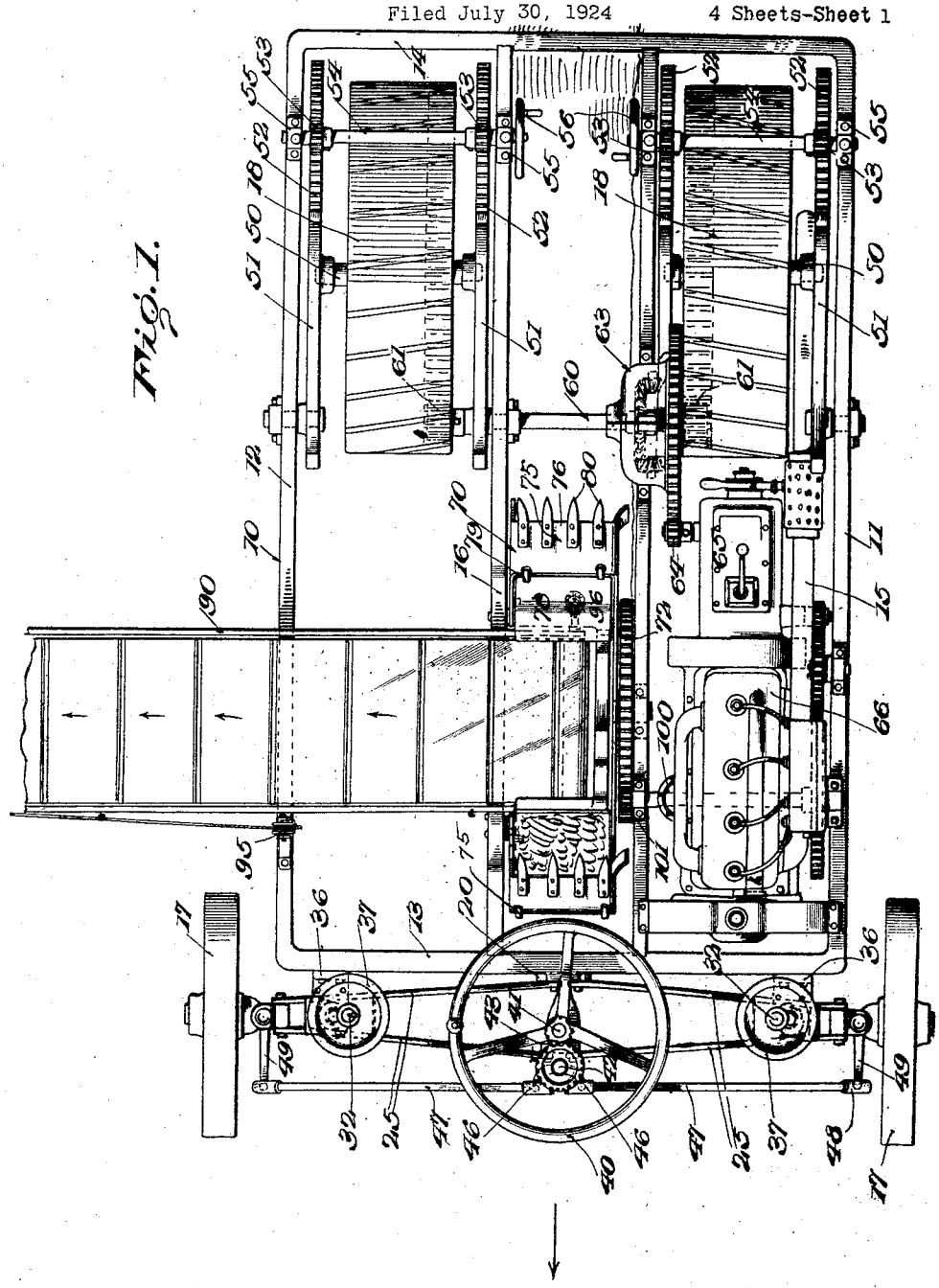
April 20, 1926. 1,581,318

J. O. LIUM

EXCAVATING MACHINERY

Filed July 30, 1924 4 Sheets-Sheet 1

Fig. 1.



WITNESSES

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EXCAVATING MACHINERY

Filed July 30, 1924 4 Sheets-Sheet 2

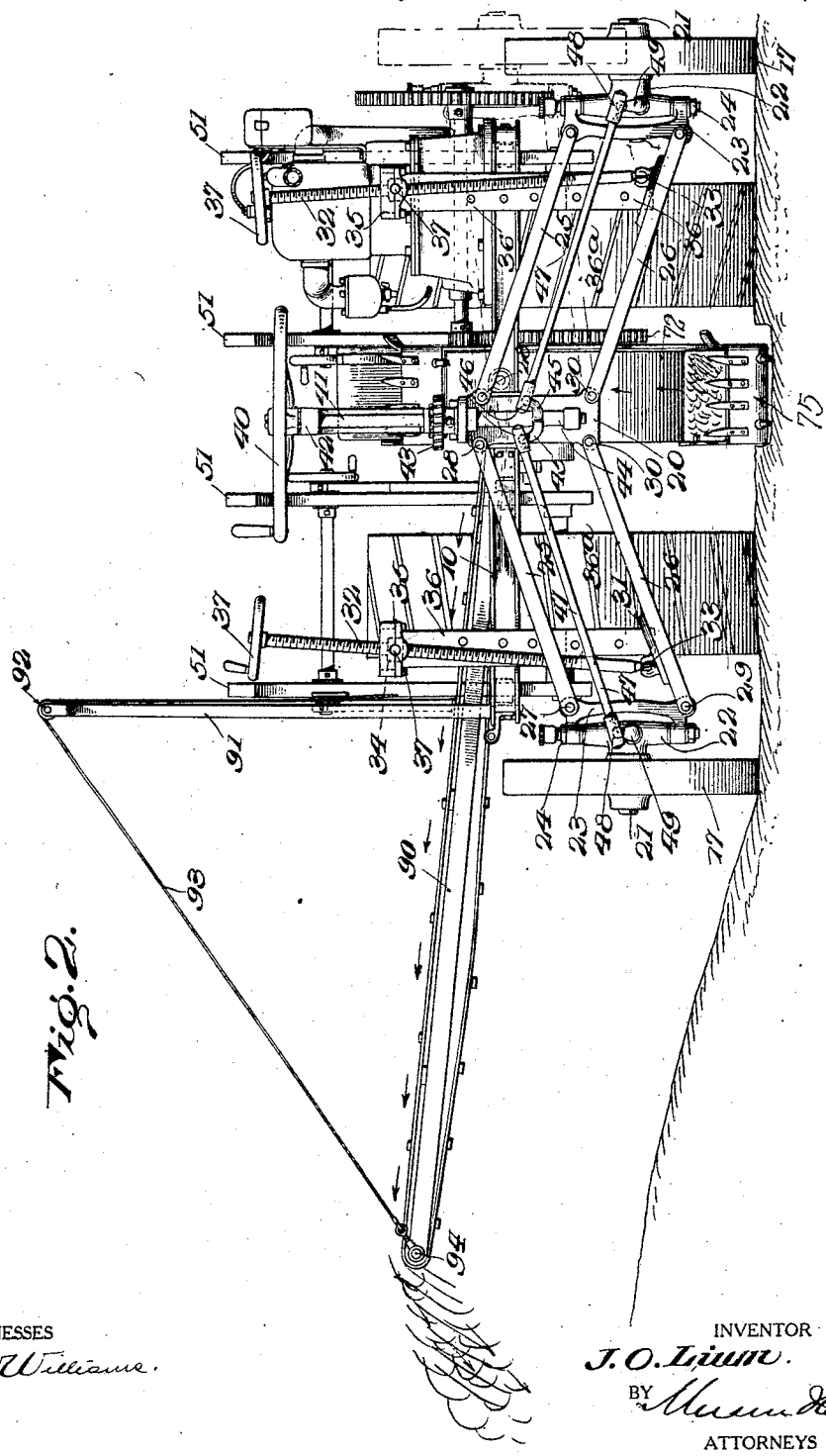


Fig. 2.

WITNESSES

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EXCAVATING MACHINERY

Filed July 30, 1924 4 Sheets-Sheet 3

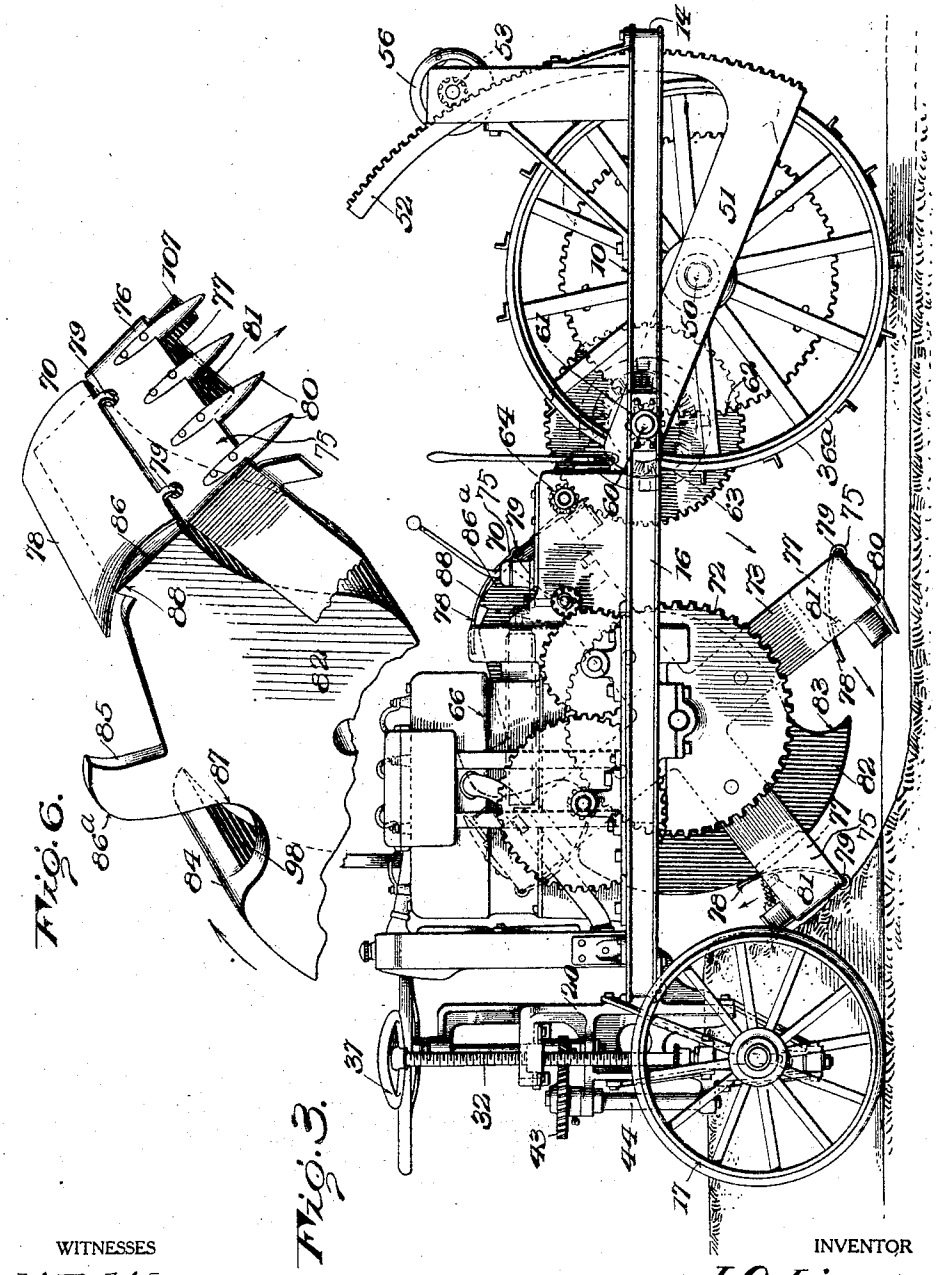


Fig. 6.

Fig. 3.

WITNESSES

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INVENTOR

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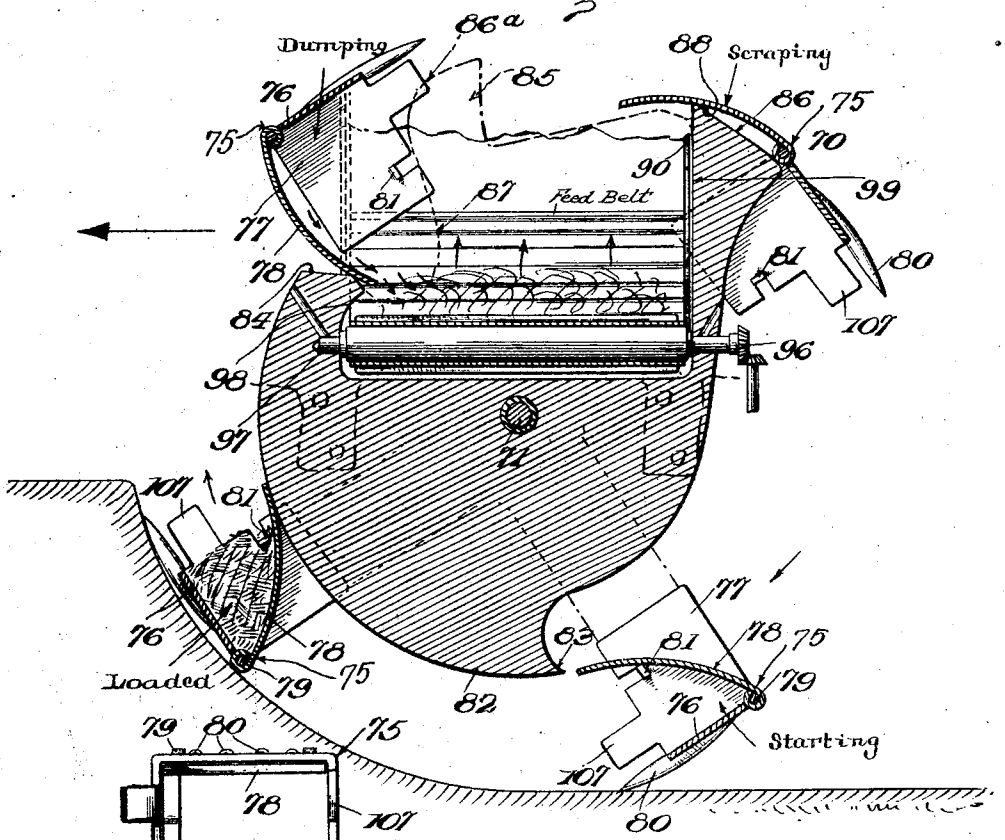
April 20, 1926. 1,581,318

J. O. LIUM

EXCAVATING MACHINERY

Filed July 30, 1924 4 Sheets-Sheet 4

Fig. 4.



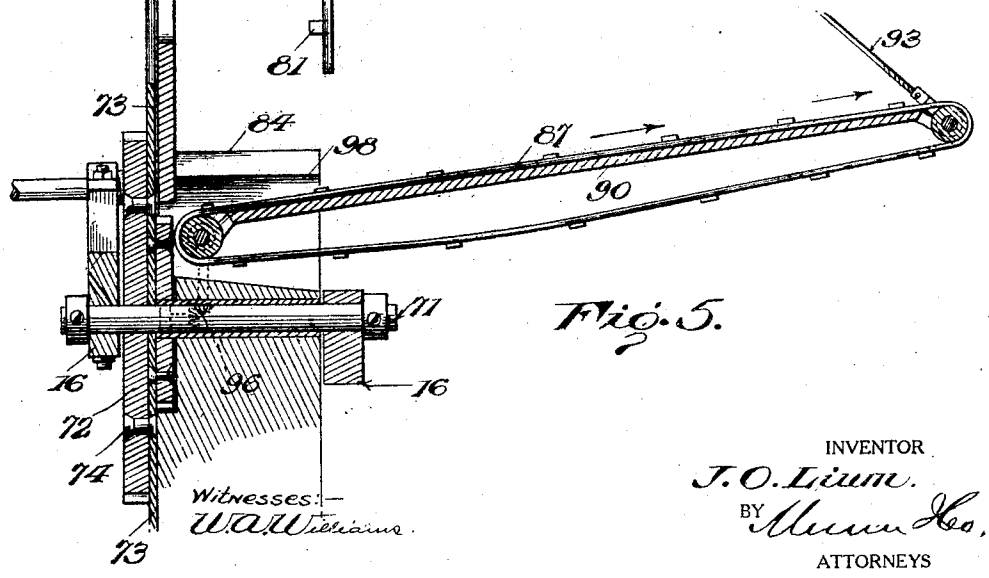


Fig. 5.

Witnesses:—
W. A. Williams.

INVENTOR
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ATTORNEYS

Patented Apr. 20, 1926. 1,581,318

UNITED STATES PATENT OFFICE.

JULIUS O. LIUM, OF CHRISTINE, NORTH DAKOTA.

EXCAVATING MACHINERY.

Application filed July 30, 1924. Serial No. 729,149.

To all whom it may concern:

Be it known that I, JULIUS O. LIUM, a citizen of the United States, and a resident of Christine, in the county of Richland and State of North Dakota, have invented certain new and useful Improvements in Excavating Machinery, of which the following is a specification.

This invention relates in general to excavating machinery, and more especially to a machine designed for the purpose of digging ditches in road work or for general purposes.

The object of the invention is to provide a machine of this character which is more efficient and practical than machines heretofore used, especially in that a great deal more material is excavated in proportion to the linear movement of the machine generally than has been proposed heretofore, this being largely due to the fact that a greater depth and width of cut is had with the present invention.

Other objects and advantages of the invention reside in certain novel features of the construction, combination and arrangement of parts which will be hereinafter more fully described and particularly pointed out in the appended claims, reference being had to the accompanying drawings forming part of this specification, and in which:

Figure 1 is plan view of a machine embodying the invention;

Figure 2 is a view thereof in front elevation;

Figure 3 is a view of the machine in side elevation;

Figure 4 is a detail view, partly in vertical section and partly in elevation, showing the excavating mechanism;

Figure 5 is a fragmentary view in vertical section, taken at right angles to Figure 4; and

Figure 6 is a fragmentary perspective view of the upper portion of the excavating mechanism.

Referring to the drawings, the numeral 10 designates generally a horizontally disposed main frame which as shown to advantage in Figure 1 includes side bars 11 and 12, end bars 13 and 14 and longitudinal bars 15 and 16, the side bars being connected to the end bars and the longitudinal bars also being connected to the end bars. The frame 10 is supported in a horizontal position by a pair of front wheels 17 and a pair of rear wheels 18, the front wheels 17 being the steering wheels and the rear wheels 18 being the drive or traction wheels, as will presently appear. The front wheels 17 are connected with the frame 10 in such manner as to be vertically adjustable, and for this purpose a bracket 20 is secured to the forward end bar 13 at its center, and this bracket 20 preferably takes the form of a short section of an I-beam. The steering wheels 17 are supported from the bracket 20 and from the frame by identical means so that a single description will apply to both wheels. Each wheel 17 is rotatably mounted on a stub axle 21 carried by a steering spindle sleeve 22. The sleeve 22 is mounted for rotary movement about a vertical axis on a yoke 23 by means of the usual spindle bolt 24. The yoke 22 is mounted for adjustment in a vertical plane, and for this purpose an upper pair of links 25 and a lower pair of links 26 are provided. The links 25 and 26 are parallel, and are of the same length as shown in the drawing. One end of each link 25 is pivotally connected, as at 27, to the upper portion of the yoke 23, and the other end of each link 25 is pivotally connected, as at 28, to the upper portion of the bracket 20. Similarly, one end of each link 26 is pivotally connected, as at 29 to the lower end of the yoke 23 and the opposite end of each link 26 is pivotally connected, as at 30, to the lower end of the bracket 20. It is to be understood that each pair of links 25 and also each pair of links 26 functions as a single link except in so far as the use of a pair of links strengthens the assembly and precludes fore and aft tilting of the yoke 23 which the links control.

To each pair of links 26 adjacent the point of their connection to the yoke 23 a plate 31 is secured, the plates 31 spanning the space between the members of the pairs of links 26. An adjusting screw 32 is associated with each pair of links 26, the lower end of each adjusting screw 32 being connected with the plate 31, as indicated at 33. The connection 33 may be a ball and socket joint or may be an ordinary pivotal connection. Each adjusting screw 32 is operatively fitted in a nut 34 swingably mounted in the upper forwardly offset end 35 of a bearing bar 36 by means of trunnions 37. The bearing bars 36 are secured to the forward end bar 13 of the frame 10 and project above and below said bar 13. The portion of each bar 36 which projects below the frame is desig-

nated at 36ª and affords an abutment for the links 25 and 26 in all of their adjustments. At the upper end of each adjusting screw 32 a hand wheel 37 is fixed to facilitate turning of the screw. It will be understood from the foregoing that by turning the hand wheels 37 the steering wheels 17 may be adjusted independently of each other in vertical planes. This adjustment of the steering wheels and a similar adjustment of the traction wheel, later to be described, enables the main frame 10 to be maintained in a horizontal plane even though operating on a hillside or even though the wheels on one side of the machine run in the ditch that has been dug by the machine.

The steering of the wheels 17 is effected by means of a hand wheel 40 fixed to the upper end of a shaft 41 rotatably mounted in bearings 42 provided therefor. The shaft 41 is geared, as at 43, to a second shaft 44 having crank arms 45 connected by universal joints 46 to drag links 47, the drag links 47 having universal connection indicated at 48 to steering arms 49 provided on the spindle sleeves 22.

Identical means is provided for mounting each traction wheel 18 for adjustment in a vertical plane and for driving each traction wheel 18 in any adjustment, and a single description will apply to both wheels 18. Each wheel 18 is rotatably mounted by means of an axle 50 on a pair of swinging arms 51, the arms 51 being mounted for swinging movement on the frame 10 and the axes of swing of all of the arms 51 being alined. Each arm 51 carries an arcuate rack bar 52 and the rack bars 52 of each pair of arms 51 mesh with pinions 53 fixed on a shaft 54 journaled in bearings provided therefor in standards 55 carried by the frame 10. A hand wheel 56 is fixed to each shaft 54 to facilitate turning of the same. As the shafts 54 are turned the pinions 53 thereof coact with the rack bars 52 to raise or lower the same and consequently raise or lower the arms 51 and the wheels 18 mounted thereon. As will be understood the shafts 54 are entirely independent of each other so that one may be adjusted independently of the other thereby permitting independent adjustment of the wheels 18. Any suitable means may be employed for holding the wheels 18 in adjusted position. Various expedients to this end are widely known in the art. For instance, ratchet wheels may be fixed to the shafts 54 and pawls may be pivoted to the standards 55 and arranged to cooperate with the ratchet wheel or the rack bars 52 may be formed with a series of openings designed to successively register with one or more openings formed in the standard 55 and in the alined openings of the rack bars and standards, pins may be removably fitted.

In order to drive the wheels 18 in any adjustment a shaft 60 is provided and is mounted for rotary movement on the frame 10 and with its axis alined with the axis of swing of the arms 51. The shaft 60 carries pinions 61 which mesh with gear wheels 62 provided on the traction wheels 18. The usual differential 63 is employed. Gearing 64 is provided for transmitting motion to the shaft 60 from the transmission 65 of an internal combustion engine 66. The engine 66 is preferably of the type widely used on tractors and built by the International Harvester Co.

The excavating or digging mechanism is mounted on the frame 10 and more especially on the longitudinal bar 16 thereof, this excavating mechanism being designated generally at 70. As shown in detail in Figures 4, 5 and 6 the excavating mechanism includes a shaft 71 fixedly mounted in bearings provided therefor in the bars 16 of the frame 10. A gear wheel 72 is rotatably mounted on the shaft 71 and to this gear wheel a plurality of radiating arms 73 are riveted or otherwise suitably secured, as at 74. At their outer ends the arms 73 carry digging buckets or shovels, designated generally at 75. Each bucket 75 includes a bottom wall 76, side walls 77, one of which side walls is constituted by a portion of the arms 73 which carries the bucket, and a combined back and top wall 78 pivotally connected, as at 79 to the bottom wall 76. A plurality of digging teeth 80 are removably secured to the bottom 76 of each bucket. In order to limit the swinging movement of the combined back and top wall 78 toward the bottom wall 76 a stop lug 81 is provided on one of the side walls 77 and engages the wall 78 when the same is positioned, as shown in the lower portion of Figure 4.

The buckets 75 are designed so that their combined top and back wall 78 rest against the lug 81 when the buckets are positioned to start the actual digging or excavating action, and in order to hold the combined top and back wall 78 so positioned throughout the digging operation and up to the point where it is desired to unload the buckets a curved track 82 is provided and is disposed to engage the combined top and back walls 78 during the digging phase of the movement of the buckets in such a manner as to hold said walls 78 against their lugs 81 without interfering with the movement of the buckets as a whole. The starting point of the track 82 is indicated at 83 and the point at which the said track terminates is indicated at 84. The stock or frame on which the track 82 is formed is rigidly supported on one of the bars 16, and on this same stock or frame an opening cam 85 and a scraper 86ª is provided for the walls 78. Between the point 84 at which the track 82 terminates and

the cam 85 the stock or frame is cut away as indicated at 87 to provide a clearance to permit the walls 78 of the buckets to swing to an open position under the influence of gravity and under the influence of the cam 85. The cam 85 has a curved cam surface 86 upon which the walls 78 successively ride during the rotation of the excavating buckets and in order to insure dumping of the contents of the bucket at the proper time. The scraper 86[a] has a scraping edge 88 and across this scraping edge the bottom walls 76 as well as the walls 78 of the buckets successively pass whereby all of the dirt or material excavated is removed from the buckets.

A conveyor 90 is provided for receiving the material dumped from the buckets and the conveyor extends laterally from the machine and is supported and controlled by means of a mast 91 having a pulley 92 at its upper end over which a cable 93 is trained, the cable having one end secured as at 94 to the outer end of the conveyor and having its opposite end wound upon a windlass 95. As shown in the drawings the cable 93 is connected to the outer end of the conveyor and the inner end thereof is swingably supported by means of trunnions 96 journaled in bearings provided therefor in the stock or frame upon which the track 82, cam 85 and scraper 86 are formed. The conveyor 90 has a lateral extent sufficient to insure collection of all of the material dumped or discharged from the buckets 75 and for this purpose one side of the conveyor is located just to the left of the clearance 87 as illustrated in Figure 4, and the other side thereof is located below the scraper 86. Guide walls 98 and 99 are provided on the stock or frame to insure delivery of the contents of the buckets onto the conveyor.

The gear wheels 72 to which the arms 73 carrying the buckets 75 are fixed is driven from the engine 66 by means of a shaft 100 and a pinion 101, the pinion being fixed to the shaft and meshing with the gear wheels 72. The conveyor 90 is also driven from the engine 66 by means of suitable gearing.

In operation the machine is slowly driven forwardly during the excavating operation. Referring now to Figure 4 and bearing in mind that the machine as a whole is being advanced forwardly in the direction indicated by the horizontal arrow it will be seen that the buckets successively take or cut away a considerable bulk of the bank or wall at the forward end of the ditch in such a manner as to permit a very considerable depth of cut as well as a cut of considerable width. In making a cut each bucket moves forwardly and upwardly due to the rotation of the arms 73 upon which the bucket is carried and the bucket is also advanced forwardly to some extent due to the forward movement of the machine. During the cutting action of the bucket and while it is being loaded the combined top and back wall 78 thereof is held in closed position against the plug 81 by the action of the track 82. When the bucket has been fully loaded and nears the point at which it is to be dumped or discharged of its contents the combined top and back walls 78 of the bucket lies below or on the underside of the bucket so that the weight of the contents of the bucket as well as the weight of the wall 78 itself tend to cause the walls 78 to swing downwardly and permit the contents of the bucket to fall onto the conveyor 90. The downward swinging movement of the walls 78 to such an extent as to insure complete discharge of the contents of the bucket is positively provided for by virtue of the action of the cam 85 which lifts the wall 78 almost up into the plane of the bottom 76. After the dumping action the scraper 86[a] coacts with the bucket to insure complete removal of the contents thereof. After the scraping action the bucket has moved downwardly to such an extent as to bring the bottom 76 below the walls 78 and as to cause the walls 78 to flip over against the lug 81 due to the action of gravity.

In order that a clearance may always be had for the gear 72 a laterally offset auxiliary cutter 107 is provided on the side wall 77 of each bucket.

In order to contain a proper and effective excavating action with the excavating or digging mechanism proposed by the present invention it is necessary to maintain the frame 10 horizontally disposed even though operating on a hillside and even though the wheels on one side of the machine are operating in the ditch. The maintenance of the frame in a horizontal position under such conditions may be readily effected by an adjustment of the hand wheels 37 and 56 to raise or lower the steering or traction wheels as may be necessary.

In starting a ditch, the frame 10 is elevated to such an extent that the buckets 75 dig only slightly into the ground when the same are rotated. As the digging progresses the frame 10 is gradually lowered until the maximum depth of cut is obtained.

I claim:

1. In an excavating machine, digging means comprising a plurality of rigid arms mounted to rotate about a horizontal axis, means for rotating said arms, buckets carried at the outer ends of the arms and including bottoms, sides and a combined top and back plate pivotally connected to the bottom, a stop for limiting the movement of each plate toward the bottom, said plate being designed to swing away from the

stop and from the bottom in certain positions of the bucket, a track engageable with the plates for holding the same against the stops during the digging operation, a cam cooperable with the plates for swinging the same away from the bottoms in the dumping position of the buckets, and a scraper cooperable with the buckets immediately after the dumping of the same to insure complete discharge of the contents of the buckets.

2. In an excavating machine, digging means comprising a plurality of rigid arms mounted to rotate about a horizontal axis, means for rotating said arms, buckets carried at the outer ends of the arms and including bottoms, sides and a combined top and back plate pivotally connected to the bottom, a stop for limiting the movement of each plate toward the bottom, said plate being designed to swing away from the stop and from the bottom in certain positions of the bucket, a track engageable with the plates for holding the same against the stops during the digging operation, and a cam co-operable with the plates for swinging the same away from the bottoms in the dumping position of the buckets.

3. In an excavating machine, digging means comprising a plurality of rigid arms mounted to rotate about a horizontal axis, means for rotating said arms, buckets carried at the outer ends of the arms and including bottoms, sides and a combined top and back plate pivotally connected to the bottom, a stop for limiting the movement of each plate toward the bottom, said plate being designed to swing away from the stop and from the bottom in certain positions of the bucket, and a track engageable with the plates for holding the same against the stops during the digging operation.

4. In an excavating machine, a bucket including a pivoted plate designed to be positioned to retain the contents of the bucket therein or to permit the contents of the bucket to be discharged therefrom, a track cooperable with the plate for holding the same in position to retain the contents of the bucket therein, a cam for swinging the plate to such position as to effect dumping of the contents of the bucket, and a scraper cooperable with the bucket and with the plate for insuring a complete dumping of the contents of the bucket.

5. In an excavating machine, a bucket including a pivoted plate designed to be positioned to retain the contents of the bucket therein or to permit the contents of the bucket to be discharged therefrom, a track cooperable with the plate for holding the same in position to retain the contents of the bucket therein, and a cam for swinging the plate to such position as to effect dumping of the contents of the bucket.

6. In an excavating machine, a bucket including a pivoted plate designed to be positioned to retain the contents of the bucket therein and to permit the contents of the bucket to be discharged therefrom, and a track cooperable with the plate for holding the same in position to retain the contents of the bucket therein.

7. In an excavating machine, a bucket having a pivoted plate designed to be positioned to retain the contents of the bucket therein and to permit the contents of the bucket to be discharged therefrom, and means for controlling the position of the plate.

8. In an excavating machine, a bucket, means for mounting the bucket for bodily rotation about a fixed axis, said bucket having a pivoted plate designed to be positioned to retain the contents of the bucket therein and to permit the contents of the bucket to be discharged therefrom, and means for controlling the position of the plate.

JULIUS O. LIUM.