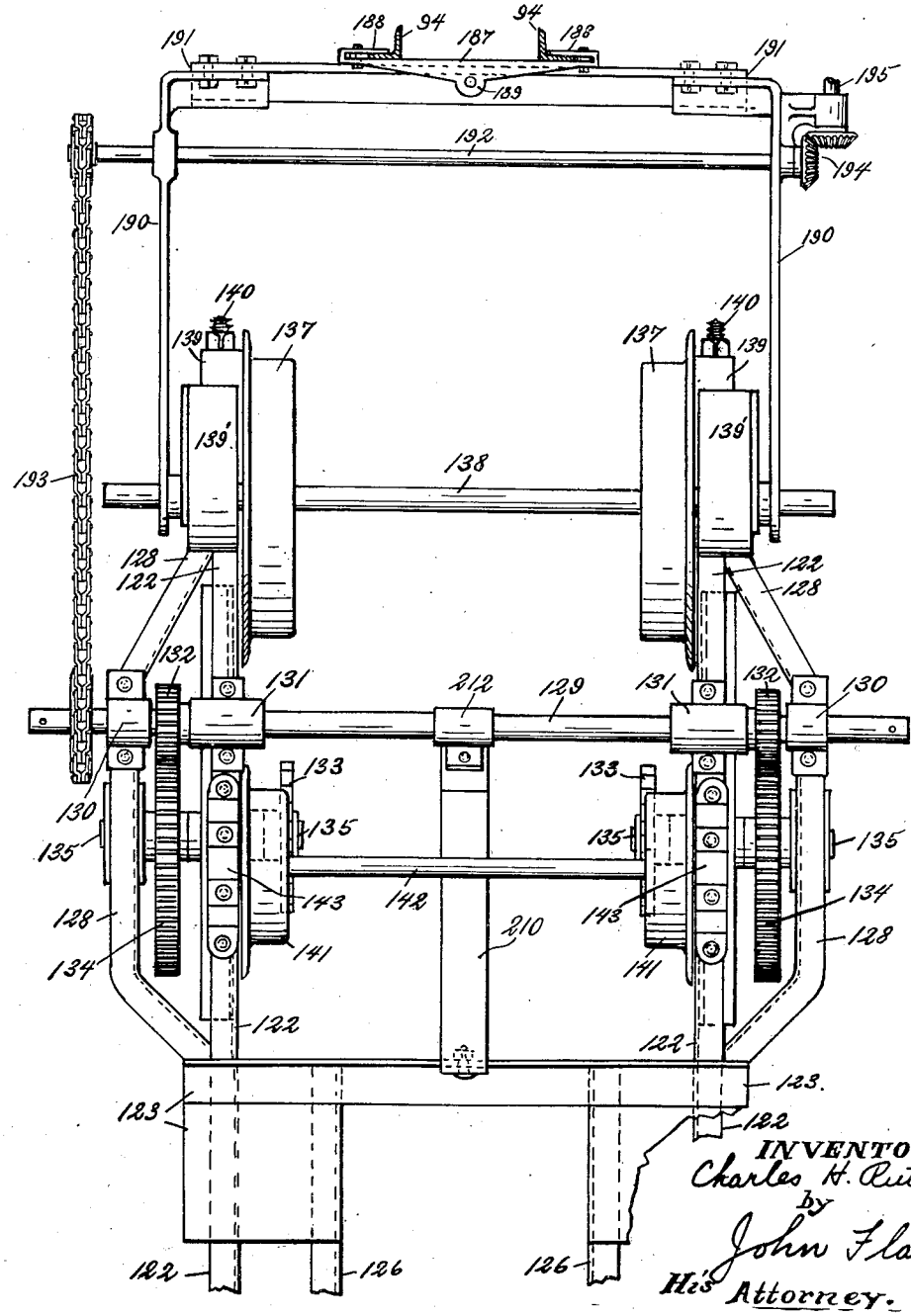
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Fig. 5.



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Fig. 7.

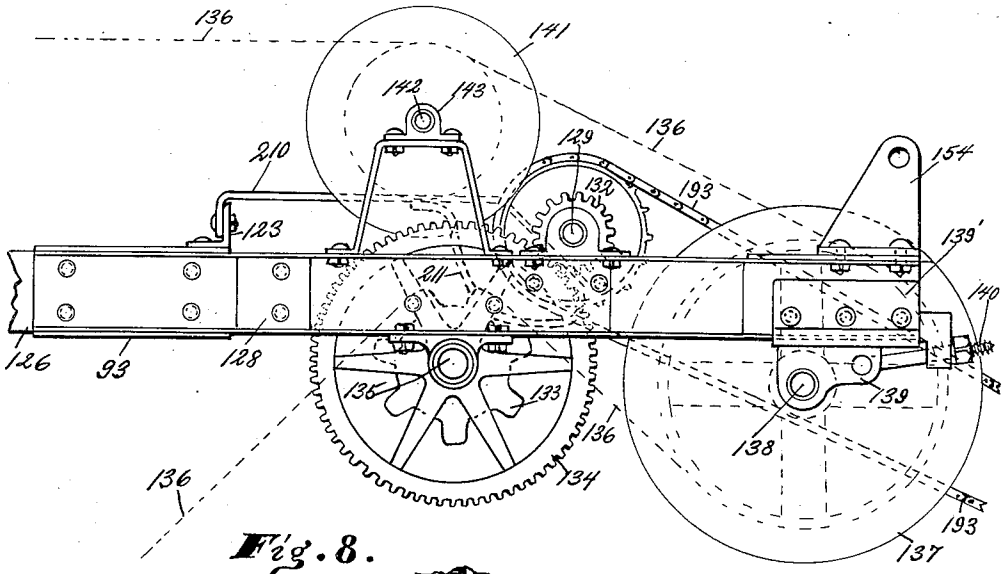
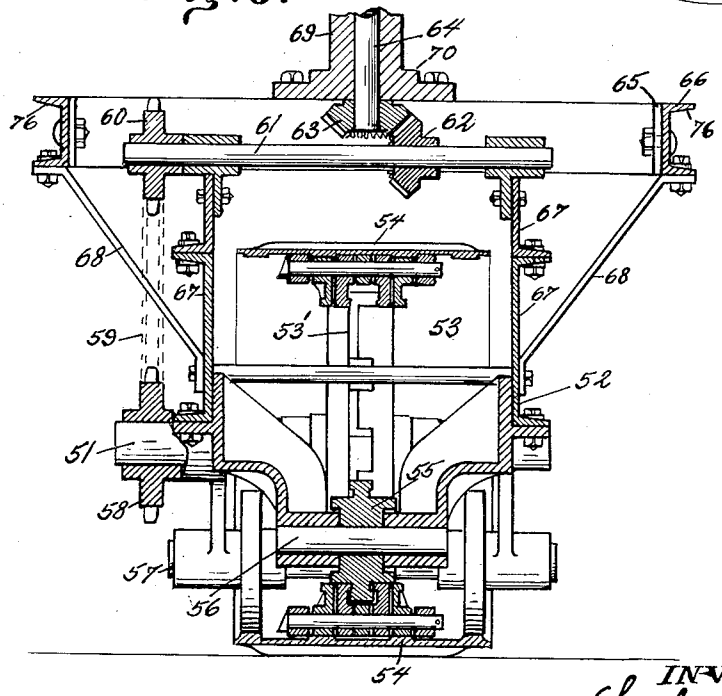


Fig. 8.



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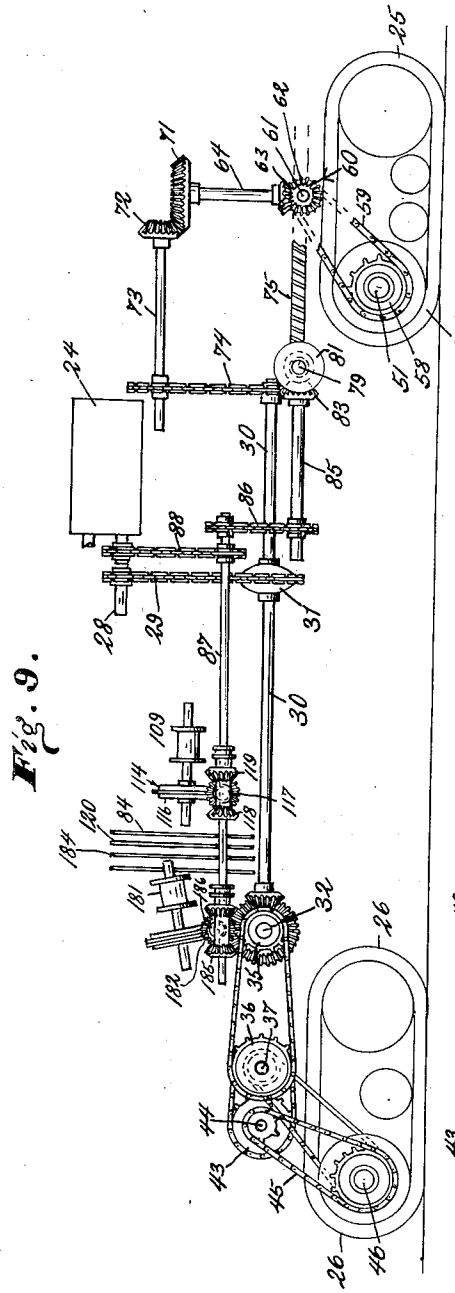


Fig. 9.

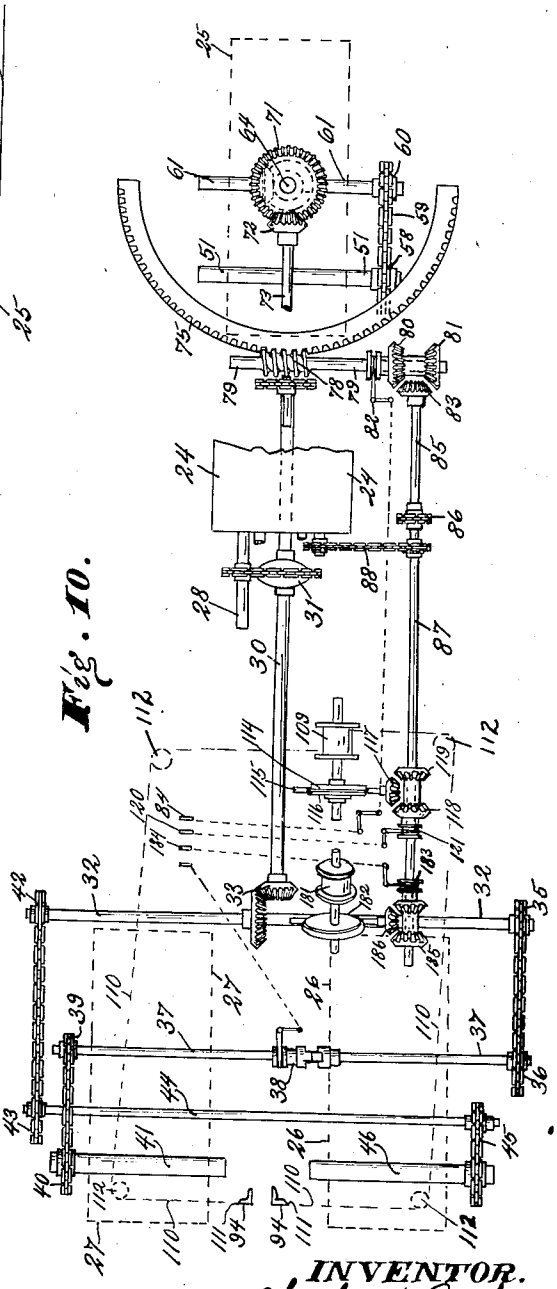


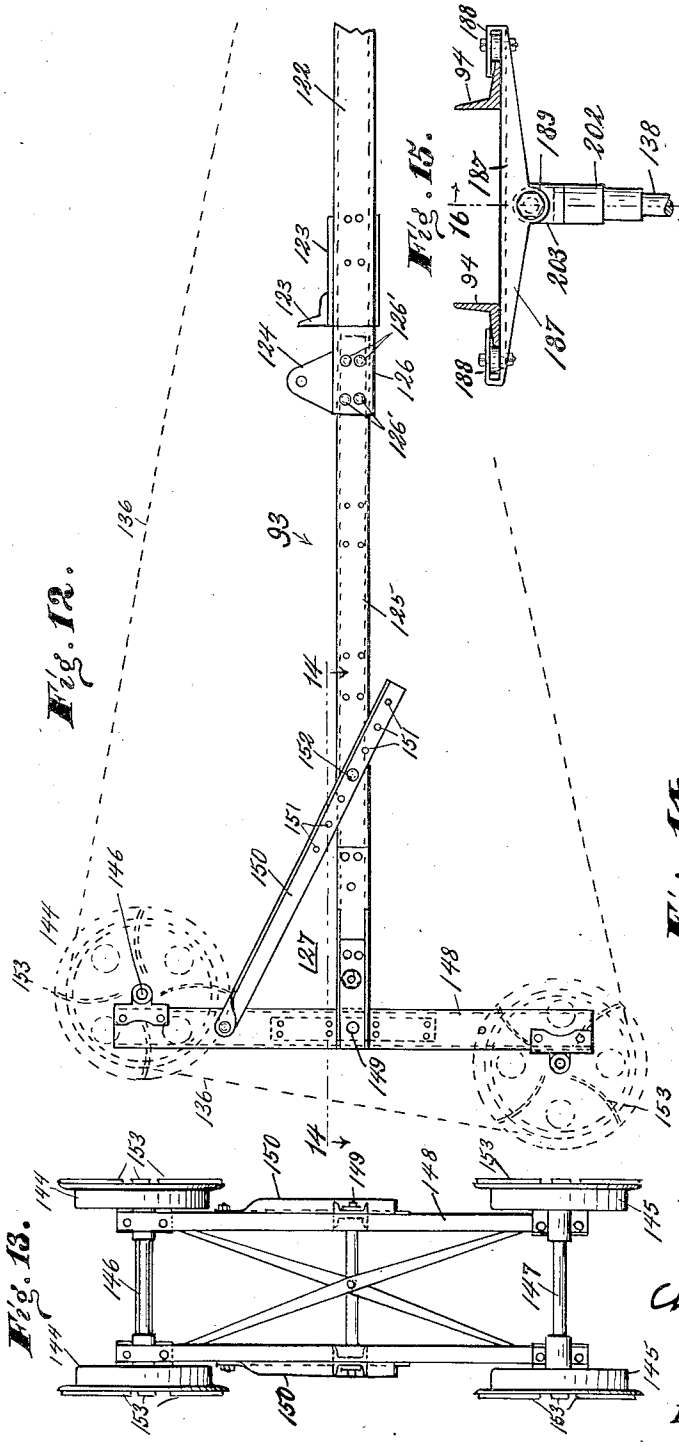
Fig. 10.

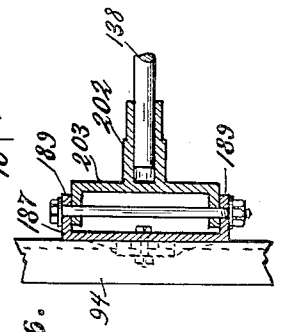
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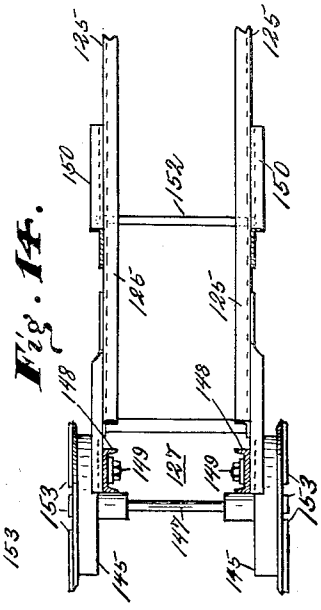
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EXCAVATOR

Filed March 15, 1926 8 Sheets-Sheet 8







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UNITED STATES PATENT OFFICE

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EXCAVATOR

Application filed March 15, 1926. Serial No. 94,809.

In such activities as in the laying of underground pipes or conduits, or in providing irrigation for farming, it is convenient to utilize an excavator or dredger for forming ditches; and such dredgers have in fact been in common use in recent years. Many of these excavators or dredgers are provided with their own means of locomotion, such as power driven crawlers, and they are arranged to move at a slow rate and simultaneously to dig the trench or ditch, the movement of the entire dredger being in the direction in which the ditch or trench is to extend. It is one of the objects of my invention to improve in general this type of apparatus.

In dredgers heretofore provided, difficulty has been experienced in adjusting the dredger to a variety of work. For example, in making ditches, sometimes it is necessary to make the walls or embankment steep, and at other times, the walls must have a more gradual slope. It is thus another object of my invention to make it possible to adjust the dredger to accommodate it to its varying requirements in a simple and expeditious manner.

Another difficulty often encountered in connection with dredgers is that the dredger, being usually somwhat unwieldy, can with difficulty only, be nicely adjusted to dig the ditch at the exact spot desired. With my invention, it is possible to set the dredger mechanism quite readily and with comparatively simple apparatus.

Another object of my invention is to provide a dredger that is simple to operate and capable of performing a wide range of functions.

My invention possesses many other advantages, and has other objects which may be made more easily apparent from a consideration of one embodiment of my invention. For this purpose I have shown a form in the drawings accompanying and forming part of the present specification. I shall now proceed to describe this form in detail, which illustrates the general principles of my invention; but it is to be understood that this detailed description is not to be taken in a limiting sense, since the scope of my invention is best defined by the appended claims.

Referring to the drawings:

Figure 1 is a side view, substantially complete, of a dredger embodying my invention;

Fig. 2 is an enlarged side view of the rear portion of the dredger, a portion of the apparatus being in section;

Fig. 3 is a rear view of the dredger, illustrating the manner in which it can be adjusted to conform with varying requirements;

Fig. 4 is an enlarged rear fragmentary view of the dredger;

Fig. 5 is an enlarged plan view of the inner end of the boom and its associated parts in position for trenching; that is, for digging a ditch with substantially vertical sides;

Fig. 6 is a plan view of the inner end of the boom in position for dredging; that is, for digging a ditch with sloping sides;

Fig. 7 is an enlarged side view of the inner end of the boom, showing the manner in which the drive for the buckets is accomplished;

Fig. 8 is a sectional view of the front crawler, taken along plane 8—8 of Fig. 1;

Figs. 9 and 10 are diagram views, in elevation and plan respectively, illustrating the mode in which power is transmitted for the various moving elements of the dredger;

Fig. 11 is an end diagrammatic view of the transmission mechanism connected with the prime mover used for the dredger;

Fig. 12 is a side elevation of the rear end of the boom, the position of the associated parts being indicated in dotted lines;

Fig. 13 is an end view of the boom;

Fig. 14 is a sectional view taken along plane 14—14 of Fig. 12;

Fig. 15 is a fragmentary view of a portion of the boom supporting structure, in position for digging ditches with sloping sides; and

Fig. 16 is a sectional view taken along plane 16—16 of Fig. 15.

The dredger comprises a body or carriage 21, shown in this instance as appropriately made from structural steel, and as provided with devices for causing it to travel along the ground. The prime mover for supplying the power for this purpose, and for all other power moved elements is shown in this

instance as a conventional gasoline engine 22 (Fig. 1) located near the front of the mechanism on a framework 23 above the body 21. This engine drives a transmission mechanism 24 located for convenience adjacent the rear of the engine 22.

In the present instance, a plurality of crawlers 25, 26, and 27 (Figs. 1, 9 and 10) is used to move the excavator along the ground; crawlers 25 is located in front, while the other two are at the rear. Since the crawler can be of any well-known form of construction, details thereof will not be minutely described, but only in so far as essential to an understanding of the present invention. The mode in which power is supplied to the crawlers will not be set forth.

Referring more particularly to Figs. 1, 2, 9, 10, and 11, the transmission 24 has a shaft 28, which drives as by a sprocket chain 29, a longitudinally supported shaft 30, located beneath frame 21. This drive is accomplished through a conventional differential gear mechanism 31, which mechanically connects the rearwardly extending portion of the shaft 30 (transmitting power to the rear crawlers 26 and 27), and the forwardly extending portion (transmitting power to the front crawler 25). Adjacent the rear of the frame 21, there is a transverse shaft 32, which is driven as by the aid of bevel gearing 33, from shaft 30. The shaft 32 carries at one end, a sprocket wheel 35, which is connected by a chain to wheel 36 mounted on shafting 37. At the other end, shafting 37 carries sprocket wheel 39, which is mechanically connected to wheel 40 on main drive shaft 41 of crawler 27. A manually controlled clutch 38 can be provided, to control the drive between shafting 37 and wheel 39.

A similar arrangement is provided for the other rear crawler 26. This drive includes a sprocket wheel 42 connected to shaft 32, and driving sprocket 43 on a transverse shaft 44, which in turn is connected by sprocket mechanism 45, with the main drive shaft 46 of crawler 26.

It is possible to adjust the width of tread between the rear crawlers 26 and 27, by spacing them apart the proper distance. This is sometimes necessary in order that the dredger may properly straddle such obstructions as ditches or mounds or ridges. The adjustment is facilitated by the manner in which the rear crawlers support the rear of frame 21. Each of these crawlers carries, at its upper side, a series of V shaped seats 47, (Figs. 1, 2 and 4), in which a pair of transverse pipes 48 is accommodated. Clamps 49 serve to clamp the pipes 48 to the crawlers. Additional end clamps 34 (Fig. 4) have their upper portions fastened to the bottom of frame 21 and are arranged at each side of the frame for holding the pipes 48 thereto. The crawlers 26 and 27 can be moved close together or further apart along pipes 48 or their extensions, such as 50, which telescope in pipes 48. In this way, an extended tread can readily be obtained. In order to take care of this extension, the transverse shaftings such as 32, 37 and 44, for driving the rear crawlers 26 and 27, and shown diagrammatically in Fig. 10, can be made telescopic.

Since, in order to steer the dredger, the front crawler 25 must be capable of being turned from parallelism with the center line of frame 21, or "angled," it is obvious that a special drive to permit this, must be provided. This crawler has a main drive shaft 51 (Figs. 1 and 8) which extends in this instance completely through the framework 52. This framework provides a hollow interior space 53 (Fig. 8) within which the various front crawler parts are accommodated. Thus the cog wheel 53′ engaging the linked tread 54 is mounted on shaft 51; a smaller cog wheel 55 serves as a guiding idler for the tread, and is journaled on shaft 56 on framework 52. Further guides may if desired be provided, and can be mounted on other shafts such as 57.

Main drive shaft 51 has attached to it a sprocket wheel 58, driven by chain 59, passing over a driving sprocket wheel 60. This wheel is fastened to a transverse shaft 61 mounted in the crawler framework, and rigidly carries a bevel gear 62. This gear is in mesh with a gear 63 mounted on the end of a vertically alined shaft 64. This shaft is supported in a bearing 69, fastened on a framing 65, which extends across a ring 66 fastened to the crawler by the aid of the channels 67, and stiffened by the struts 68. The purpose of ring 66 will be hereinafter described. The bearing 69 is also arranged with a step bearing portion 70 upon which the lower surface of frame 21 can rest, while yet permitting the angling movement of crawler 25 for steering. The shaft 64 is appropriately driven from transmission 24, as by the aid of the bevel gear 71 (Figs. 9 and 10), which is fastened to shaft 64; and the bevel pinion 72 on a countershaft 73. This shaft has a sprocket chain drive 74 from the front end of the power shafting 30.

In order to rotate the crawler 25 about the vertical shaft 64 for steering, use is made of a segmental worm gear 75 fastened in this instance to the lower flange of the horizontal ring 66. The upper flange 76 is used as a guide for keeping the crawler 25 in proper alinement as it is moved about the vertical axis. For this purpose, a series of pulleys 77 on stationary axes is provided, and supported on frame 21, which pulleys engage the flange 76. The worm wheel segment 75 is arranged to be driven by a worm 78 (Fig. 10) fastened to a transverse shaft 79. This shaft has splined to it, a pair of opposed bevels 80 and 81, which are arranged to be moved

axially by a fork 82, in a well-known manner, so that either one or the other bevels, or neither, may be placed in mesh with constantly driven pinion 83. It is evident that the segment 75, and consequently the entire crawler 25, will be rotated relatively to the frame 21, in either direction, depending upon which bevel gear 80 or 81 is in mesh with the pinion 83. When no movement is desired, fork 82 remains in the neutral position shown, in which pinion 83 is out of engagement with each of the bevels 80 and 81.

The control of fork 83 is indicated merely diagrammatically, since the manner in which this can be accomplished is well-known. A hand lever 84 is accordingly indicated as in mechanical connection with fork 82.

The motion of pinion 83 is provided from a shaft 85, which is driven by chain 86, from a shaft 87, in turn driven by sprocket chain 88 from transmission 24.

The mechanism for moving the dredger and for steering it has been described. There remains to be detailed the bucket elevator system, which performs the operation of digging as the dredger is moved forward on its crawlers 25, 26, and 27. For this purpose, an elevator supporting structure 89 (Figs. 1, 2, 3) is provided, which is located adjacent the rear of the dredger. As shown most clearly in Fig. 2, the dredger carries a pair of transverse rails 90 and 91, shown in this instance as I beams, on which the structure 89 is transversely movable. This transverse adjustment makes it possible to adjust the position of the elevator mechanism relative to frame 21, and forms an important feature of my invention. The framework 89 will now be described, and especially as regards the mechanism whereby this transverse movement is obtained and the manner in which it supports the boom 93 carrying the train of buckets 92, driven from engine 22 by appropriate mechanism.

The framework 89 includes a pair of spaced upright angles 94, which are shown in Figs. 5 and 6 as serving the purpose of guides for a boom supporting device, to be later described. These uprights are approximately fastened at their bottoms to a transverse structural iron element 95 (Fig. 4), from which depend a series of brackets 96 and 97, carrying pulley or rollers 98. These engage between the horizontal webs of the rear I beam rail 90 and thus keep the framework 89 alined, and provide for a smooth transverse movement thereof. In order to lend further stability to the framework, another angle iron 99 is spaced forwardly from the angle 95, as by the aid of the pipe or rod 100 serving as a brace between the two angles. Similarly, brackets 101 and 102, with rollers 103, are provided on angle 99 to engage the flanges of the front I rail 91. In order to brace the angle irons 94 adjacent the top thereof, a series of transverse angle irons such as 104 and 105 can be provided. Furthermore, a pair of struts 105′ in the form of angle irons extend from the two ends of the transverse angle iron 99 up to the top of the angles 94.

Extending through the space formed between the angle irons 94 and near the top thereof, is a beam 106 formed of a pair of channel irons and providing a space between said channel irons of sufficient width to accommodate a series of pulleys forming a part of the system for moving the boom 93 to its various positions. The transverse angle iron 104 serves as a seat for this longitudinally extending beam. At the forward end of the beam and externally thereof, there are a pair of angles 106″ which serve as anchors for the system of braces 107 and 108; the braces 107 extend between angles 106 and the bottom of braces 105′; and braces 108 extend between these angles and the tops of angle irons 94. Further angle braces 104′ (Fig. 3) can if desired be provided at the rear of the structure, between angles 104 and rear horizontal angle 95, as well as between angles 104 and the top of angles 94.

It is evident that by the provision of these braces, a rigid framework is provided by the aid of which the boom 93 can be adequately supported.

In order to move the framework 89 transversely of the framework 2, use is made of a power driven drum 109 (Figs. 2, 9 and 10). This drum has an endless rope or cable 110 wound upon it, which is fastened as at 111 to the transverse angle iron 95 between the upright angles 94. To guide this cable, a series of pulleys 112 are arranged on the inner faces of the beams forming the sides of the frame 21, as shown most clearly in Fig. 10, and as indicated (in a diagrammatic manner only) in Fig. 2. It is evident that when the drum 109 is rotated in one direction, the cable 110 will pull the framework 89 in a definite direction, and when the rotation of drum 109 is reversed, the framework 89 will be moved in the opposite direction. This drum is driven by the aid of a worm wheel 114 which is arranged to be driven by a worm connected to a short shaft 115. The worm and wheel is encased in a casing 116 shown in Fig. 2. The shaft 115 carries a bevel gear 117 which is arranged to be engaged by either of two opposite disposed bevel gears 118 and 119 splined on the shaft 87, which has been described heretofore as being driven from the transmission mechanism 24. A hand lever 120 manually controls a fork 121 which moves the connected bevel gears 118 and 119 axially in either direction, whereby the drive to the wheel 114 can be accomplished in either direction, or alternatively the gears may be left disconnected as illustrated in Fig. 10. In this position, the drum 109 is of course stationary, and the frame 89 is also stationary.

The boom 93 upon which the excavating mechanism proper is supported, is illustrated to best advantage in Figs. 2, 3, 5, 7, 12, 13, and 14. In general, it supports a series of sprocket wheels as well as a pair of sprocket chains 136, between which the buckets 92 are supported. These buckets are guided by the aid of idler pulleys in a path that permits them to scrape and excavate the ground adjacent the boom. This action is illustrated to best advantage in Fig. 3. There is also illustrated, in this figure, the three main positions of the boom 93, obtained by proper adjustment, whereby the buckets 92 can be located to either side of the frame 21, in order to excavate on the left hand side thereof (as shown in the full line position), or on the right hand side thereof (as shown in the dotted line position); or else centrally of the frame 21, as indicated at 121'. This adjustment of the boom is affected readily with the aid of my invention; but before describing this in detail, the structure of the boom itself will be here outlined.

The boom 93 includes a pair of spaced channel beams 122 (Figs. 5 and 12) connected by transverse angle irons and plates 123 at several places along its length. These beams 122 extend substantially to a point where clevises 124 are anchored to the boom. Extending between the angle irons 123 which are placed one near each end of beams 122, are a pair of auxiliary channel beams 126. These extend slightly beyond the channel beams 122 as shown most clearly in Fig. 12, and provide an adjustable connection between head portion 127, extending rearwardly of frame 21, and the rest of the boom; this is effected by telescoping the channel beams 125, forming the main support for the head portion, into the beams 126. The telescoping sections can be held together as by bolts 126', for which a number of sets of apertures are provided in channels 125. In this way, the length of the boom can be varied to take care of varying conditions of work simply by unloosening a series of bolts. This extension mechanism is shown most clearly in Fig. 12, where it is seen that by removing bolts 126' and moving the boom head 127 in one or the other direction, the bolts 126' can be reapplied in another set of apertures to fasten the boom parts together in the new setting. This is a highly important feature of the invention, for thereby the boom can be extended outwardly to any desired distance within limits, and it can take care of the dredging or digging of ditches or trenches that would otherwise be inaccessible without repositioning the dredger mechanism entirely, which repositioning is always troublesome and time consuming.

At the forward end of the boom 93 there are offset channel beams 128 (Fig. 5) which serve to support various shaft bearings for the conveyor chains 136 to which the buckets 92 are connected. Thus, for example, a transverse shaft 129 is appropriately supported in bearings 130 and 131 fastened to the tops of the channel beams 122 and 128. This shaft has fastened to it a pair of driving pinions 132 (Figs. 5 and 7) located partly in the space formed between the two channel irons 122 and 128 and meshing with the gears 134. These gears are fastened on short shafts 135 journaled underneath the channel irons and carrying at their inner ends a pair of driving sprocket wheels 133 over which the sprocket chains 136 are led. It is evident that by appropriate driving of shaft 129, the sprocket chains 136 can be moved and therefore the buckets 92 in a closed loop path.

In order to guide the sprocket chains 136, a pair of guide pulleys 137 are fastened on a transverse shaft 138, journaled in slidable bearings 139 which can be adjusted to take up the slack in the chains, as by the aid of the bolts 140. These bearings 139 are mounted for sliding movement on the bottom flanges of the channel irons 122 and 128, in guide 139'.

It should be noted that the axis of the guide pulleys 137 is so located relatively to the shaft 135 on which the driving sprockets are fastened, that the sprocket chains between wheels 135 and 137 take a downward dip. This is essential to cause the buckets 92 to empty at this point onto any convenient conveyor system provided for carrying off the excavated material. In order to guide the buckets 92 to dipping position as they pass from wheels 135 to wheels 137, a bar 210 is fastened at one end to the angle 123, and has a curved portion 211 which operates on the rear edges of the buckets. A bearing 212 (Fig. 5) on shaft 129 serves as another point of support for this bar.

The sprocket chains 136, after passing around pulleys 137 are guided along a pair of idler pulleys 141, supported on a shaft 142 journaled in the bearings 143 fastened appropriately to the top of the channel beams 122.

The lower reach of the chains 136 extends around pulleys 144 and 145, which are mounted on shafts 146 and 147, journaled one on each side of a frame 148. This frame is arranged to be swung on a pivot 149 located adjacent the free end of the boom 93. In this way, it is possible to vary the slope of the cut. For example, as shown in Fig. 3, the left hand ditch is being excavated by the buckets with the framework 148 substantially perpendicular with the boom 93, with the result that walls for the ditch of about 45 degrees slope are formed. In the alternate dotted line position at the right of Fig. 3, the frame 148 has been swung far from the perpendicular position, with the result that the bottom of the ditch is broadened, being nearly horizontal; and the slope of the inner walls is

less. Other adjustments obviously give intermediate results. This adjustment feature is of considerable importance, for by its aid, it is possible to vary the dimensions and form of the ditch that is being excavated by the dredger.

The mechanism whereby the framework 148 may be adjusted and held in any position, includes a pair of beams 150, one on each side of the frame 148. These beams are pivoted on the framework 148 and each of them has a series of apertures 151 arranged to cooperate with apertures in the telescoping section 125 of the boom 93. A bolt 152 or other fastening means can be passed through one of the series 151 and the boom section 125 to hold the parts in adjusted position.

In order to facilitate the work of excavation, each of the pulleys 144 and 145 have a series of cutters or blades 153 which operate against the ends of the ditch or the sides of the trench being excavated when the entire dredger moves forward. This is illustrated most clearly in the central portion 121′ of Fig. 3 for the trenching position.

The details of the boom structure have now been completed. There remains to be described the mechanism whereby the inner end of the boom can be adjusted both horizontally and vertically, as well as the means for imparting motion to the shaft 129 to move the buckets.

Adjacent the inner end of the boom 93, a pair of spaced clevises 154 is provided, to which is pivotally fastened a bail 155. This bail has a central sheave 156 (Figs. 2 and 3). This sheave 156 serves to guide a rope or cable 157 which is used for adjusting the inner end of boom 93 vertically. For this purpose, one end of the rope 157 is fastened to a small bail 158 pivoted on the shaft for the pulley 156, and this rope then passes over a pulley 159 located on a stationary axis within the beam 106. The rope 157 then passes around pulley 156 and then again around another pulley 160 in boom 106 and spaced forwardly from the other pulley 159. The rope 157 then passes thru a part of the beam 106 and over a pulley 161 which is adjacent the upright angles 94. Thence, the rope 157 passes on to a drum 162 which is supported in appropriate bearings on the angle irons 94, and which is arranged to be driven by a worm and wheel mechanism 163. This mechanism can be rotated by the aid of a hand lever 164 in any appropriate manner as by the aid of the bevel gearing 165. It is evident that by the worm and wheel construction, the inner end of the boom can be raised and lowered to any extent, and left in any adjusted position by simply turning the hand lever 164 the required amount.

Provisions are made not only to move the inner end of the boom 93 vertically as has just been described, but also to swing it so that it occupies either one of the three positions shown in Fig. 3. For this purpose, a crane structure 166 is provided which is shown in greatest detail in Fig. 2. This includes a horizontally extending strut 167, the length of which can be adjusted by a turnbuckle 168. One end of the strut 167 is pivoted between the angle irons 105 and 169, connecting the upper ends of angles 94. Its other end carries a small bail 170 to which is attached one end of a rope or cable 171. This cable then passes around a pulley 172 provided with a hook 173 and thence around another pulley 174 pivoted on the end of the strut 167. The hook 173 engages a large bail 175 connected to the clevises 124 of the boom 93. It is evident that by proper manipulation of the rope or cable 171, the inclination of the boom can be varied; while by swinging the strut 167 about its horizontal pivot, the vertical position of the boom can also be adjusted. In order to stiffen the crane structure 166, a further strut bar 176 is provided which is fastened at one end near the free extremity of the strut 167, and its other extremity is horizontally pivoted near the lower angle iron 105.

It is evident that the boom 93 can be swung to either side of the dredger, or it can be placed in parallelism with the main axis of the dredger for the trenching position. The axis of this swing must be that of the center line of bail 155, which passes through the center of pulley 156, whereby the pulley arrangement for raising and lowering the inner end of the boom is operative for any position. This can be accomplished even if the crane structure 166 is pivoted slightly to the front of the bail 155, for this merely necessitates an extent of rotation less than 180° on the part of structure 166 to effect a complete semi-circular movement of the boom 93 in a horizontal plane.

The manner in which the bail 175 connected to the center portion of the beam 93 can be raised or lowered will now be described. As has been stated heretofore, rope 171 passes first around pulley 172 which has a hook 173 engaging the bale 175, which rope then continues over the idler pulley 174 located at the extremity of the strut 167, thence over an idler pulley 178. This pulley is supported at the mouth of a swinging tube 178′, pivoted in angles 105 and 169; this tube is fastened to the struts 167 and 176, whereby it is rotated as the crane structure 166 is rotated; in other words, tube 178′ acts as a hollow pivot pin, supporting the struts. Due to this structure, idler 178 is always maintained in proper position to guide rope 171, for all positions of structure 166. The rope 171 passes downwardly axially of the tube 178′ and over an idler pulley 179 located in the beam 106. Thence, it extends horizontally through beam 106 and over a pulley structure 180 lo-

cated at the forward end of the beam 106, and then is wound on an inclined drum 181. This drum is arranged to be driven by the aid of a worm and wheel mechanism 182 (Fig. 10) entirely similar to the mechanism used for rotating dum 109. A similar fork shifting arrangement 183 is provided, operable by hand lever 184, for causing a pair of connected bevel gears 185 (which are splined on shaft 87) to operate a bevel pinion 186 which drives the drum mechanism. It is evident that the lever 184 can be operated to cause the drum 181 to turn in either direction, whereby either to raise or lower the central portion of boom 93.

Figs. 1, 2, and 5 illustrate the manner in which the boom 93 is guided for vertical movement, while in trenching position, and held in proper spaced relation with respect to the dredger carriage 21. For this purpose the flanges of angle irons 94 are utilized, on which is adjustably supported a slide 187 which is clamped in any desired vertical position on the angle irons 94, by the aid of the clamping bars 188. This slide 187 has a pair of ears 189 in which a support for the boom 93 can be attached. In Fig. 5, the boom 93 being in the trenching position, use is made of a supporting yoke 190 which is fastened to the slide 187, and which encompasses, at its free extremities, the shaft 138. This yoke 190 is made in parts joined together as illustrated in 191, in order to facilitate its assembly on the boom structure as needed for the trenching position. A transverse shaft 192 extends across the yoke and is supported thereby, which serves as one element in the transmission of motion to the driving pinions 132, on shaft 129. For this purpose there is a sprocket chain connection 193 between shafts 192 and 129, shown at the left hand side in Fig. 5. At the right hand extremity of shaft 192 a bevel gear drive 194 is provided which permits a driving shaft 195 to rotate the shaft 192, and thereby through the mechanism described to move the buckets 92. This shaft 195 is connected as shown most clearly in Figs. 1 and 2 by universal joint 196 to a long transmission shaft 197. This shaft in turn is splined to a sleeve 198, connecting, by universal joint 199, with a shaft 200 driven by the transmission mechanism 24. The direction of motion of shaft 200 is such that the lower reach of the bucket chain 136 goes upwardly as indicated by the arrows 201 on Fig. 2. This is the proper drive for trenching position when the dredger is moving forward.

Of course, the vertical adjustment of the boom can be varied by the mechanism described in order to vary the depth of the trench which is being dug.

In the ditch digging positions illustrated at the right and left of Fig. 3, it is necessary to swing the crane mechanism 166 in one or the other directions so as to make the boom 93 project at right angles to the axis of the dredger. This can be readily effected by hand. Of course, under such circumstances, the yoke 190 is removed from the support 187, as well as the driving chain 193. The boom takes the position illustrated in Fig. 6. In this position, the drive shaft 129 on which the driving pinions 132 are located is arranged to be directly driven through the universal joint 196 from the shaft 197. The inner end of shaft 138 is supported from the support 187 by the aid of a bearing 202 (Fig. 16) located on a fork 203. This fork is pivoted, by the aid of ears 189 to the support 187. It is evident that in this position the shaft 129 when viewed from the rear, as in Fig. 3, must have a counterclockwise rotation, in order that the buckets 92 travel upwardly on the inner slope of the ditch. Now, if the boom 93 be swung to the right of the dredger, the other extremity of shaft 129 is utilized for the drive. Under such circumstances, the drive must be in a clockwise direction, in order to cause the buckets to move in the proper direction. For this purpose, there are two shafts 200 and 204 reversely driven by transmission 24. In order, therefore, to maintain the direction of bucket movement correct as the boom is changed from one position to the other, it is necessary to move the joint 199 from one of the shafts 200 and 204, to the other.

The dredger mechanism has now been described. It is a simple matter to adjust the height and position of boom 93 to vary the character of the cut, as well as the position of the crawlers 26 and 27 to take care of the traction for the mechanism. The hand levers 84, 120 and 184 make it possible to steer the tractor by power, and to operate the boom raising mechanism and the transverse motion of the frame 89. Since the front portion of the dredger is supported by a power driven crawler, much better traction is obtained than with the ordinary arrangement. Due to the manner in which power is lead to this front crawler it is feasible to steer by angling this crawler with respect to the dredger frame 21.

I claim:

1. In an excavating mechanism, a boom, a frame pivoted at an intermediate point thereof, and adjacent one end of the boom, an endless bucket carrier system supported by said boom and frame, and means for adjusting the frame angularly about its pivot.

2. In an excavating mechanism, a boom, a frame pivoted at an intermediate point thereof, and adjacent one end of the boom, guide pulleys supported on said frame and boom, the pulleys having axes parallel to that of the pivot for the frame, an endless bucket carrier system supported by said pulleys, and means for adjusting the frame angularly about its pivot.

3. In an excavating mechanism, means forming a vehicular support, an endless

bucket carrier system having a driving shaft, a boom for supporting said system and capable of swinging about a vertical axis, so as to extend to either side of parallel with the main axis of the vehicular support, means for supporting said boom, and an adjustable drive for the carrier system for imparting motion to it in any of the boom positions, comprising a power shaft arranged to be coupled to either end of said drive shaft.

4. In an excavating mechanism, means forming a vehicular support, an endless bucket carrier system having a driving shaft, a frame supported on the vehicular support, a boom adjustably carried by said frame, upon which boom the carrier system is mounted, and means for driving said system in any of its adjusted positions, comprising a power shaft, and means for coupling said shaft directly to either end of the driving shaft.

5. In an excavating mechanism, an endless bucket carrier system, means forming a vehicular support therefor, means whereby said system can be swung to either side of the support so as to extend substantially at right angles thereto, a driving mechanism having a pair of reversely driven shafts, and shafting between the system and one of the shafts, said shafting being adjustable so that it can be connected to either of said reversely driven shafts.

6. In an excavating mechanism, means forming a vehicular support, an upright frame supported thereby, a boom, an endless bucket carrier system carried by the boom, said carrier system including a shaft and guide pulleys thereon adjacent the inner end of the boom, means supported on the frame, whereby the inner end of the boom can be swung about a vertical axis, and a support for the boom when it is at either of its extreme positions, comprising a bearing slidably mounted on the frame for vertical movement, and accommodating either end of said shaft.

7. In an excavating mechanism, an upright frame, a swinging jib, a boom supported at its intermediate point by said jib, and adjacent its inner end on said frame, hoisting means including flexible cables for raising the boom at either of said points, and a hollow beam extending horizontally of the frame, a portion of said hoisting means being passed through at least a portion of said beam.

8. In an excavating mechanism, an upright frame, a hollow beam extending horizontally of the frame, and serving to stiffen said frame, a boom adjustably mounted on said frame, and hoisting mechanism at least partly housed in said beam for adjusting the boom.

9. In an excavating mechanism, a boom having a series of guide pulleys, an endless bucket carrier system passing over the pulleys, a shaft supporting some of the pulleys and extending beyond the boom and transversely thereof, a frame for supporting the inner end of the boom adjacent the shaft, and a guide adjustably supported on the frame for accommodating either end of said shaft.

In testimony whereof I have hereunto set my hand.

CHARLES H. RUTH.